

EIS 1177

AB019824

Proposed granite quarry : Gunnalong, Bendemeer NSW :  
environmental impact statement.

NSW DEPT. PRIMARY INDUSTRIES  
AB019824

L96-0008



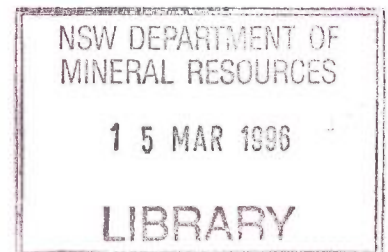
**SOUTHPAC LIMITED**



**PROPOSED  
GRANITE  
QUARRY**

**GUNNALONG  
BENDEMEER  
NSW**

**Environmental  
Impact  
Statement**



**November  
1995**

FORM 4

ENVIRONMENTAL PLANNING AND ASSESSMENT ACT 1979

(SECTION 77(3)(d))

ENVIRONMENTAL IMPACT STATEMENT

This statement has been prepared on behalf of Southpac Limited, being the applicant making the development application referred to below.

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

Gunnalong Quarry Project

The development application relates to the land described as follows:

Part Portion Nos. 60, 61, 74, 83, 164 Parish of Bendemeer.

The area subject of the application is entirely within Exploration Licence No. 3315 held by Southpac Limited.

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

Name, qualifications and address  
of person who prepared the  
Environmental Impact Statement

Malcolm John Robinson BSc(Hons)  
Southpac Limited  
Level 14 Philips Building  
15 Blue Street, North Sydney

I, Malcolm Robinson of Southpac Limited, 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.

  
\_\_\_\_\_  
Signature

*15 November 1995*  
\_\_\_\_\_  
Date

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## 1. SUMMARY

### 1.1 Outline of the Proposed Development

Development consent is sought in respect of a proposal to establish a granite (dimension stone) quarry on "Gunnalong" property north of Bendemeer in the New England district of New South Wales. Production of stone in blocks, individually 10-30 tonnes in size, is proposed for sale to processors for subsequent manufacture into slabs, tiles, panels and other products for use in construction, the monumental industry and so on. The development proposal follows an extensive exploration programme for granite throughout NSW and other states. There is not currently an equivalent granite on the world market and sales are anticipated in south and east Asia, the USA and Europe, in addition to local markets.

The project is characterised by its small size, compared with other types of quarry operation, in terms of its production tonnage, its area of occupied land, its number of employees and its environmental impact. It is however presented as a project providing employment which is significant in a local context, and having growth potential.

Dimension stone quarrying requires the use of specialised equipment and techniques. Machinery used includes wire saws, drills and varied equipment for splitting and handling blocks. All equipment is mobile and there is no fixed plant or equipment.

Production of saleable blocks is projected to be about 1500 cubic metres in the first year, increasing possibly to 4000 cubic metres within five years. Provision is included in the proposal for a dump for waste rock on the site although much of this is expected to be disposed of on a nominal or no-cost basis for various potential uses.

Product transport will mainly use the surplus capacity of southbound trucks on the New England Highway for freight to customers in the capital cities or to ports for export.

The project involves a small water supply dam, and a 1.7km road to access the Highway. Employees will be 3-5 in number initially, possibly doubling within a few years.

### 1.2 The Existing Environment

The project area is located near the north-western corner of the grazing property "Gunnalong". Of the 11 hectare or so total area which the quarry and its associated facilities would eventually occupy, much is uncleared bush. The quarry will be situated on a low hill, entirely within a timbered area, with the waste dump occupying cleared land adjacent to the north.

A typical rural environment prevails in respect of air quality and the acoustic environment although affected to some degree by the New England Highway which is approximately one kilometer distant. Surveys have not identified the existence of endangered species of flora or fauna, and there is some evidence of aboriginal presence in the area in the form of scattered stone artefacts. The nearest residences to the site are 1.6 and 2km distant respectively.

### 1.3 Summary of Environmental Impacts

- The final quarry void cannot be backfilled and therefore represents a permanent change to the landscape. However the design of the quarry and the preservation of surrounding timbered areas will ensure that from the New England Highway and from the nearest residence only the uppermost part of the western wall of the quarry will be visible, at a distance of almost two kilometers.
- The small area of land to be cleared presents no threat to any endangered species of flora or fauna and has only a nominal impact on the stock carrying capacity of the property.
- Water use by the project will have no measureable impact on the flow in creeks in the district; rather the proposed dam will enable improved management of the available water to the benefit of both the project and the surrounding property.
- The proposed system of sedimentation dams will prevent silt-contaminated stormwater runoff from the project reaching surrounding areas and watercourses.
- The nearest residences currently experience traffic noise from the Highway; the existing timbered area surrounding the project and the design of the quarry itself will provide effective acoustic screening from the noise of quarry machinery. Blasting will be audible and at these residences monitoring of blasts will be undertaken during the early stages of operation to establish acceptable levels.
- Transport impacts will be minor, mainly utilising existing surplus unladen truck capacity on the New England Highway.
- Quarry methods are designed to minimise the production of fine material and therefore dust. Machinery will be fitted with appropriate dust and noise suppression accessories.
- Further study is proposed of the rock overhang and cave in the central part of the quarry area to determine whether it has aboriginal heritage significance. If such significance can be demonstrated some modification to the quarry plan may be possible to permit its preservation.

- Progressive rehabilitation of the waste disposal area will be undertaken preceded by pre-stripping of topsoil for later use. The western face of the dump, some five metres high will be grassed and planted as an early priority. Batters associated with the access road and the water supply dam will be graded and planted in accordance with the requirements of the Soil Conservation Service.
- All installations relating to fuel storage, amenities and waste water treatment and so on will be in accordance with the requirements of the appropriate authority.

## 2. INTRODUCTION

### 2.1 General

Development consent is sought in respect of a proposal to establish a granite dimension stone quarry on "Gunnalong" property north of Bendemeer in the New England region of New South Wales. The discovery of a highly marketable construction industry granite following an extensive exploration programme presents an opportunity to establish an industry based on direct raw material exports and value adding opportunities to local processing companies for both local and overseas sales. The project is located close to the New England Highway approximately mid-way between Tamworth and Armidale (see Figure 1).

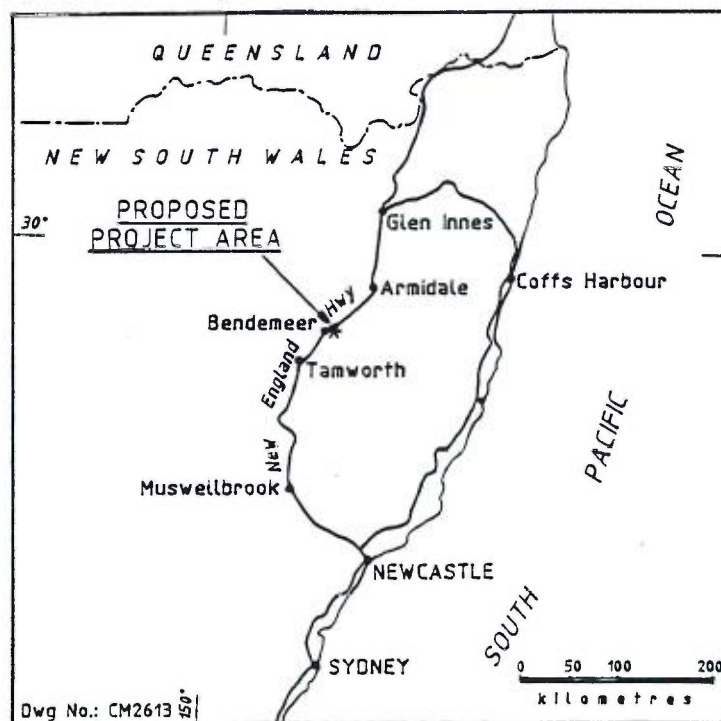


Figure 1. Project Location

### 2.2 Corporate Background

Southpac Limited (formerly Clutha Minerals Limited) and its wholly owned subsidiary South Pacific Granite Pty Ltd were previously part of the Clutha Limited group whose main business activity was the mining and marketing of coal. The companies were acquired by their present owners, a group of private investors, following the split up and sale of the various operating subsidiaries of Clutha Limited.

During their time as part of the Clutha group, Southpac and South Pacific Granite undertook various resource-oriented activities including exploration for gold, base metals, industrial minerals and construction materials. The latter included exploration for granite dimension stone throughout Australia and the development of quarries and trial quarry operations in the Northern Territory and New South Wales.

## 2.3 Dimension Stone - the Commodity

### 2.3.1 *General*

Dimension stone is defined as natural stone which has been selected and cut to specified shapes and sizes with one or more surfaces polished or otherwise treated. Marble and granite are the main types followed by limestone, sandstone, slate and others. Production of raw stone is from quarries in the form of blocks, generally 10-30 tonnes in size, which are subsequently processed into slabs, panels, tiles and other products for use in construction, the monumental industry and so on. The project under review in this report involves the quarrying of granite blocks and the sale of those blocks to processing companies, either locally or overseas.

### 2.3.2 *The World Stone Industry*

The world stone industry is variously estimated to be worth up to US\$30 billion per annum. World trade is dominated by Italy as an exporter of processed product, albeit often made from imported raw material, and by Japan as an importer of both raw and processed stone. Other major players in the international stone trade include Spain as an exporter of raw and processed stone, the USA, France and Germany as both importers and exporters, and countries such as Brazil, China, South Africa, Korea, Finland, Norway, Sweden and India as raw stone exporters. The rapidly expanding economies of south-east Asia, in particular Taiwan, and more recently Singapore, Malaysia, Thailand and Indonesia represent expanding markets for suppliers of both raw and processed stone, although tariff barriers inhibit access of the latter to certain countries.

World raw (dimension) stone production in 1994 totalled almost 40 million tonnes and continues to increase at about 5% per annum. About 40% of total production is traded internationally, much of it in raw form, characterised by bulk shipments from the main raw stone producing countries to processing companies worldwide. Vertical integration within the industry is not the norm, and companies involved in quarrying are not usually involved directly in downstream processing.

The major part of world production and trade involves marble and granite with the latter increasing its market share because of its better

durability and the fact that technical advances have dramatically reduced processing costs.

Although there are some notable exceptions most companies engaged in the stone business are small, with individual production units, whether these be quarries or processing facilities, being characterised by a small number of employees and a specialised range of products.

### **2.3.3 *The Stone Industry in Australia***

Australia has a history of stone quarrying and the use of stone in construction and monumental work dating from the earliest days of European settlement. The industry however remained small and indeed no more than a cottage industry in that production, even up to recent times was generally only to supply immediate, usually local requirements and the concept of stockpiling for wider distribution and sale, particularly to export was not entertained. With rare exceptions Australia's part in the immense world trade in stone, remained that of a minor importer and, only in recent years has there been any attempt to develop the industry on an internationally competitive basis.

Dimension stone production in Australia is currently about 100,000 tonnes per annum, much of this total being sandstone and only some 25% being granite. The industry is worth an estimated \$200 million per year taking into account quarrying and the processing of both locally produced and imported raw and semi-processed stone.

Most quarry production, particularly that which is exported in raw form is in South Australia; most processing capacity is in NSW and Victoria. Significant growth in the export of granite blocks is likely to precede the growth of the local processing industry to a significant export oriented size.

## **2.4 Project History**

As part of an extensive exploration programme throughout NSW and elsewhere in Australia the proponent has held title to a number of mineral Exploration Licences in the New England region. Two such licence areas to the north of Bendemeer have been the subject of detailed exploration and have the potential to support quarries producing possibly three or more varieties of granite. The exploration has involved mapping and sampling, topographic surveys, core drilling, the extraction of trial blocks, testing and market research. The present report refers to a quarry proposal in respect of one selected site. Sequential development of other sites will be treated as separate projects in due course.

## 2.5 Objectives of the Proposal

The proposed quarry is designed to produce granite blocks for local and (predominantly) export markets. Saleable production is projected to be about 1500 cubic metres in the first year increasing thereafter; expansion beyond 4000 cubic metres per year is considered unlikely within the first five years. There will be no fixed plant or equipment with the possible exception of a crane; a demountable office unit and small workshop are the only building developments involved. Employees will be 3-5 in number. No crushing or other processing is involved and quarry techniques involve wire sawing, drilling and the minimal use of explosives. An access road (1.7km) directly to the New England Highway and a small water supply dam are proposed.

Waste rock generated during quarry operations will be disposed of on a nominal or no-cost basis where possible, although provision is made for the permanent placement of the surplus on the site.

### 3. THE GRANITE RESOURCE

Substantial areas in the New England region of NSW are covered by granite. However, the demands of modern processing plants, the sophistication of the international buying market and competition from major producers throughout the world means that most granites do not have any economic value as dimension stone. A granite with the appropriate attributes of quarryability and marketability is a rare commodity.

The granite contained within the area proposed for development was selected following extensive exploration throughout NSW and in particular the New England region. The deposit has reserves in excess of 1 million cubic metres within the proposed quarry area and is capable of production on the scale proposed for an extended operating life.

The granite will be marketed under the trade name "Koala" and markets are anticipated in south and east Asia, the USA and Europe, in addition to local markets. Trial shipments of a similar stone from a nearby exploration site have been shipped to Japan with small samples for market research purposes having been despatched elsewhere. Tiles produced in Australia from the stone have been exported to the United States. Plate 3 (at the end of this report) shows the granite in polished form with a technical specification on the reverse.

## 4. THE EXISTING ENVIRONMENT

### 4.1 Location

The project area is located on the property "Gunnalong" which is situated on the east side of the New England Highway some 9km north of Bendemeer, approximately mid-way between Tamworth and Armidale (Figure 1). It is situated at the eastern end of Portion 60 and 61 in the parish of Bendemeer.

### 4.2 Topography

The regional topography is typical of the granite uplands which occupy much of New England. The specific area of interest is the north-western slopes of a low hill rising to an elevation of approximately 940 metres, some 50 metres above the surrounding country. To the north and south are westward flowing tributaries of Rocky Gully, a permanent creek here crossing gently undulating grazing land to the south west of the proposed quarry site. Figure 2 shows the general topography of the project area with contours from a more detailed survey being shown on Figure 5.

The specific area of interest for quarrying is predominantly rock outcrop, locally steeper than  $18^\circ$  and defined as Protected Lands. The more level country adjacent to the north of the quarry site (Figure 2) is proposed for product stockpile and waste rock disposal.

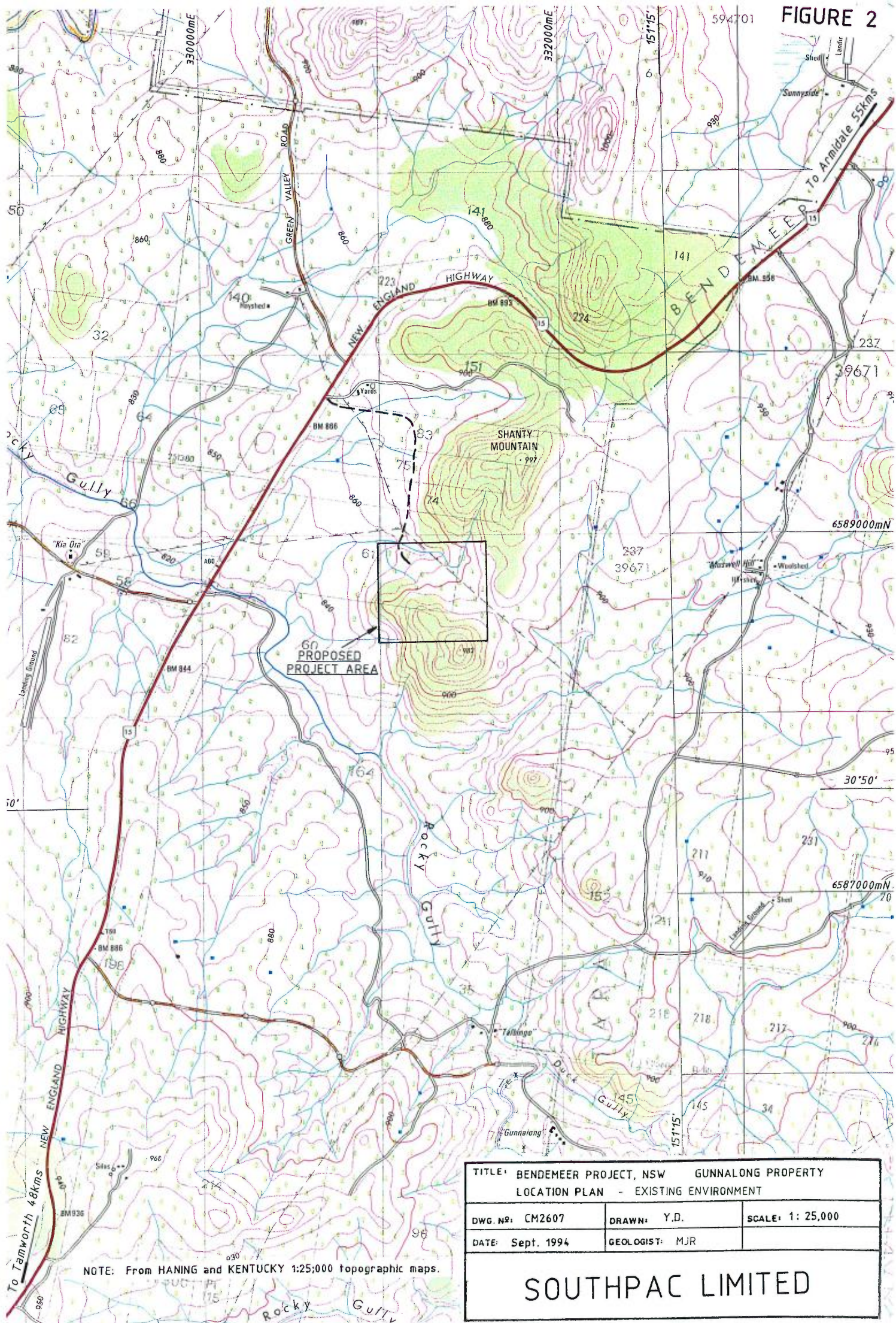
### 4.3 Geology and Soils

#### 4.3.1 Regional Geology

Figure 3 illustrates the regional geology, essentially a series of granite plutons of Permo-Carboniferous age and varying composition.

#### 4.3.2 Local Geology

The area of interest as a granite resource is within the coarse-grained, blue-grey phase of the Banalasta Adamellite. Although this lithology occurs over a somewhat wider area, the proposed quarry area is characterised by a greater freedom from joints, the absence of tourmaline veining and other defects, and an acceptable depth of weathering. Several years' reserves are available in a single large outcrop which is essentially joint free, soil-free and has 100% exposure; additional reserves will be made available by advancing the quarry to the south and east and as necessary in depth. Beyond the proposed quarry area as defined on Figure 5, certain characteristics of the granite deteriorate from a dimension stone viewpoint, for example increased jointing towards the east and increased jointing and tourmaline veining to the north. Other potential sites in the vicinity were explored and rejected largely for reasons of poor structure or colour. However the potential does exist for additional quarry sites in



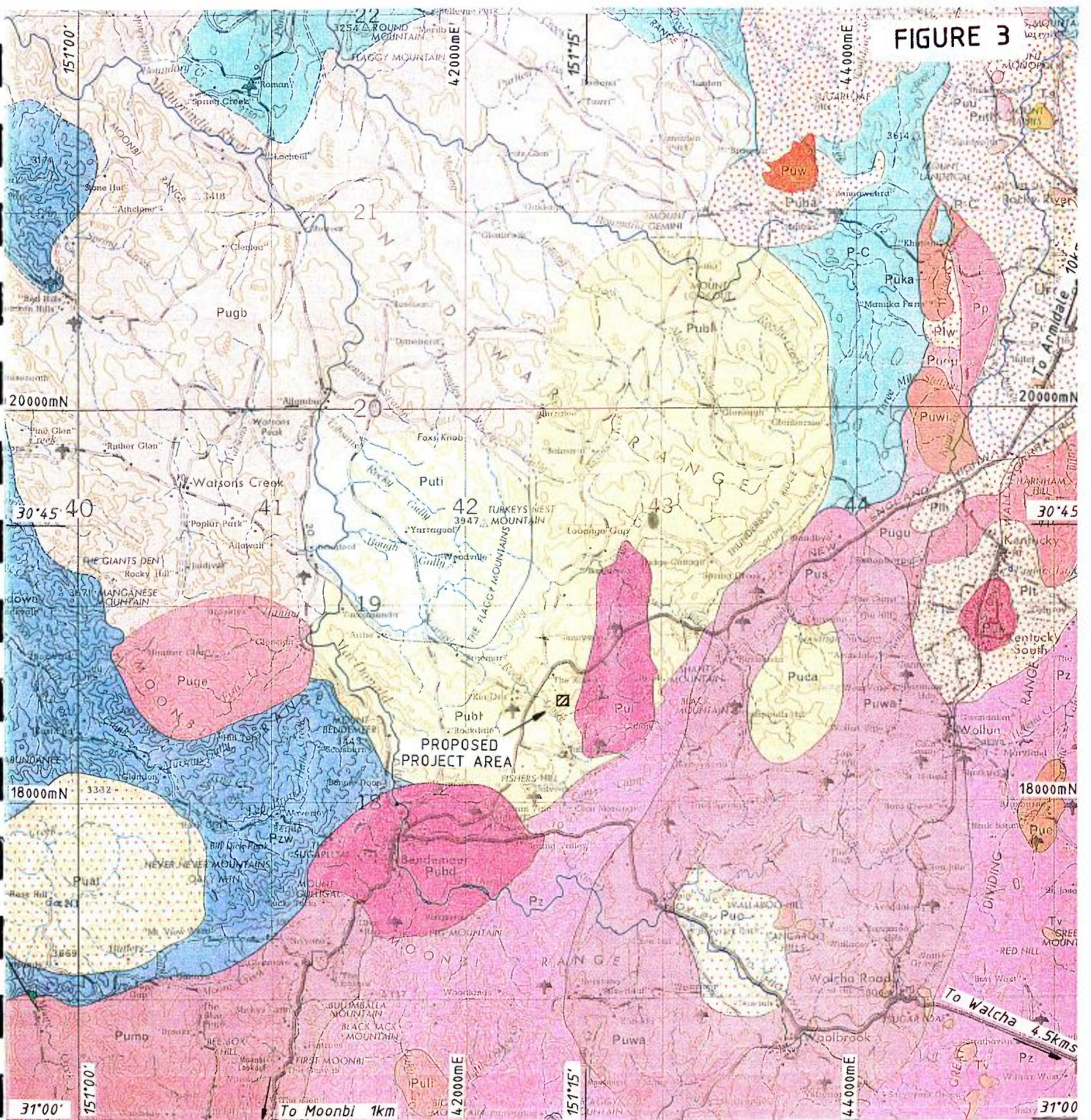
NOTE: From HANING and KENTUCKY 1:25,000 topographic maps.

TITLE: BENDEMEER PROJECT, NSW GUNNALONG PROPERTY		
LOCATION PLAN - EXISTING ENVIRONMENT		

DWG. NO: CM2607	DRAWN: Y.D.	SCALE: 1: 25,000
DATE: Sept. 1994	GEOLOGIST: MJR	

SOUTHPAC LIMITED

FIGURE 3



**LEGEND**

- Tv.....Basalt flows and plugs
- Ts.....Gravels, sands, clays
- Puc.....Congi Creek Adamellite
- Puca.....Campbells Hill Adamellite
- Pus.....Standbye Adamellite
- Pul.....Looanga Adamellite
- Puw.....Wongalee Complex
- Pugy.....Gwydir River Adamellite
- Pur.....Blackfellows Gully Leucoadamellite
- Putl.....Tollys Gully Leucoadamellite
- Pull.....Limfri Leucoadamellite
- Puy.....Yarrowyck Granodiorite
- Puwa.....Walcha Road Adamellite
- Pumo.....Moonbi Adamellite
- Pubd.....Bendemeer Adamellite
- Puat.....Attunga Creek Adamellite
- Puk.....Kentucky Diorite
- Pue.....Shalmar Tonalite
- Puka.....Khatoun Tonalite
- Puwl.....Wilhelmshohne Tonalite
- Pugu.....Glenburnie Leucoadamellite
- Puge.....Glenclair Adamellite
- Puti.....Tilmunda Adamellite

- Publ.....Banalasta Adamellite
- Pugb.....Undifferentiated
- Plt.....Terrible Vale Porphyritic Microtonalite
- Plw.....Manuka Farm Porphyritic Microtonalite
- Plh.....Harnham Grove Porphyritic Microtonalite
- Pp.....Porphyries and porphyries
- P-C.....Mudstones, lithic sandstones, conglomerates
- Pzw.....Woolomin Beds In part

0 5 10 20kms

NOTE: From geological map MANILLA sheet SH56-9 scale 1:250,000

<b>SOUTHPAC LIMITED</b>		
TITLE: BENEMEER PROJECT, NSW GUNNALONG PROPERTY REGIONAL GEOLOGY		
DWG. No: CM2623	DRAWN: Y.D.	SCALE: 1:250,000
DATE: March 1995	GEOLOGIST: MJR	<b>FIGURE 3.</b>

different colour variants within the district, and exploration of these areas is continuing.

The Banalasta Adamellite is a biotite cordierite granite of Permo-Carboniferous age. It is a coarse grained porphyritic rock with a hypidiomorphic granular texture and variable grain size. K-felspar is grey to blue-grey occurring as phenocrysts up to 3cm set in a coarse-grained groundmass of grey-white plagioclase, brown-black biotite and quartz.

#### 4.3.3 Soils

The area proposed for quarrying is entirely granite outcrop in the western part with no soil, and predominantly granite elsewhere with thin soil development and decomposed rock between outcrops. The lower ground to the north with fewer rock outcrops has better developed lithosols supporting generally larger trees and some cleared grazing land. Soil erosion is not a problem either in the cleared or uncleared land within and adjacent to the project area.

#### 4.4 Climate

The climate is similar to Uralla which is the closest weather recording station. Rainfall averages about 800mm, distributed throughout the year although the wettest months are January and February. Elevation reduces temperatures below those of Tamworth to the south, with summer maxima rarely exceeding 30°C and winter minima occasionally as low as -6°C.

#### 4.5 Flora and Fauna

A flora and fauna survey was prepared by Arnhem Environmental Impact Assessors and is reproduced as Appendix 1. The summary provided below is extracted directly from that report. The season in which the survey was undertaken (June) limited the effectiveness of some aspects of the study; as a supplementary source of relevant data a second report prepared in respect of another project on a nearby property, Banalasta is provided as Appendix 2.

##### 4.5.1 Flora

The quarry site is a low hill which rises from approximately 890m at the foot to 945m at the highest point and is predominantly covered by eucalypts and low shrubs which vary in height and density and therefore form a mosaic of low open-woodland and woodland. The vegetation, however, approaches an open-forest structure in the proposed waste rock area to the north of the quarry site. Eucalyptus laevopinea, Eucalyptus andrewsii, and Eucalyptus blakelyi are prominent and some tall specimens grow on the site.

In some areas *Olearia viscidula* forms a very dense understorey. The Project area is floristically probably as rich as the flora recorded at

Banalasta, but due to the time of sampling (mid-winter) only 54 species from 30 families were recorded. None of the species are rare or on the endangered list. Species such as orchids are, however, on the protected list.

Gunnalong is a grazing property with cattle and sheep grazing occupying native pastures in the area surrounding the proposed quarry site.

#### 4.5.2 *Fauna*

The animal survey indicated that birds (27 spp.) were the most diverse group of animals, followed by mammals (8 spp.) and reptiles (6 spp.). Ants were on this occasion not collected. None of the fauna species are threatened or endangered, although a number are protected.

### 4.6 Hydrology

The east-west flowing watercourse which is proposed as a dam site to provide water supply to the project flows only intermittently after rain. Upstream from the proposed dam it has a catchment area of about 42 hectares, of which about half is within the project area and half outside to the north. Projected discharge for a 1 in 50 year frequency is 4 cumecs.

The above-mentioned watercourse after leaving a steep sided well defined valley within the project area crosses flat, often swampy grazing paddocks before joining Rocky Gully creek. The latter is reportedly a permanent creek although along some stretches surface flow is not always apparent. Rocky Gully drains to Carlisle's Gully, a tributary of the westward flowing Macdonald River.

### 4.7 Land Use, Habitation and Employment

The district has traditionally been divided into properties averaging around 1000 hectares although in more recent years amalgamations have created some significantly larger properties. Gunnalong remains a property of some 975 hectares. The main land use is in sheep and fine wool production and to a lesser extent cattle.

The steeper hills contain a high percentage of predominantly rock outcrop areas having little grazing value; they remain uncleared and as such provide some shelter for stock. The more level areas are improved pasture with scattered dams and shade. Gunnalong has a long history of pasture and other improvements and is a particularly well watered property by virtue of Rocky Gully creek and a large number of dams.

The nearest farming property and associated residence to the project area is Kia-Ora Station which is located two kilometers due west on the western side of the Highway. The nearest individual residence is a house ("The Ranch")

situated on a small block of land some 1.5km north-west of the site and adjacent to the proposed access point to the Highway; it has been unoccupied for several years.

Employment in the area is restricted to that associated with farming pursuits and a limited provision of services, including tourist services, in the town of Bendemeer. The nearest centres of population are Bendemeer (250) and Uralla (2300) with the larger regional centres of Tamworth and Armidale each being some 50km distant.

#### 4.8 Transportation

The project area is located approximately 1km east of the New England Highway which provides the main arterial transport route through the region. Minor roads leaving the highway for several kilometers north and south of the site are property access roads only. There is no rail access into the area. Because of the small production planned from the proposed quarry no detailed research of traffic density has been undertaken.

#### 4.9 Acoustic Environment

A typical rural noise environment prevails in the area with the exception of traffic noise from the highway which is audible on the site under appropriate atmospheric conditions and at the two residences closest to the site and the highway.

A noise survey has not been carried out in the belief that the small amount of equipment to be used at the site would not add to the background highway noise levels as experienced at the two closest residences. Blasting will however be used at the quarry and the impact of this is addressed later.

#### 4.10 Air Quality

Traffic density on the New England Highway is light and there are no industrial or other sources of air pollution in the district. A typical rural environment prevails in respect of air quality.

#### 4.11 Archaeology

##### *4.11.1 Aboriginal Archaeology*

An aboriginal archaeological survey was undertaken, the report of which is reproduced as Appendix 3. The conclusions of the study and comments thereon are summarised below.

**Quarry area:** an area of granite outcrop littered with basalt artefacts was identified adjacent to the western boundary of the proposed quarry. Scattered fragments of basalt were found elsewhere in the proposed quarry area. A rock overhang and

cave were found near the central part of the quarry area but artefacts or other evidence of habitation were not seen in the immediate vicinity.

**Stockpile, Workshop area:** clusters of artefacts were identified within the area advised to the archaeologist as the proposed stockpile, workshop and office area. The site for these facilities has now been relocated to the western end of the waste disposal area which was identified as being free of artefacts or other evidence of aboriginal occupation.

**Waste disposal area, dam site, access road:** no evidence of aboriginal heritage or occupation was found in these areas.

The significance of these sites to aboriginal people requires further research. For example, in the absence of visible evidence the existence of habitation in the area of the rock overhang would need to be established by excavation to determine its significance. There is a dolerite (basalt) dyke forming the western boundary of the proposed quarry and this is the source of basalt fragments scattered throughout the area. The natural conchoidal fracture of the basalt and the fact that such fragments are numerous on the downslope side of the outcrop of the dyke and rare elsewhere suggests that most fragments are merely natural weathering products. Further investigation is appropriate.

Consultation and site inspection with Mr Bob Faulkner, the Regional Manager of ATSIC and a member of the Anaiwan tribe which inhabited this area indicates that he places little significance on the artefacts but would like to see preservation of the rock overhang and cave area.

#### *4.11.2 European Archaeology*

Pastoral development of the area began relatively early in the history of European settlement, and the town of Bendemeer was established at the crossing of the MacDonal river by the main road to the north. A staging post and hotel is understood to have existed for a time near the highway crossing of Rocky Gully immediately west of the project area, but it is believed that no building or other structures remain.

### **4.12 Landscape and Visual Quality**

The mosaic of hill and valley, grazing land and uncleared forest provides a landscape of medium-high quality. Long visual runs are possible without the intrusion of man-made structures with the exception of the roads and scattered farm buildings.

The rock outcrop proposed to be quarried is visible from the Highway although because of trees bordering the road it would not be readily observed by passing traffic. The proposed quarry will be largely hidden behind an intervening tree screen throughout most of its operational life.

#### **4.13 Legal and Planning Conditions**

##### ***4.13.1 Local Government***

The project is within the Shire of Parry and is zoned 1a (General Rural Zone), within which extractive industry is permitted with development consent. As a designated development in excess of two hectares in area an Environmental Impact Statement is required to accompany the development application.

##### ***4.13.2 State Government***

Granite is a mineral under the NSW Mining Act but one for which the royalty in the case of freehold land is due to the freehold owner rather than the Crown. A granite quarrying operation can be established under a Mining Lease issued by the Department of Mineral Resources or by means of a Private Mining Agreement directly between the developer and the freehold owner. In the case of a private mining agreement the Department of Mineral Resources is still involved to the extent that it imposes certain conditions, mainly of an environmental protection nature and also requires the developer to pay a bond to guard against default in respect of those conditions.

A Private Mining Agreement is proposed in the case of the proposal here under consideration.

In addition to the Department of Mineral Resources other state government departments and instrumentalities require consultation and have input to the decision-making process. These include the Department of Urban Affairs and Planning, the Department of Land and Water Conservation, the Soil Conservation Service, the National Parks and Wildlife Service, the Environment Protection Authority and the Roads and Traffic Authority.

## 5. THE PROPOSED DEVELOPMENT

### 5.1 General

Dimension stone quarrying, particularly granite quarrying in Australia, is characterised by its small scale of operation compared with most other forms of mining or extractive industry. In this instance saleable production in the first year is projected to be about 1500 cubic metres increasing thereafter; expansion beyond 4000 cubic metres per year is considered unlikely within the first five years. Gross extraction allowing for waste will average about double these figures, and be somewhat higher during the development phase of the first year.

The project objective is the production of granite blocks for subsequent processing into slabs, tiles and other products for use in various construction industry applications such as cladding of buildings, flooring, various interior uses, monumental products and so on. Block size will usually be in the range 10-22 tonnes, the latter being controlled by the weight limits imposed in respect of subsequent readily available handling and transport.

Dimension stone quarrying requires the application of specialised techniques and the use of specialised equipment. With the possible exception of a derrick crane there is no fixed plant and most equipment is readily interchangeable between different quarries to enable short term changes in demand to be satisfied. Equipment used includes wire saws, drills and an assortment of moving and handling equipment such as jacks, inflatable air cushions, loaders/excavators or cranes.

### 5.2 Method of Extraction

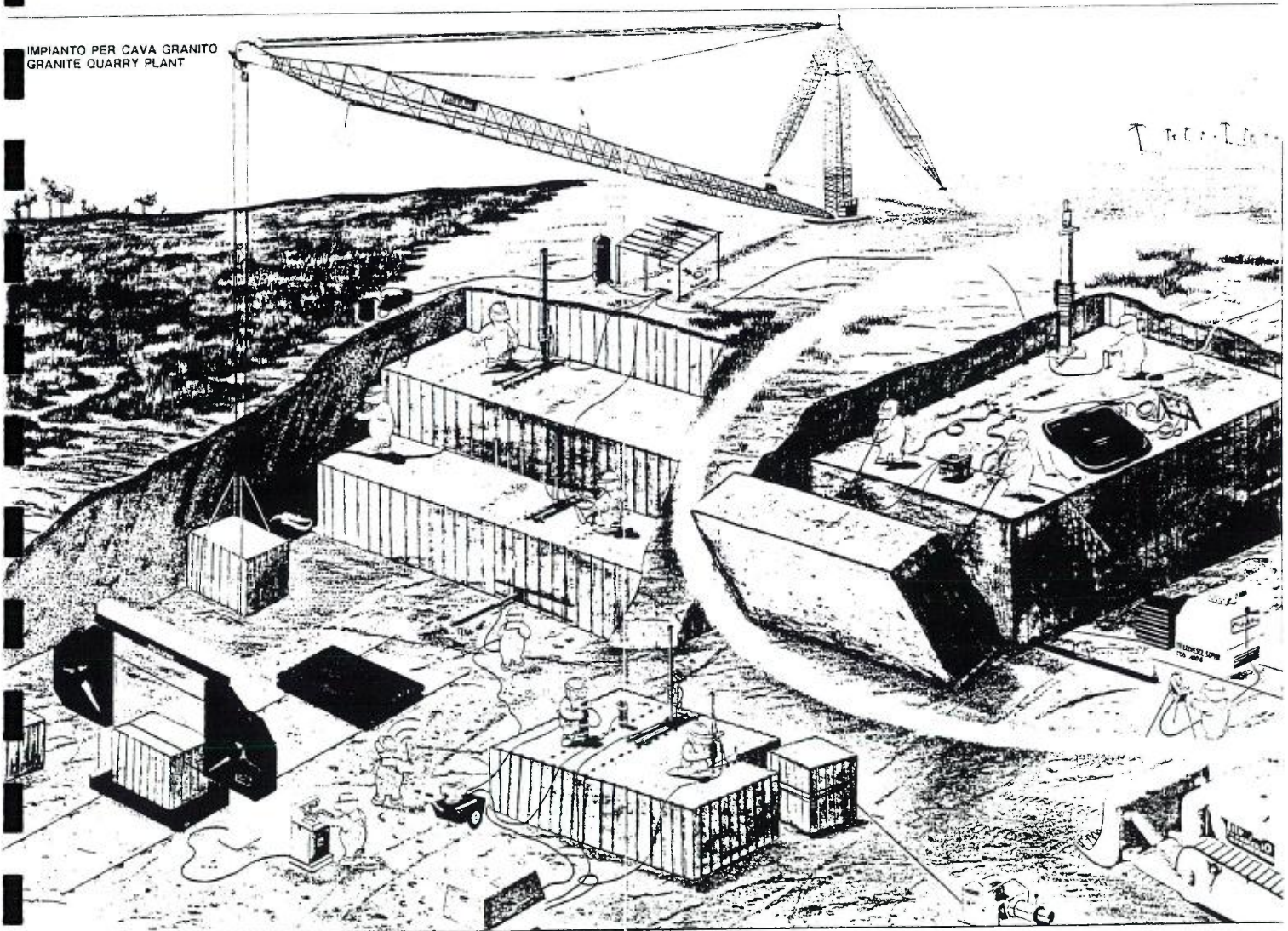
The fundamental requirement of dimension stone extraction is the recovery of blocks free from cracks, flaws and other defects, either natural or quarrying-induced. Figure 4 illustrates the extraction technique in an idealised diagrammatic manner and shows the various types of equipment which can be utilised.

Extraction requires as a first step the severing of a primary block from the rock mass. Such a block could be 1000m<sup>3</sup> or more in size, although usually smaller. At least one and usually two or three sides of this block will be cut using a diamond wire saw or slot drill with the remaining sides drilled to enable explosives to effect the separation. The primary block is then cut into secondary blocks using similar techniques and finally into smaller blocks for sale by drilling and the use of wedges. Such blocks ideally should be approximately 3 x 1.5 x 1.5 metres in size although they vary considerably according to the natural fracture pattern in the rock and the requirements of the customer.

Wire saws use water directed into the cut to cool the wire and assist in transporting the cuttings. The saw moves on rails while working on a single

FIGURE 4

IMPIANTO PER CAVA GRANITO  
GRANITE QUARRY PLANT



SCHEMATIC DIAGRAM OF GRANITE QUARRYING TECHNIQUES.

cut and is relocated to new cut positions by crane or other available lifting device such as a loader or excavator. Drills can be either pneumatic or hydraulic, mobile (tractor mounted) or crane-lifted. A loader is the most suitable machine for removing waste rock and if fitted with optional forks can be used to lift and transport finished blocks to the stockpile and to load trucks for transport from the site. Derrick cranes are particularly useful where a quarry is of some depth and restricted horizontal extent, a common situation when quarrying narrow deposits or operating in hilly country.

Explosives used are of a specialised slow-burning type such as not to cause unwanted fracturing of the block or surrounding rock. Hydraulic jacks and inflatable air bags are among techniques used to separate and move blocks at various stages of production.

### 5.3 Quarry Equipment

The equipment intended for use in the proposed quarry at the start up stage is as follows:-

- Wire saw, diesel powered
- Pneumatic drills (2), air compressor
- Hydraulic drill (tractor mounted)
- Loader, 988B equivalent, fitted with bucket, forks, tipping boom
- Jacks and inflatable airbags

Required within two years:

- Derrick crane, max. 60m boom
- Additional drill

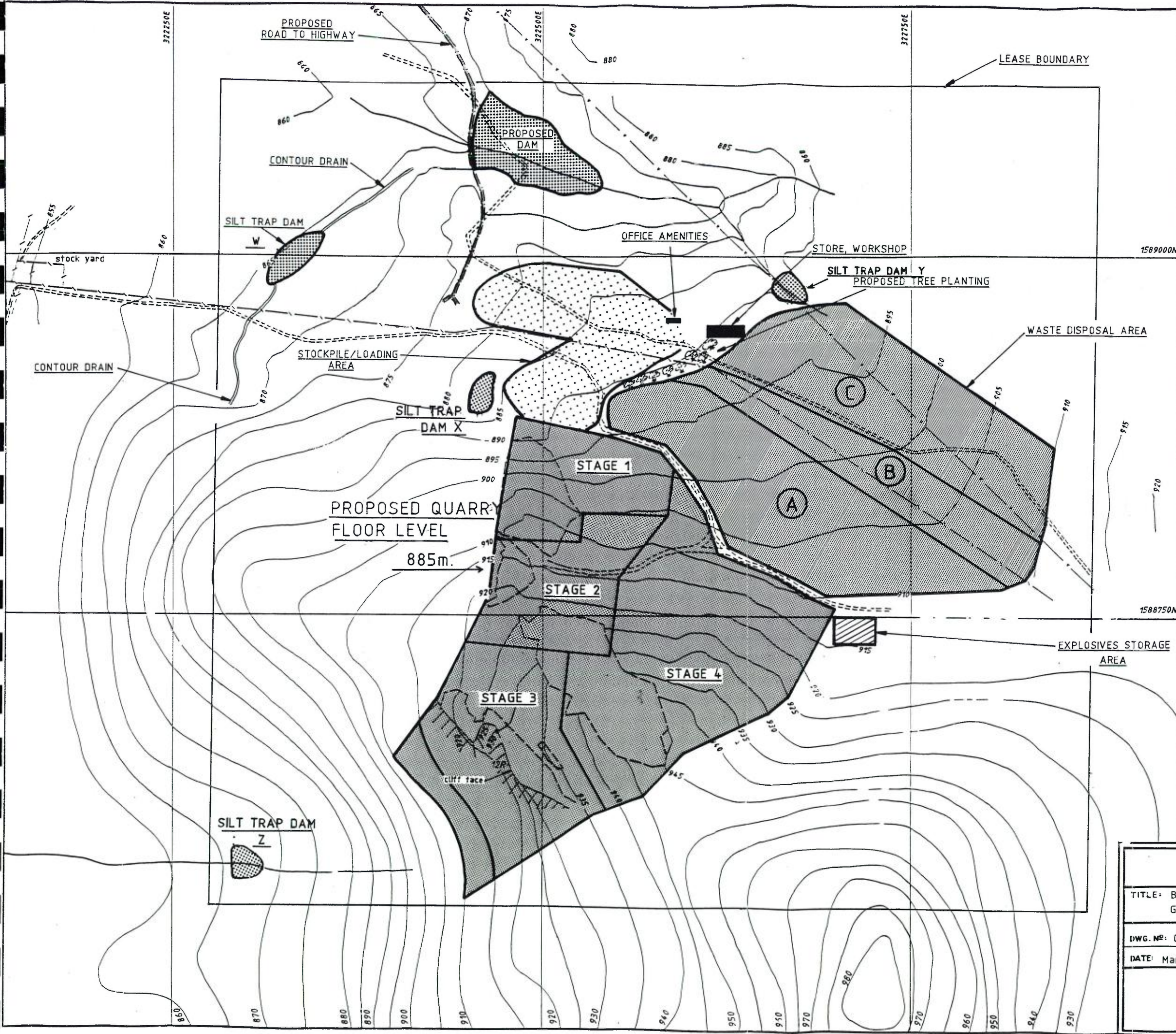
### 5.4 Ancillary Equipment and Facilities

Ancillary equipment and facilities required at start up or shortly thereafter include:-

- Explosives magazines (2)
- Water tanks (2 @ 5000 litres)
- Water pump and pipeline, dam to quarry
- Service vehicles (2)
- Workshop and store 15 x 5 metres, concrete floor, modular steel sheeted structure
- Office, demountable (10 x 2.4m)
- Power connection to office and workshop (approximately 60 metres to existing power line.)

### 5.5 Quarry Plan

Figure 5 illustrates the various components of the project including the phased developments of the quarry.



### LEGEND

- ===== tracks
- fence
- v--- power lines
- creek
- outcrop/boulder boundary
- staged quarry development
- STAGE 1**
- (A)** staged waste disposal area



NOTE: Contour Interval = 5.0m

### FIGURE 5

TITLE: BENDEMEER PROJECT, NSW GUNNALONG PROPERTY  
GENERAL DEVELOPMENT PROPOSAL

DWG. NO: CM2605	DRAWN: Y.D.	SCALE: 1: 2500
DATE: March 1995	CHECKED: M.J.R.	

## SOUTHPAC LIMITED.

A minimum of timber clearing, less than 50 trees, is required at the base of the main outcrop (Stage 1) to be worked. The top of this outcrop, where extraction will commence will be accessed by upgrading an existing track. Some 3 metres thickness of granite which is slightly weathered will be removed to access marketable stone on the top of the outcrop, less on the sides. The weathered material will be used as required to provide a base to the stockpile area and thereafter moved to the waste disposal area.

Extraction of stone will progress within Stage 1 advancing southwards into Stage 2 as the base level of quarrying in Stage 1 of the 885 metre land is approached. Individual quarry benches will be 6 metres high. Reserves in Stage 1 are sufficient for approximately 10 years of operation although there will be some development in Stage 2 during this period.

The rate of advance of quarry operations into subsequent stages will depend on the growth in the market. Although the production of individual granite quarries overseas can exceed 10,000m<sup>3</sup> per annum no quarry in Australia approaches this figure. However the potential market could be substantial provided that costs can be adequately contained; the quarry area for which development consent is sought contains adequate reserves to support such growth.

The rock overhang and cave referred to in Section 4.11.1 are not preserved in the Company's preferred quarry development programme on the grounds that at this stage no evidence of aboriginal habitation has been demonstrated. However, before any disturbance of these areas takes place, which would be ten years or more into the future, the Company is committed to undertake the necessary investigation to determine whether aboriginal significance for this or other reason requires that it be preserved. If such significance is demonstrated the area will be fenced and preserved along with an unworked strip of land connecting to the eastern boundary of the proposed quarry area. Although contrary to the orderly development of the quarry from a purely technical or operational viewpoint the effect of this action on the reserves recoverable from the area could be overcome by quarrying to deeper levels.

## 5.6 Waste Disposal

The waste generated during quarrying will be up to about 50% of the total material excavated. The need to preserve what little soil exists in the quarry area for rehabilitation purposes means that the waste material produced will be entirely granite, in the form of weathered surface rock, block offcuts or other defect material. Although it is potentially suitable for aggregate or other crushed rock applications the quantity generated is insufficient to justify the installation of a crusher, which would be necessary if regular sales of this material were to be sought.

The practice adopted in many dimension stone quarries will be followed where the waste material will be disposed of for various uses from time to

time. These include sale for landfill or landscaping in its larger unbroken form or other uses following size reduction by such methods as hydraulic rock breaker, mobile crusher and so on.

In practice it is expected that most of the waste rock will be disposed of for some useful purpose on either a nominal cost or no-cost basis. However it is necessary to provide for on-site storage, which is proposed at the location shown on Figure 5. If all or most of the waste rock is disposed of off-site then Area A on Figure 5 will be adequate for the temporary storage involved. The worst case situation is however provided for by including areas B and C in the development application giving disposal capacity of some 175000 cubic metres of waste rock assuming an average dump height of five metres. Later in the life of the operation the potential will exist for waste disposal within the quarry limits. If maximum development of the waste dump is required the relocation of the power line which will become necessary will be addressed at that time.

Topsoil will be stripped from the disposal area and initially used to construct a screening embankment at its western end. Progressive surface rehabilitation will be carried out on any dumped material which is determined to have been permanently emplaced as unsuitable for sale or relocation elsewhere.

## **5.7 Water Supply**

The only equipment used in the quarry operation which utilises water is the diamond wire saw. Consumption is about 20 litres per minute or 30,000 litres per week assuming 25 hours use of this machine. Other usage of water for dust such as for dust suppression purposes would be minor and intermittent.

Water will be pumped from the dam to two 5,000 litre tanks located initially at a point near the southern boundary of Stage 1 which is suitable for gravity feed to the area of operation. Potable water will be brought to the site from elsewhere.

The water supply dam proposed is little more than a farm dam which takes advantage of an excellent natural dam site, and, at a storage capacity of some 2 megalitres, is designed to make available additional water to the property owner.

The dam will be constructed with 3:1 batters, topsoiled and grassed with spillway and sills according to the requirements of the Soil Conservation Service and the Department of Land and Water Conservation.

## **5.8 Access Road**

The access point to the Highway for traffic entering and leaving the site has been determined by the Roads and Traffic Authority to be at an existing

access point near the (unoccupied) residence ("The Ranch") some 1.5km north-west of the site. Widening of the road shoulder on the Highway and sealing of the intersection will be carried out as specified by the RTA.

The access road some 1.7km in length will follow the route shown on Figure 2, which was selected to comply with the requirements of the RTA and the preferences of the property owner. The road will be constructed by a contractor with appropriate drains, culverts, batters to comply with the requirements of relevant authorities. It is not proposed initially to seal the road as the volume of traffic would not justify such action. However, dust suppression, maintenance costs and so on could make this advisable at a later date as production tonnages increase.

### 5.9 Noise Sources

Typical noise levels for various types of equipment which will be used on the site are:-

Wire Saw	70dB(A)
Compressor	80dB(A)
Wheel Loader	88dB(A)
Hydraulic Drill	90dB(A)
Pneumatic Drill	100dB(A)

The attenuation rates applied to these figures at the nearest residences and also the effects of blasting are discussed later in Sections 6.7 and 6.8.

### 5.10 Product Transport and Markets

Potential markets in Australia for the products of the proposed quarry are the stone processing companies located mainly in the capital cities. These potential purchasers are expected to initially take up to 40% of the total production but with this percentage reducing over time as export markets are developed. The latter include south and east Asian countries in particular Taiwan, Japan, Indonesia, Malaysia and Singapore, and elsewhere, the USA and Italy.

Transport from the site will be by conventional flat-top semi trailer or B-doubles, and will take advantage of the existing surplus of empty south-bound trucks on the New England Highway. Despatches during the first year of operation will average only 3-5 vehicles per week with a projected increase to about 15 vehicles per week after five years, still well within the capability of the available surplus capacity. An uneven distribution of despatches is however likely to be a characteristic of the sales programme, as for example during the week to two before an export shipment, when higher than average despatches can be expected.

Containerisation of blocks for export will be usual during the initial stages, however, when market acceptance increases the ensuing larger orders will accelerate the tendency towards break bulk shipping. Shipment will be from the ports of Sydney and Newcastle with possible export also through Port Kembla or Brisbane.

### **5.11 Project Workforce and Operation**

Project workforce will initially be three in number increasing within one year to five and possibly 7-8 within 3-4 years. Some management and skilled operator labour will be introduced from elsewhere but the recruitment and training of local labour will be adopted where possible. The interchange of personnel between different quarries is viewed as an important part of skills development.

Employees not resident locally will be housed in Bendemeer or other suitable accommodation which is available in the district.

Normal operating hours will be between 7am and 6pm, six days per week. Any activities outside these hours will be restricted to low noise activities such as maintenance, block dispatch and so on. Unattended overnight operation of the wire saw may be a requirement but this fits the low noise category with a noise level of about 70dB(A).

### **5.12 Erosion and Run Off Control**

The absence of significant soil cover or deeply weathered rock over much of the project area, particularly that proposed for surface disturbance means that soil erosion is not a problem now. Up to four silt trap dams are proposed, with one such dam, Dam W handling drainage for most of the project area and for most of the life of the quarry; Dam X, the overflow from which will reach Dam W is essentially a sump impounding only the immediate runoff from the quarry floor. Dam Y will only be required if the third stage (C) of the waste disposal area is developed, and Dam Z will only be required when the quarry operation advances to the southern slopes of the hill with resultant surface disturbance on those slopes.

### **5.13 Rehabilitation**

Complete backfilling of the final quarry void is not feasible although in the unlikely event that sufficient uses for the waste rock are not identified then the use of part of the quarry for waste disposal would be possible.

The steepness of the batters and the unbroken nature of the rock suggests that attempts to establish vegetation on the quarry walls would be unwise. The quarry wall in its final form presents neither a stability nor an erosion hazard. Adequate stockpiled soil material will be available to complete revegetation of the waste disposal area and the block storage area, with possibly sufficient to establish some vegetation on the quarry floor. The main water supply dam

will remain as a supply to the property owner and the silt dams can be drained and revegetated as soon as their respective catchments are no longer a source contaminated runoff.

Specialist horticultural advice will be sought in respect of various aspects of the ongoing rehabilitation and maintenance programme. In general native species will be selected, particularly those typical of the area, and appropriate practices will be adopted for weed control, the application of fertilisers and so on.

#### **5.14 Alternatives to the Proposed Development**

The suitability of a granite deposit for economic development as a source of dimension stone is determined by a large number of factors which can be collectively grouped under the terms quarryability and marketability. The former includes quarry site suitability and environmental considerations; the latter includes the aesthetics of the stone itself, production costs, transport considerations and so on. The particular granite in terms of its precise colour and textural characteristics has not been identified elsewhere in Australia beyond the immediate district of the project area, and does not have an equivalent on the world market. Such alternatives as are present in the district have either quarrying or environmental problems. Other sites in the district containing granite with somewhat different characteristics are being investigated as additional future development sites.

The quarry techniques to be adopted reflect modern technology in terms of efficiency of production, and represent the only economic option. They are also the preferred environmental option in respect of noise and the minimisation of waste.

The no development alternative would deprive the market of a variety of stone for which market acceptance has been established and would deprive the local economy of an opportunity to produce a raw material which, with the addition of subsequent quarries which are a likely sequel to this development, could result in the establishment of a value-added export-oriented processing industry.

## 6. IMPACT ASSESSMENT AND SAFEGUARDS

### 6.1 Topography

Although impacting on a hill of modest dimensions in the local landscape and creating a permanent void the highest point of the hill remains unaffected as are the complete western slopes and the more prominent part of the eastern slopes. The nature of the quarrying process means that the slopes immediately beyond the quarry limit can remain completely unaffected in respect of spillage of waste, impact on vegetation and so on. The question of visibility from surrounding areas is further addressed in Section 6.11.

The proposed quarry area is at the western end of an area of protected land on the basis of slopes steeper than 18°. Although the area is mapped only at county map scale and its precise boundaries are difficult to accurately determine, the company will comply with the requirements in respect of such land.

### 6.2 Geology

The geology of the district comprising essentially granite of various types has no known economic value other than that identified in respect of this project. The project results in maximum utilisation of the resource from a minimum affected area.

### 6.3 Flora and Fauna

The flora and fauna studies have not identified the presence of endangered species which would justify not proceeding with the project. The total area to be cleared of vegetation is small, comprising approximately about 0.3 hectare for the dam, somewhat less than 1 hectare for the stockpile/loading area (much of which is already cleared) and about 4.5 hectares for the quarry area (of which about 1 hectare is unvegetated bare rock); the waste disposal area is already cleared land. Of the total quarry area about 1 hectare of timbered land will be cleared at the establishment stage and only a further hectare or so during the first 10 years of operating life.

### 6.4 Impact on Hydrology

#### 6.4.1 *Water Demand*

Water usage by the project at about 2 million litres per year is small and would have no measurable impact on the flow in Rocky Gully which is a permanent stream. Although pumping direct from Rocky Gully was proposed by the property owner the construction of a dam is preferred by the proponent as a means of avoiding concerns by downstream properties during periods of drought and low flow, and also as a means of making the project as self-contained as possible.

The size of water storage proposed is such that benefit will accrue to the property from the surplus which will be available.

#### 6.4.2 *Water Quality and Stormwater Control*

The small quarried area and the quarry techniques employed which are specifically designed not to produce a high degree of fragmentation and the generation of fines, minimises the risk of silt contamination beyond the quarry area. Fines generated by diamond wire sawing are estimated to be about 3 tonnes per week and a somewhat lesser quality will result from drilling operations. Some of the silt laden water from wire sawing will directly reach Silt dam X but most will be absorbed into the quarry floor or lost by evaporation. The result will be the deposition of such fines on the quarry floor, along with that produced by the drill rigs. Subsequent stormwater action has the potential to redistribute this material, which will be controlled by the dual system of sedimentation dams. Silt Dams X will collect direct run off from the quarry floor with any overflow passing to Dam W. Unaided sedimentation of silt in such dams can usually be expected but flocculants will be added if necessary. The water in Dams W and X is available for recirculation back to the quarry. Dam W and associated drains will be built before any site clearing within its catchment is commenced and Dam X will be built before quarrying commences.

The porosity of the waste rock dump will be such that some filtration will occur; run off from the dump eventually reaches Dam W with the exception of that from Stage C which will be collected in Dam Y.

The quarry floor will always slope to the north and drain in this direction. In the unlikely event of surface disturbance beyond the extreme southern limit of the quarry, Dam Z will contain any silt movement in this direction.

The water supply dam will have little or no impact in mitigating flood potential from major storm events; its capacity represents only some 15 minutes of the estimated 4 cumecs discharge from a 1 in 50 year event.

#### 6.4.3 *Groundwater*

No impact on groundwater can be anticipated from any aspect of the project. Bunding around the fuel storage area will be sufficient to accommodate a volume of spillage 50% greater than the maximum fuel storage capacity.

## **6.5 Impact on Land Use and Employment**

Although situated on a farming property of some 961 hectares the total project area of about 11 hectares including the access road, is approximately equally divided between uncleared bush and grazing land. The negative impact of the project on the stock carrying capacity of the property is essentially nil and may be beneficial as a result of the increased water availability.

The number of employees, initially 3-4, increasing to double this figure is small but significant in the local context. Indirect employment arising from the project relates to transport and supply and service personnel in respect of quarry equipment. No impact on building in the district is envisaged although the occupation of existing unoccupied residences is anticipated.

## **6.6 Transport Impacts**

As detailed in Section 5.10 the transportation of the quarry product will utilise mainly existing southbound transport. The impact therefore will relate more to an increase in the number of loaded vehicles on the New England Highway rather than an increase in total vehicle movements. Supplies to the site of fuel, quarry consumables and so on is unlikely to require more than one delivery per week and the movement of employees and other site vehicles to the project will have negligible impact. The effect on the ports and port facilities of exports resulting from the project will be beneficial although very small.

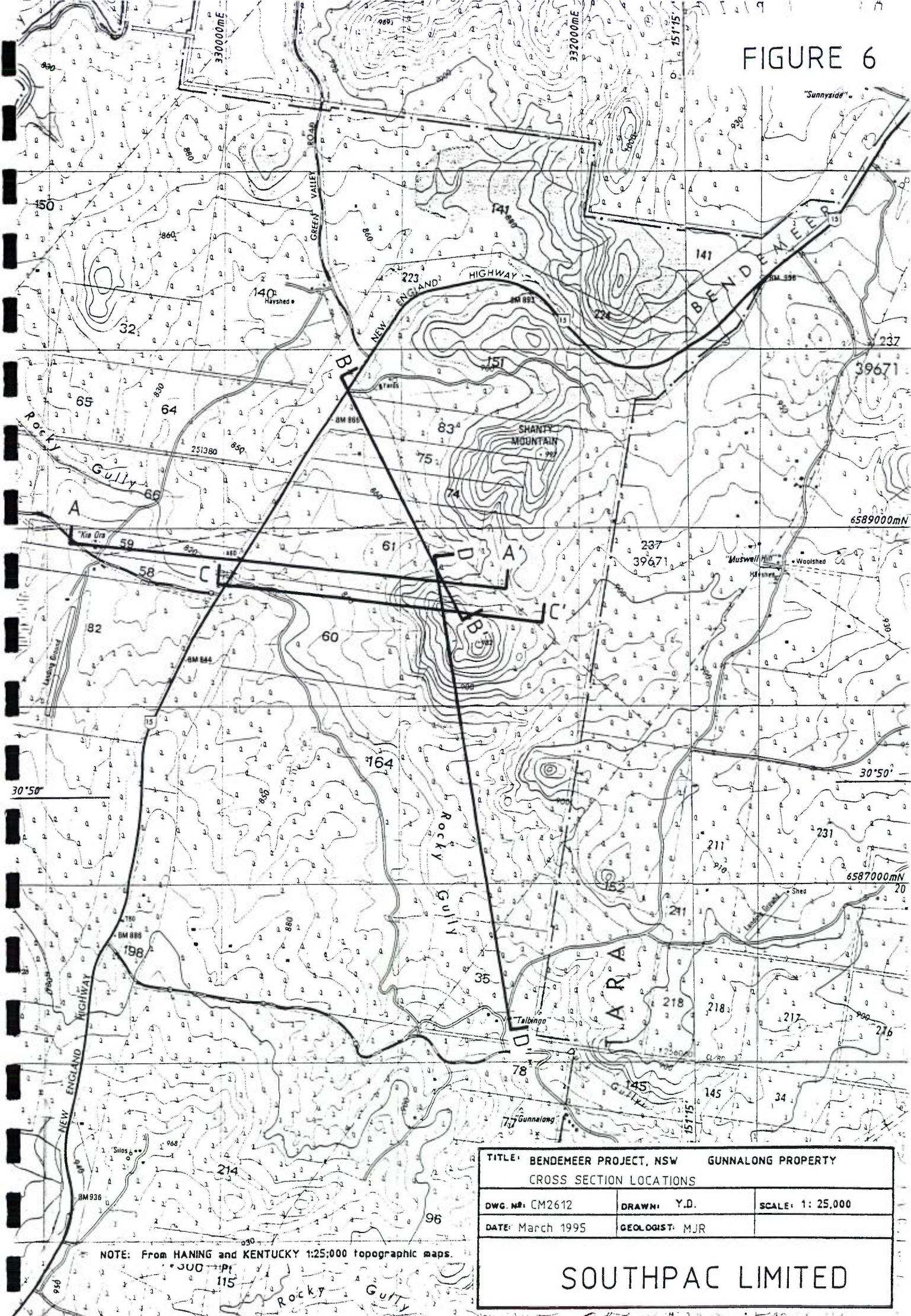
## **6.7 Noise Impacts**

The noise levels of various items of quarry equipment were listed in Section 5.9. In summary all equipment except the pneumatic and hydraulic drills would be well within background levels at the nearest residences which are respectively 1.6 and 2 kilometres distant. Under ideal weather conditions for sound transmission and ignoring the effects of any acoustic shielding the drill rigs may be audible at these locations. However, with the exception of the initial quarry development phase and when operations are located at the original ground surface, the working face will be visually and acoustically screened by the existing tree barrier immediately beyond the western quarry limit (see Plate 1). More significantly the containment of operations within the quarry walls on three sides, which will become apparent well within the first year of operation, will provide effective acoustic screening.

## **6.8 Impact of Blasting**

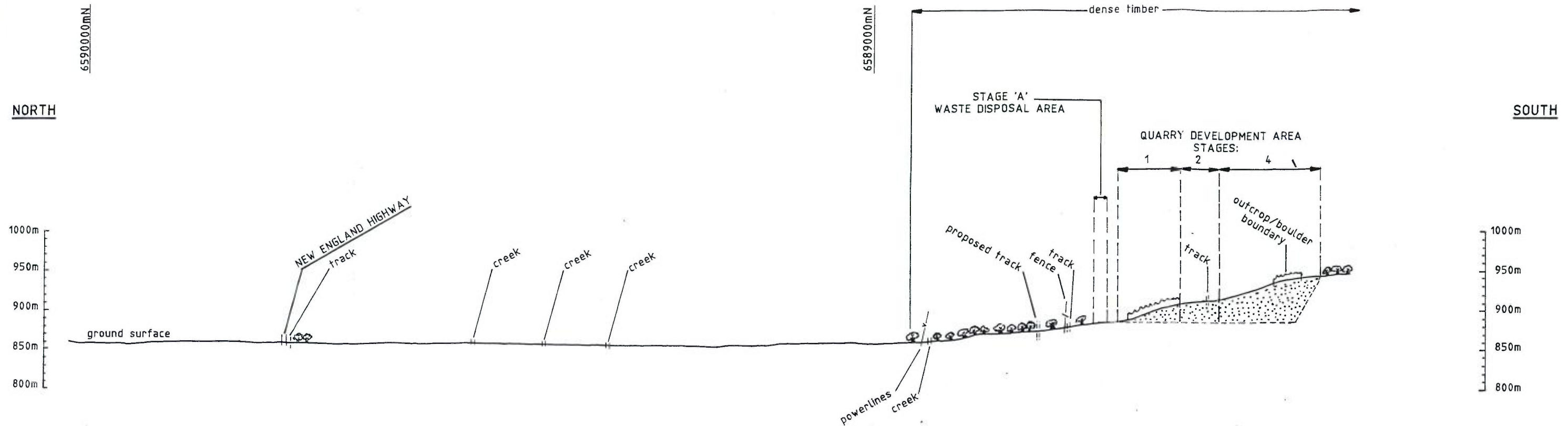
The type of explosives used and the blasting techniques adopted in dimension stone quarrying differ greatly from other types of surface mining or quarrying where the primary objective of blasting is to fragment the material as completely as possible. In the case of dimension stone the objective is to

FIGURE 6



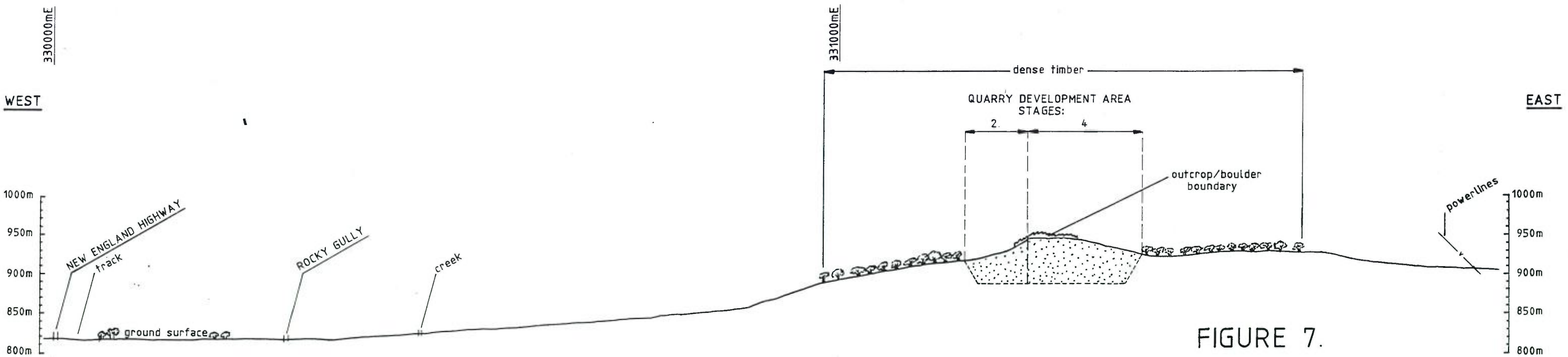
TITLE: BENDEMEER PROJECT, NSW GUNNALONG PROPERTY		
CROSS SECTION LOCATIONS		
DWG. NO: CM2612	DRAWN: Y.D.	SCALE: 1: 25,000
DATE: March 1995	GEOLOGIST: MJR	
SOUTHPAC LIMITED		

NOTE: From HANING and KENTUCKY 1:25,000 topographic maps.



**SECTION B-B'**

SCALE 1: 5000

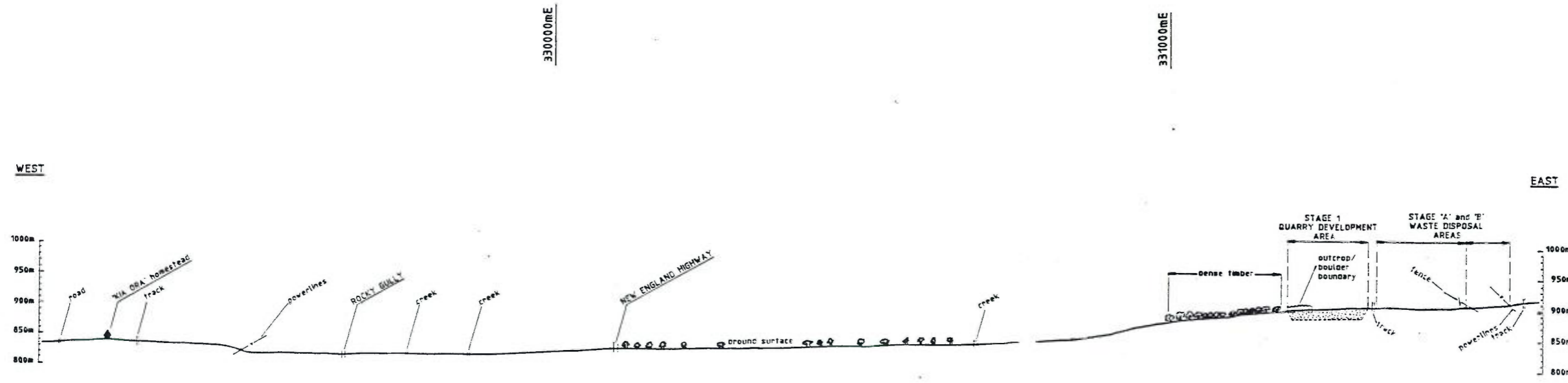


**SECTION C-C'**

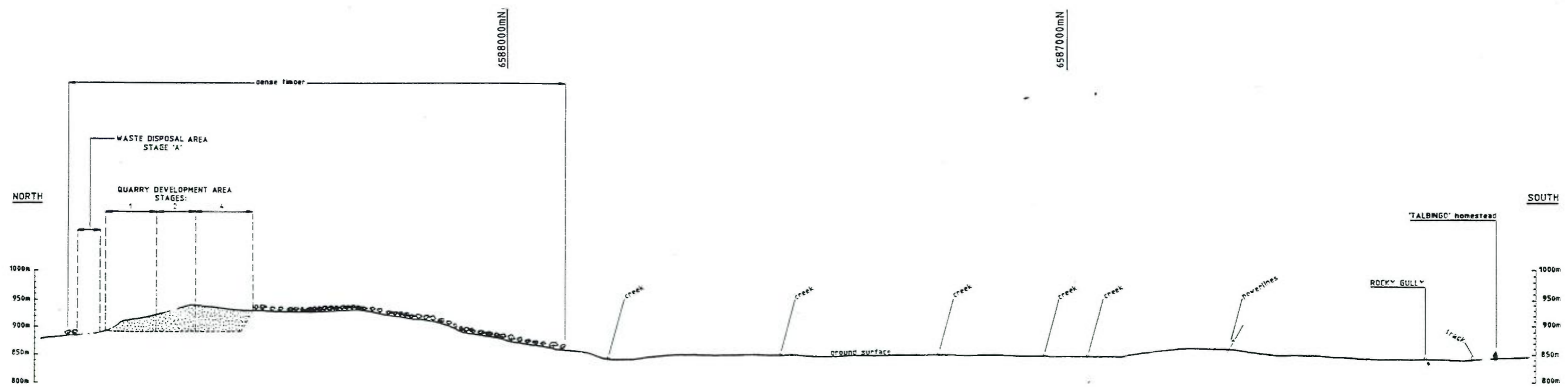
SCALE 1: 5000

FIGURE 7.

<b>SOUTHPAC LIMITED.</b>		
TITLE: BENDEMEER PROJECT, NSW GUNNALONG PROPERTY CROSS SECTION B-B' and C-C'		
DWG. NO: CM2609	DRAWN: Y.D.	SCALE: 1: 5000
DATE: March 1995	GEOLOGIST: MJR	



**SECTION A-A'**  
SCALE: as shown



**SECTION D-D'**  
SCALE: as shown

**FIGURE 8**

<b>SOUTHPAC LIMITED</b>		
TITLE: BENDEMEER PROJECT, NSW GUNNALONG PROPERTY CROSS SECTION A-A' and D-D'		
DWG. No: CM2608	DRAWN: Y.D.	SCALE: AS SHOWN
DATE: March 1995	GEOLOGIST: MJR	

split the rock along predetermined lines. This effectively eliminates the risk of fly rock and very substantially reduces the amount of dust.

With effective elimination of dust and fly rock there remains the potential impact due to overpressure and ground vibration. The small amount of explosive used in individual blasts, often less than 10kg compared with 100kg or more in crushed rock quarries would reduce ground vibration to unnoticeable levels at the nearest residences and it is believed that the overpressure would be well within the normally acceptable comfort level of 115 dB PeakLin. However, predictions without the benefit of normal sized blasts in the developed quarry may be inaccurate and it is appropriate therefore to monitor blasting during the early stages of operation in order that blasts can be limited if necessary to achieve normally acceptable overpressure levels. It is also appropriate that in the early stages the nearest residents be advised of impending blasts to agree on the need for ongoing notification of this type.

### **6.9 Air Quality Impacts**

Drilling machines will be fitted with dust collectors or use water for dust suppression purposes. Vehicle movements will of necessity raise some dust but the small amount of fine material produced at all stages of the operation will limit the potential in this respect. Routine watering of the access road is not practicable because of the low traffic volume but sealing of this road could be appropriate when production volumes increase.

### **6.10 Impact on Aboriginal Heritage**

The aboriginal artefacts reported in Appendix 3 are mainly located outside the boundaries of the proposed quarry. The stockpile and workshop areas as now proposed have been moved from the location previously identified in Appendix 3 to avoid an area reported as containing such artefacts. The small number of artefacts reported within the quarry area are proposed to be the subject of further study and comment by others. It is expected that the company will make in due course application to remove these items.

The rock overhang and cave identified in Appendix 3 will be further investigated to determine its aboriginal history and significance. Consideration will be given to modifying the quarry plan to ensure the preservation of this feature if its heritage significance can be demonstrated.

### **6.11 Landscape and Visual Impact**

Plate 1 shows the view of the project area from close to the New England Highway near "The Ranch" property; it coincides approximately with Section B-B' in Figure 7. The impact on the landscape and views from other directions are shown on section form in Figures 7 and 8. In summary the quarry will not be visible from Gunnalong or from the adjacent Talbingo homestead.

Critical to the minimisation of visual impact is the maximum preservation of existing tree cover on the western side of the project area; this is an integral part of the proposal. The western boundary of the proposed quarry is along an existing tree line beyond which there will be no disturbance of the tree cover. This will ensure minimum visual impact from the highway and from Kia-ora Station.

The prominent rock outcrop visible on Plates 1 and 2 is visible from the Highway, although not readily noticeable to passing traffic; the visible outcrop forms part of Stage 1 of the proposed quarry the operating part of which will be lowered behind the tree line within the first year of operation. Operations many years later would again be temporarily visible in the higher parts of Stage 4. Most of the waste dump area is screened by existing trees which will remain; new plantings along the western face of the dump early in the life of the project and progressive rehabilitation of its surface will further assist in this respect.

Although the proposed development is well screened by the existing timbered areas within and adjacent to the project area this is further assisted by the relatively dense tree cover within the Travelling Stock Reserve which borders the Highway. There is scope for further augmentation of this screening if it should become necessary by plantings in the intervening areas, with the property owners agreement.

If, as is possible a derrick crane is introduced as a means of handling the quarry product then the mast and boom of this item of plant will be visible above tree height during much of the life of the quarry. At some 1.5km distant from the highway it will not be an obvious feature and will of course not be a permanent change to the landscape.

## **7. SUMMARY OF ENVIRONMENTAL SAFEGUARDS AND PROCEDURES**

### **7.1 Pre-development and Site Preparation Stage**

- Silt dam W and associated drains will be constructed before any land clearing or surface disturbance occurs within its catchment.
- The removal of sufficient topsoil from the waste dump area to construct a screening embankment, approximately 5 metres high, along its western boundary and its planting with grass and trees, will be an early priority.
- Tree removal will be restricted to that necessary for establishment of the access road, dam, quarry, waste and stockpile areas.
- Batters on the access road will be 3:1 and grassed.
- The removal of trees within Protected Lands (steeper than 18 degrees) will only be with the appropriate approvals.
- Batters on the water supply dam and other construction details such as spillways will be in accordance with the requirements of the Soil Conservation Service.
- Further consultation and recording of the aboriginal artefacts within the quarry area will be undertaken.
- Development applications will be lodged as necessary in respect of office and workshop facilities and employee amenities as required on the site.

### **7.2 Operational Stage**

- Monitoring of blasting will be undertaken during the early operational stages.
- Maintenance of revegetated areas by the application of water and fertiliser as appropriate will be undertaken.
- Drains and sedimentation dams will be maintained to ensure effectiveness.
- Equipment will be maintained to ensure efficient operation especially in respect of dust collectors and the like.
- Operational policy will be one of strict compliance with the conditions of any approval and with the health and safety requirements of employees and the public.

### **7.3 Decommissioning and Rehabilitation**

- Rehabilitation of the waste dump and stockpile area will be completed with final grading of batters, topsoil spreading and revegetation.
- The quarry floor will be grassed where sufficient topsoil is available to achieve success. Quarry walls will remain bare rock with appropriate fencing to protect straying stock.
- Sedimentation dams will be drained and the area grassed once the risk of silt-contaminated runoff has passed.
- The water supply dam will remain for the ongoing use of the property owner.
- According to the wishes of the property owner the access road will either remain or will be ripped and grassed.
- All equipment, buildings, water and fuel tanks and so on will be removed from the site.

Waste disposal area

Quarry area



**PLATE 1** Project area viewed from North-west near New England Highway. Stage 1 quarry area is main outcrop in centre of picture, Stage 4 is boulder outcrop behind.

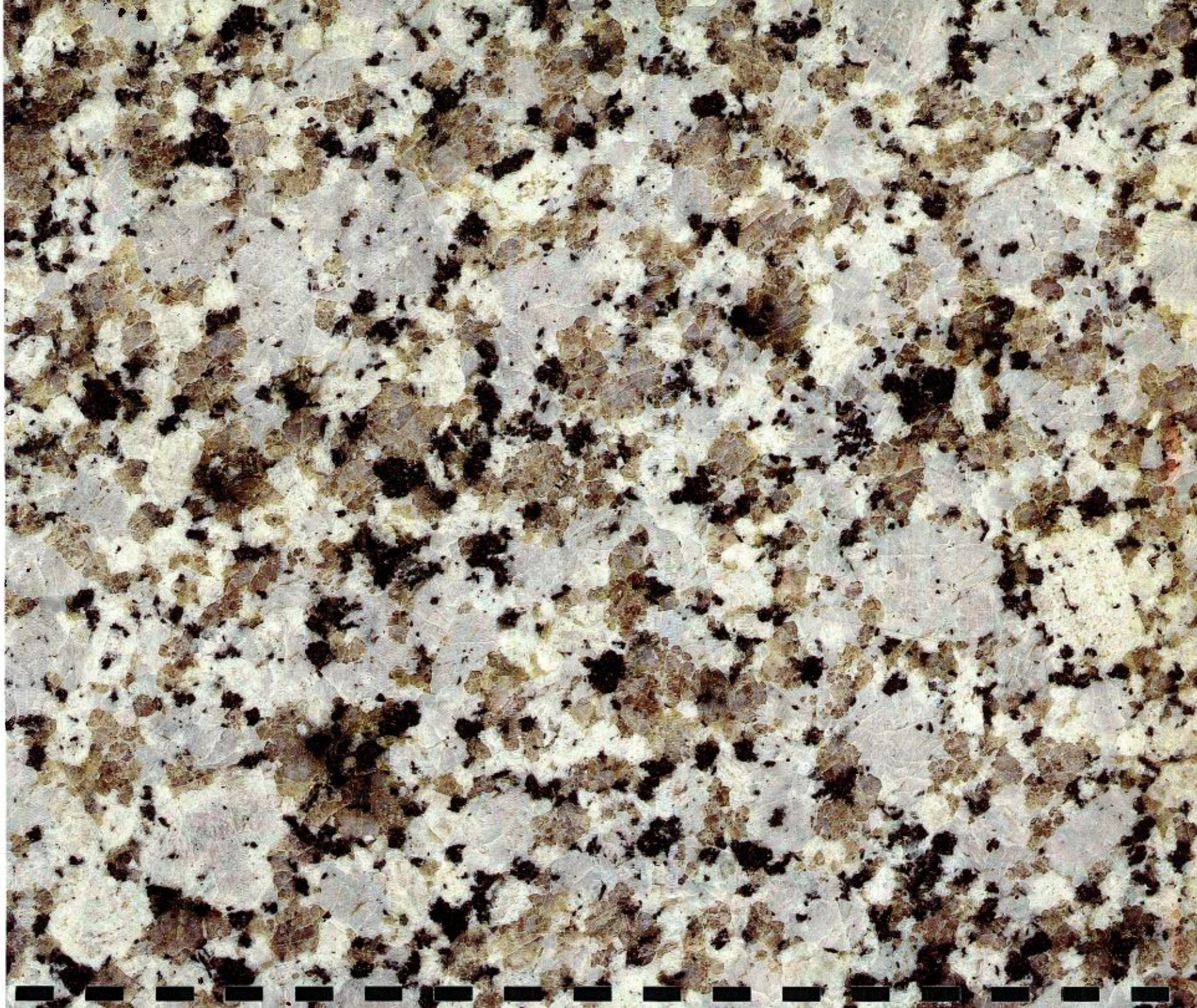


**PLATE 2** Proposed quarry site, Stage 1 in foreground, Stage 2 in background.



PLATE 3

KOALA



## SOUTH PACIFIC GRANITE



PRIMARY NAME	<b>KOALA</b>
ALTERNATIVE NAMES	
STONE TYPE	<b>GRANITE</b>
COLOUR	<b>BLUE/GREY</b>
GEOLOGICAL NAME	<b>BIOTITE-CORDIERITE GRANITE</b>
GEOLOGICAL AGE	<b>PERMO-CARBONIFEROUS</b>

### MINERAL COMPOSITION

<i>K-feldspar</i>	45%	<i>Plagioclase</i>	20%
<i>Quartz</i>	20%	<i>Biotite</i>	10%
<i>Other</i>	5%		

### PETROGRAPHIC DESCRIPTION

*A coarse grained porphyritic granite with hypidiomorphic granular texture and variable grain size. K-feldspar is grey to blue-grey occurring as phenocrysts up to 3cm set in a coarse grained groundmass of grey-white plagioclase brown-black biotite and quartz. Minor altered cordierite occurs among the accessory minerals.*

### RECOMMENDED FINISHES

- |  |   |  |
|--|---|--|
| <input checked="" type="checkbox"/> POLISHED | <input checked="" type="checkbox"/> HONED | <input checked="" type="checkbox"/> FLAMED |
| <input checked="" type="checkbox"/> ETCHED   | <input type="checkbox"/> SPLIT            | <input type="checkbox"/> ROUGH SAWN        |
| <input type="checkbox"/> DIAMOND SAWN        | <input type="checkbox"/> HAND WORKED      |  |

### TECHNICAL SPECIFICATION

<i>Bulk Density (ASTM C97-83)</i>	<b>2.64 tonnes/m<sup>3</sup></b>
<i>Absorption by weight (ASTM C97-83)</i>	<b>0.15%</b>
<i>Flexural Strength (ASTM C880-89)</i>	<b>11.0 MPa dry, 10.3 MPa wet</b>
<i>Compressive Strength (ASTM C170-87)</i>	<b>146 MPa dry, 134 MPa wet</b>

The sample illustrated is as accurate as photographic, colour reproduction and printing processes allow. As with all natural materials some degree of variability can be expected. Repeat testing is recommended to confirm suitability of technical specification for individual projects and applications.

### QUARRY PRODUCER SOUTH PACIFIC GRANITE

**Level 14, Phillips House  
15 Blue Street, North Sydney**

**PO Box 1674 North Sydney  
NSW 2059 Australia**

**Tel: (61) 02 9966 1988  
Fax: (61) 02 9964 0209**

**APPENDIX 1**

**Gunnalong Project  
Vegetation and Fauna Survey**



# ARNHEM ENVIRONMENTAL IMPACT ASSESSORS

'SANDON PARK' TILBUSTER, N.S.W. 2350

PHONE: (067) 711259

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## Clutha Minerals Limited Gunnalong Project

### Vegetation and Fauna Survey



Job No. AE 940801

3 August 1994

Vegetation and Fauna Survey  
Gunnalong Project

**EXECUTIVE SUMMARY**

At the request of Clutha Minerals Limited, AEIA (Arnhem Environmental Impact Assessors) performed a Vegetation and Fauna Survey on the grazing property Gunnalong, owned by Mr. S Green, and situated some 9kms North of Bendemeer.

The Project area consists of a low hill with substantial outcrops of Banalasta Adamellite, a porphyritic biotite-muscovite-cordierite granite, which produces soils of low fertility. It measures approx. 9ha and forms a mosaic of granite outcrops, lithosols and grey podzols in situations where deeper soil profiles have developed. Granite outcrops are a feature of the hill (approx. 3.5ha) reserved for quarrying (Cover Photo).

The quarry site is thus a low hill which rises from approximately 890m at the foot to 945m at the highest point and is predominantly covered by eucalypts and low shrubs which vary in height and density and therefore form a mosaic of low open-woodland and woodland. The vegetation, however, approaches an open-forest structure in the proposed waste rock area to the north of the quarry site. *Eucalyptus laevopinea*, *Eucalyptus andrewsii*, and *Eucalyptus blakelyi* are prominent and some tall specimen grow on the site. In some areas *Olearia viscidula* forms a very dense understorey. The Project area is floristically probably as rich as the flora recorded at Mt. John, but due to the time of sampling (mid-winter) only 54 species from 30 families were recorded. None of the species are rare or on the endangered list. Species such as orchids are, however, on the protected list.

The animal survey indicated that birds (27 spp.) were the most diverse group of animals, followed by mammals (8spp.) and reptiles (6spp.). Ants were on this occasion not collected. None of the fauna species are threatened or endangered, although a number are protected. It must be stressed that the lists of plants and animals are far from complete, since they represent only those species present and recorded at an unfavourable time of sampling. Particularly the plant numbers are much reduced compared to the Mt. John area.

## Gunnalong Project - Vegetation Survey

by

Paul J.R. Broese van Groenou

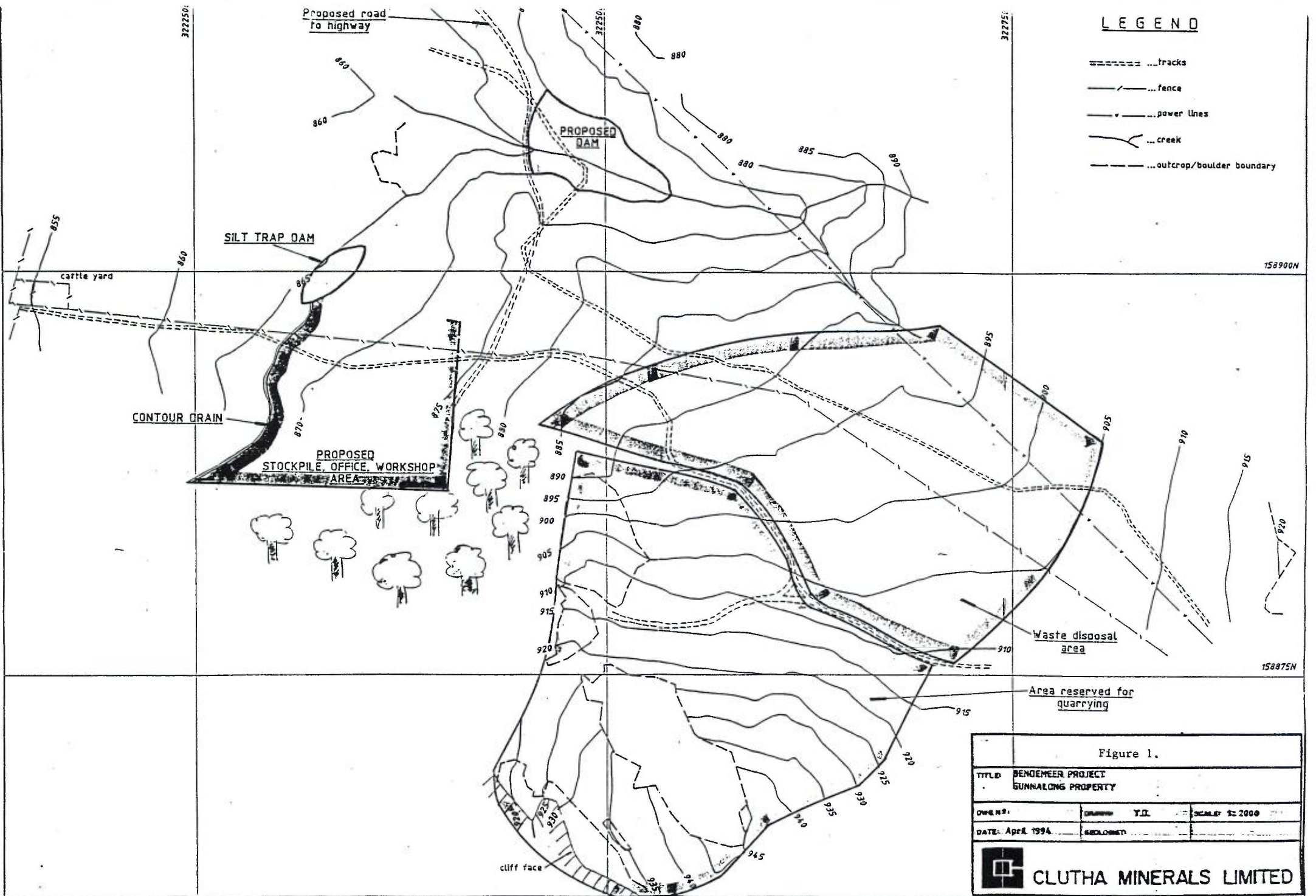
### INTRODUCTION

Clutha Minerals Ltd. through Mr. Malcolm J. Robinson, Manager Exploration and Development, contacted Paul Broese van Groenou late in April 1994 to ask if AEIA would undertake a survey of the heritage component of the Gunnalong project. Following a site visit and further discussion regarding the scope of the consultancy, AEIA was formally requested to carry out the work and submitted a **Preliminary Report on Archaeological Survey - Bendemeer Project** on 17 May 1994. In June 1994, Malcolm Robinson requested AEIA to follow up the heritage survey with a vegetation and fauna survey. This report presents the data of that survey.

The vegetation survey was performed by Paul Broese van Groenou and the fauna survey by Steve Tremont with help from Ruth Tremont.

The Project area is located approximately 33km south of Uralla and 9km north of Bendemeer. The area surveyed is fairly small (9ha) and consists of an area reserved for quarrying, a waste disposal area and an area proposed for stockpile, office and workshop (Figure 1).

The geology of the site is such that the entire Project area is on Banalasta Adamellite, a porphyritic biotite-muscovite-cordierite granite, which produces soils of low fertility. A feature of the area is the prominent hill (Plate 1) with a number of granitic outcrops interspersed with lithosols which are better developed in the gully to the north of the quarry site, and because of the better water economy and nutrient status appear to support the largest trees.



**LEGEND**

- tracks
- fence
- power lines
- creek
- outcrop/boulder boundary

Figure 1.


TITLE: BENDEMEER PROJECT GUNNALONG PROPERTY		
Drawn by:	Checked: Y.J.	Scale: 1:2000
DATE: April 1994	Geologist:	
 <b>CLUTHA MINERALS LIMITED</b>		



Plate 1. Low hill reserved for quarrying on Gunnalong property. (Viewed to the south-east from entrance gate on New England highway).

The climate is very similar to Uralla, which is the closest weather recording station. Rainfall of about 800mm with January and February the wettest months and April and May the driest months. Summer temperatures generally do not exceed 30 °C, with winter temperatures on occasion reaching -6 °C.

The vegetation is dominated by eucalypts and angophoras varying in height, cover and density, and thus forming a mosaic. Nevertheless, the vegetation is predominantly woodland, thus structurally of a type with medium trees 10-30m high, and with a foliage cover of generally less than 30%. In some areas, however, the vegetation is more like an open forest and foliage cover is in the range of 30-70%, with trees reaching heights greater than 30 metres.

Seven eucalypts were recorded in the area, but the dominant species were *Eucalyptus laevopinea*, *Eucalyptus andrewsii* and *Eucalyptus blakelyi*. Hence the community could best be described as an *Eucalyptus laevopinea/andrewsii/blakelyi* association. The understorey is fairly dense, and *Olearia viscidula* is prominent. Gunnalong is a grazing property with cattle and sheep grazing on native pastures on the area surrounding the proposed quarry site.

## METHODS

Field work on the Project site was performed on 26 June 1994. The survey party left Armidale at 5am in order to be on site before the birds stirred and started to call, and after a days work returned to Armidale at 5pm. Clutha Minerals Limited furnished AEIA with a site plan on a scale of 1:2000 which served to delineate the area to be surveyed.

To get a "feel" for the site the 9ha was traversed throughout in a random manner and species encountered were recorded. The vegetation was further analysed by plotless sampling using the quarter method. At the selected sampling points measurements were made of tree circumference at breast height (cbh), so that basal areas could be calculated. Tree heights were also recorded, and to be able to calculate density of trees, distances to the nearest tree in each quadrat were measured.

## RESULTS

Frequent traverses of the area in combination with the sampling strategy adopted, produced the data for the Species List, which is presented as Table 1.

Two line transects at approximately 322500E and 322550E were surveyed, and measurements were taken at 40m intervals. Results are presented in Table 2.

Table 1. Species List of plants occurring on the Gunnalong  
Project area.

(arranged alphabetically according to family)

ADIANTACEAE

*Cheilantes tenuifolia*

APIACEAE

*Trachymene incisa*

ASTERACEAE

*Cassinia quinquefaria*

\**Cirsium vulgare*

*Gnaphalium sphaericum*

*Helichrysum apiculatum*

*Hypochoeris glabra*

*Olearia viscidula*

*Olearia* sp. aff. *elliptica*

CARYOPHYLLACEAE

*Stellaria pungens*

CONVOLVULACEAE

*Dichondra repens*

CYPERACEAE

*Carex* sp.

DILLENIACEAE

*Hibbertia obtusifolia*

EPACRIDACEAE

*Lissanthe strigosa*

*Melichrus urceolatus*

FABACEAE

*Glycine clandestina*

GENTIANACEAE

*Centaurium tenuiflorum*

GERANIACEAE

*Geranium solanderi*

JUNCACEAE

*Juncus* sp.

LILIACEAE

*Dianella laevis*

LOBELLIACEAE

*Isotoma axillaris*

LORANTHACEAE

*Amyema pendulum*

MIMOSACEAE

*Acacia neriifolia*

MYRTACEAE

*Angophora floribunda*

*Eucalyptus andrewsii*

*Eucalyptus blakelyi*

*Eucalyptus bridgesiana*

*Eucalyptus laevopinea*

*Eucalyptus malacoxylon*

*Eucalyptus melliodora*

*Eucalyptus prava*

*Eucalyptus viminalis*

*Leptospermum polygalifolium subsp. montanum*

ONAGRACEAE

*Epilobium billardierianum*

ORCHIDACEAE

*Pterostylis parviflora*

PITTOSPORACEAE

*Bursaria spinosa*

POACEAE

*Aristida contorta*

*Cymbopogon refractus*

*Echinopogon sp.*

*Eragrostis sp.*

*Imperata cylindrica*

*Pennisetum alopecuroides*

*Poa sieberana*

*Themeda australis*

POLYPODIACEAE

*Pyrrosia rupestris*

RANUNCULACEAE

*Clematis aristata*

ROSACEAE

\**Rubus procerus*

RUTACEAE

*Correa reflexa*

SANTALACEAE

*Exocarpus cupressiformis*

SCROPHULARIACEAE

*Veronica calycina*

URTICACEAE

\**Urtica urens*

VERBENACEAE

*Verbena bonariensis*

XANTHORRHOEACEAE

*Lomandra filiformis*

*Lomandra longifolia*

Notes on Species List :

\* denotes a naturalised taxon  
references used include Beadle et al. (1972), Beadle (1972-1978),  
and Harden (1990, 1991, 1992 and 1993).  
mosses and lichens have not been identified to generic and species  
level.  
number of Families recorded: 30  
number of species recorded: .54

Table 2. Density and basal areas of trees.

SP	Sp	D	cbh	BA	Sp	D	cbh	BA	Sp	D	cbh	BA	Sp	D	cbh	BA
1	E.v.	7.6	107	0.09	E.v.	9.5	119	0.11	E.b.	8.5	103	0.08	E.a.	21.9	140	0.16
											44	0.02				
2	rock															
3	E.m.	8.0	199	0.32	A.n.	11.3	48	0.02	E.l.	5.1	72	0.04	E.b.	10.7	91	0.07
			91	0.07							45	0.02				
4	E.l.	3.7	108	0.09	E.b.	5.8	88	0.06	E.l.	5.5	100	0.08	E.l.	7.3	200	0.32
			125	0.12							92	0.07				
5	E.l.	1.9	120	0.11	E.l.	3.0	61	0.03	E.l.	2.6	75	0.04	E.a	4.7	207	0.34
							88	0.06								
6	E.l.	1.6	85	0.06	E.p.	1.7	53	0.02	E.p.	1.0	77	0.05	E.p.	3.7	87	0.06
7	E.b.	23.2	80	0.05	E.ma.	17.8	152	0.18	A.f.	12.0	142	0.16	E.l.	9.7	197	0.31
			101	0.08												
			60	0.03												
8	A.f.	18.9	270	0.58	A.f.	5.8	172	0.24	E.l.	22.9	88	0.06	A.n.	12.5	51	0.02
											89	0.06				
											96	0.07				
											70	0.04				
9	E.b.	5.6	76	0.05	E.l.	9.4	187	0.28	E.l.	14.0	70	0.04	E.m.	5.9	302	0.73
							74	0.04			81	0.05				
							97	0.07								
10	rock															
11	E.a.	27.4	122	0.12	E.a.	7.6	130	0.13	E.a.	8.5	174	0.24	E.a.	16.7	93	0.07
														78	0.05	
12	E.l.	6.4	46	0.02	E.a.	6.6	102	0.08	E.m.	1.5	109	0.09	E.l.	1.0	74	0.04
							94	0.07						56	0.02	
SUM		104.3				78.5				81.6				94.1		

Notes on Table2: (use of abbreviations)

SP=sampling point; Sp=species; D=distance in metres; cbh=circumference at breast height in cm; BA=basal area in m<sup>2</sup>.

A.n.=*Acacia neriifolia*; A.f.=*Angophora floribunda*, E.e.=*Eucalyptus andrewsii*, E.b.=*Eucalyptus blakelyi*; E.l.=*Eucalyptus laevopinea*, E.ma.=*Eucalyptus malacoxylon*; E.m.=*Eucalyptus melliodora*; E.p.=*Eucalyptus prava*; E.v.=*Eucalyptus viminalis*

Total distance of 40 measurements was 358.5m, hence a mean distance of 9.0m and thus a mean area of 81m<sup>2</sup>. Mean density of trees per hectare is thus 124.

	Relative density (%)	Absolute density (trees/ha)	B.A. (m <sup>2</sup> /ha)
<i>Acacia neriifolia</i>	5.0	6.2	0.13
<i>Angophora floribunda</i>	5.0	6.2	3.10
<i>Eucalyptus andrewsii</i>	17.5	21.7	3.94
<i>Eucalyptus blakelyi</i>	12.5	15.5	1.40
<i>Eucalyptus laevopinea</i>	35.0	43.4	7.01
<i>Eucalyptus malacoxylon</i>	2.5	3.1	0.45
<i>Eucalyptus melliodora</i>	7.5	9.3	3.76
<i>Eucalyptus prava</i>	7.5	9.3	0.38
<i>Eucalyptus viminalis</i>	5.0	6.2	0.63

Basal area was calculated from:  $BA=(cbh)^2/12.57$

## Preliminary Vertebrate Survey

Survey conducted and report prepared by Steve Trémont.

A preliminary survey of birds, mammals and reptiles was conducted at the proposed granite quarry site south of Mt. Shanty approximately 10 km north of Bendemeer, New South Wales, on 25 June 1994 between 0630 and 1500.

The survey was performed by randomly walking throughout the proposed 9ha site, listening and looking for birds and mammals, searching the ground for active reptiles, tracks and traces of mammals, and searching for reptiles under rocks and logs.

During the first part of the day the weather was cool to cold and overcast with a strong breeze. However, the clouds cleared and the breeze eased during the latter part of the day.

Species detected were limited to those present during winter (sedentary species), diurnally active, located under rocks or logs, or those which left traces of their presence in the form of scats, tracks and scratchings.

The following are lists of species detected and methods used for identification:

### Birds

Wedge-tailed Eagle	<i>Aquila audax</i>	sighted
Crimson Rosella	<i>Platycercus elegans</i>	sighted, calls
Laughing Kookaburra	<i>Dacelo novaeguineae</i>	calls
Scarlet Robin	<i>Petroica multicolor</i>	calls
Eastern Yellow Robin	<i>Eopsaltria australis</i>	calls
Golden Whistler	<i>Pachycephala pectoralis</i>	sighted, calls
Grey Shrike-thrush	<i>Colluricincla harmonica</i>	calls
Willy Wagtail	<i>Rhipidura leucophrys</i>	sighted
Superb Fairy-wren	<i>Malurus cyaneus</i>	sighted, calls

**Birds** (continued)

White-browed Scrubwren	<i>Sericornis frontalis</i>	sighted, calls
Brown Thornbill	<i>Acanthiza pusilla</i>	sighted, calls
Buff-rumped Thornbill	<i>Acanthiza reguloides</i>	sighted, calls
Striated Thornbill	<i>Acanthiza lineata</i>	sighted, calls
Varied Sittella	<i>Daphoenositta chrysoptera</i>	sighted, calls
White-throated Treecreeper	<i>Cormobates leucophaea</i>	sighted, calls
Red Wattlebird	<i>Anthochaera carunculata</i>	calls
Noisy Miner	<i>Manorina melanocephala</i>	calls
White-eared Honeyeater	<i>Lichenostomus leucotis</i>	sighted, calls
Brown-headed Honeyeater	<i>Melithreptus brevirostris</i>	sighted, calls
Eastern Spinebill	<i>Acanthorhynchus tenuirostris</i>	calls
Mistletoebird	<i>Dicaeum hirundinaceum</i>	calls
Spotted Pardalote	<i>Pardalotus punctatus</i>	sighted, calls
Striated Pardalote	<i>Pardalotus striatus</i>	calls
Australian Magpie-lark	<i>Grallina cyanoleuca</i>	sighted
Grey Butcherbird	<i>Cracticus torquatus</i>	calls
Australian Magpie	<i>Gymnorhina tibicen</i>	calls
Australian Raven	<i>Corvus coronoides</i>	sighted, calls

**Mammals**

Echidna	<i>Tachyglossus aculeatus</i>	scratchings
Common Brushtail Possum	<i>Trichurus vulpecula</i>	scats
Eastern Grey Kangaroo	<i>Macropus giganteus</i>	scats
Common Wallaroo	<i>Macropus robustus</i>	sighted, scats
Swamp Wallaby	<i>Wallabia bicolor</i>	sighted, scats
Rabbit	<i>Oryctolagus cuniculus</i>	scats
Fox	<i>Vulpes vulpes</i>	scats
Goat	<i>Capra hircus</i>	scats

## Reptiles

### Gekkonidae

Wood Gecko	<i>Diplodactylus vittatus</i>	under rocks
Lesueur's Velvet Gecko	<i>Oedura lesueurii</i>	under rocks
-	<i>Underwoodisaurus sphyrurus</i>	under rocks

### Scincidae

Copper-tailed Skink and under rocks	<i>Ctenotus taeniolatus</i>	under logs
-	<i>Morethia boulengeri</i>	under logs

### Elapidae

Red-bellied Black Snake*	<i>Pseudechis porphyriacus</i>	shed skin
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\* This specimen may have been a King Brown Snake, *Pseudechis australis*, but the species could not be determined from the scale characteristics alone as skin colour was also required but not apparent. The most likely identification based on geographic location is *P. porphyriacus*.

## DISCUSSION

It was recognised that the time of sampling was not favourable for the identification of all species which form part of the ecosystem of the Gunnalong Project. Nevertheless, AEIA agreed to conduct the survey since it had gained experience from the Mt. John survey, and certain inferences may be made as a consequence.

As expected the number of plant families and species recorded were much lower than in the Mt. John survey. The Gunnalong survey identified 54 species from 30 families, compared to 106 species from 46 families at Mt. John. On the other hand, the Mt. John survey area was 72 hectares, whereas the Gunnalong Project area measures only 9 hectares. Both surveys identified some plants on the protected list but none of the species recorded were threatened or endangered.

The data on tree density and basal areas of trees on the Gunnalong property show that *Eucalyptus laevopinea* is the most abundant species with an absolute density of 43.8 trees/ha followed by *Eucalyptus andrewsii* (21.9 trees/ha) and *Eucalyptus blakelyi* (15.6 trees/ha). Because of their greater number *Eucalyptus laevopinea* and *Eucalyptus andrewsii* also have the greatest total basal area (respectively 7.01 and 3.94 m<sup>2</sup>/ha), but *Eucalyptus melliodora* (3.76 m<sup>2</sup>/ha) and *Angophora floribunda* (3.10 m<sup>2</sup>/ha) both have a much greater basal area than *Eucalyptus blakelyi* (1.40 m<sup>2</sup>/ha) because the individual trees are much larger than the Blakely redgums. Not apparent from the data is that *Eucalyptus prava* occurred as a discreet clump of trees in the south-west corner of the area reserved for quarrying near the cliff face, and *Eucalyptus malacoxylon* and *Eucalyptus viminalis* occurred on the deeper soils at the base of the hill and towards the gully in the waste disposal area.

Another point probably worth mentioning is that at some future stage consideration needs to be given to waste material in the waste disposal area in relation to the power line that traverses the area.

The fauna survey at Gunnalong recorded 27 birds (2 more), 6 reptiles (1 less), and 8 mammals (1 more) than at Mt. John. Overall, it thus appears that there are about the same number of animals in both locations. Only with the mammals, however, are the same species recorded. The additional species at Gunnalong is the goat *Capra hircus*. At Gunnalong only two of the reptiles recorded are found at Mt. John as well, whereas only 12 of the birds recorded were found at both locations. Possibly the Olive Whistler *Pachycephala olivacea* recorded at Mt. John may have been the Golden Whistler *Pachycephala pectoralis*. This means that there were no vulnerable and rare species at Mt. John, nor were there any recorded at Gunnalong.

## ACKNOWLEDGMENTS:

Arrangements made by Mr Malcolm Robinson to allow access to the Project area, and the provision of maps are much appreciated and facilitated the survey. Information given by the Armidale office of the National Parks and Wildlife Service and the Department of Mineral Resources is gratefully acknowledged.

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## **APPENDIX 2**

### **Mt. John Project**

### **Vegetation, Animal and Heritage Survey**

Note: This report relates to a survey undertaken on Banalasta property as part of a study of a much larger area known as the Mt. John project. Mt. John itself does not lie within the survey area covered by this report.



# ARNHEM ENVIRONMENTAL IMPACT ASSESSORS

'SANDON PARK' TILBUSTER, N.S.W.

PHONE: (067) 711259

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Clutha Minerals Limited  
Mt. John Project

Vegetation, Animal and Heritage Survey

Job No. AE 930101  
26 January 1993

Vegetation, Animal and Heritage  
Survey - Mt. John Project

## EXECUTIVE SUMMARY

At the request of Clutha Minerals Limited, AEIA (Arnhem Environmental Impact Assessors) performed a Vegetation, Animal and Heritage Survey on part of EL 3315 in October, November and December 1992.

The exploration licence covers nine units (approx. 2700ha) in an area 10km north of Bendemeer and 32km south of Uralla. Two thirds of the EL and all of the Project area are over Banalasta Adamellite, a porphyritic biotite-muscovite-cordierite granite, which produces soils of low fertility. The Mt. John Project area (approx. 72ha) consists of a mosaic of granite outcrops, lithosols and grey podzols in situations where deeper soil profiles have developed. Extensive areas of granite outcrops are a feature of the site.

The Project area consists of a large hill which rises from approximately 950m at the foot to 1013m at the highest point and is predominantly covered by eucalypts which vary in height and density and thus form a mosaic of low open-woodland, woodland, and open-forest. *Eucalyptus laevopinea* and *Angophora floribunda* are prominent and some tall specimen grow on the site. In some areas *Olearia viscidula* forms a very dense understorey. The Project area is floristically very rich, with 106 species from 46 families recorded. None of the species are rare or on the endangered list. There are, however, a number on the protected list, such as *Davallia pyxidata*, and the orchids.

The animal survey indicated that ants were the most diverse group of animals (27 species), followed by birds (25 spp.), reptiles (7 spp.) and mammals (5 spp.). None of these are threatened or endangered, although a number are protected. It must be stressed that the lists of plants and animals are not to be taken as complete, since they represent only those species present and recorded at the time of sampling. Nevertheless, the lists represent a fair assessment of the flora and fauna of the Project area.

The archaeological survey found one rock art site, and one stone artefact

which indicated Aboriginal occupation of the site by members of probably the Anaiwan tribe. Protection of the rock art site and salvage of the stone artefact are recommended. The survey concluded, however, that the area does not provide sufficient evidence of anything which would prevent the activities intended by Clutha Minerals Limited.

Mt. John Project - Vegetation and  
Animal Survey

by

Paul J.R. Broese van Groenou and Elizabeth A. Davison

## INTRODUCTION

Clutha Minerals Ltd. through Mr. Malcolm J. Robinson, Manager Exploration and Development, contacted Paul Broese van Groenou in August 1992 to ask if AEIA would undertake a survey of the vegetation, animal and heritage components of the Mt. John project. Following a site visit and further discussion regarding the scope of the consultancy, AEIA was formally requested to carry out the Survey on 19 October, 1992. This report presents the data of the survey.

The vegetation and animal survey was carried out by Paul Broese van Groenou and Dr. Elizabeth Davison, with the assistance of Warren and Gloria Sheather. Confirmation and identification of plant species was performed by Mr. John Williams, Senior Lecturer, Department of Botany, University of New England.

The archeological and heritage survey was carried out by Sue Rutten and Bob Faulkner, Northern Regional Manager ATSIIC.

The Project area is located approximately 32km south of Uralla and 10km north of Bendemeer. The area to be surveyed is fairly small (72ha) and forms part of a much larger exploration licence (EL 3315) which is approx. 2700ha (9 units). The larger part of the Project area is a hill with an elevation of 1013m ASL at the highest point, and 950m ASL at the base. The Project area is mainly within the boundary of a property known as "Banalasta", which at one stage in its history was a very substantial pastoral holding.

The geology of the site is such that the entire Project area is on Banalasta Adamellite, a porphyritic biotite-muscovite-cordierite granite, which produces soils of low fertility. A feature of the area is the large number of granitic outcrops and lithosols which appear to carry the largest trees.

The climate is very similar to Uralla, which is the closest weather recording station. Rainfall of about 800mm with January and February the wettest months and April and May the driest months. Summer temperatures generally do not exceed 30 °C, with winter temperatures on occasion reaching -6 °C.

The vegetation is dominated by eucalypts and angophoras varying in height, cover and density, and thus forming a mosaic. Nevertheless, the vegetation is predominantly open forest, thus structurally of a type with medium trees 10-30m high, and with a foliage cover of 30-70%. In some areas the understorey is fairly dense, and *Olearia viscidula* prominent. Parts of the property have been cleared, and sheep graze on native pastures. There is some evidence of logging with a number of logs of *Eucalyptus laevopinea* left in the paddock.

## VEGETATION SURVEY.

### METHODS

Field work on the Project Site was carried out on 17, 18, and 25 October, and 7, 8 November, 1992, with a further site visit on 2 January 1993.

A site plan on a scale of 1:2000 compiled by Geo-Spectrum (Australia) Pty.Ltd. in May 1992, from 1:12,500 scale aerial photography flown on 11th May 1992, in combination with the actual aerial photo's, formed the basis of field reconnaissance of the Project area. The area to be surveyed was thus delineated and wooden pegs were placed at 1590800N/323200E to mark the SW corner, and at 1590800N/323800E to mark the SE corner. The northern boundary was marked by pegs at 1592000N/323200E for the NW corner and 1592000N/323800E for the NE corner.

To prepare a vegetation map of the Project area it was decided to use the aerial photo's in combination with data gathered from a number of line transects. It was decided that sufficient information would be gathered from two E-W transects with sampling points at 100m intervals, and one N-S transect with sampling points at 150m intervals to interpret the aerial photo's. The 1591000N and 1591600N latitude, and the 323600E longitude were selected. Notes were made of plants encountered and voucher specimen were taken of most species for verification at the herbarium of the Botany Department of the University of New England.

The vegetation was further analysed by plotless sampling using the quarter method. At the selected sampling points measurements were made of basal area of trees and tree heights recorded. To calculate density of trees, distances to the nearest tree in each quadrat were also measured.

## RESULTS

Frequent traverses of the area in combination with the sampling strategy adopted, produced the data for the Species List, which is presented as Table 1.

Table 1. Species List of plants occurring on the Mt. John Project area.  
(arranged alphabetically according to family)

### ADIANTACEAE

*Pellaea falcata* var. *falcata*  
*Cheilanthes sieberi*  
*Cheilantes tenuifolia*

### APIACEAE

*Hydrocotyle peduncularis*  
*Trachymene incisa*

### ASPLENIACEAE

*Asplenium flabellifolium*

## ASTERACEAE

*Brachycome tenuiscapa*  
*Cassinia quinquefaria*  
\**Cirsium vulgare*  
*Cotula coronopifolia*  
*Helichrysum apiculatum*  
*Helipterum australe*  
*Hypochoeris glabra*  
\**Hypochoeris radicata*  
*Olearia viscidula*  
*Olearia* sp. aff. *elliptica*  
\**Silybum marianum*  
\**Taraxacum officinale*

## BORAGINACEAE

*Myosotis australis*

## CAMPANULACEAE

*Wahlenbergia stricta*

## CARYOPHYLLACEAE

*Cerastium glomeratum*  
*Scleranthus biflorus*  
\**Stellaria media*  
*Stellaria pungens*

## CONVOLVULACEAE

*Dichondra repens*

## CRASSULACEAE

*Crassula sieberana*

## DAVALIACEAE

*Davallia pyxidata*

## DILLENACEAE

*Hibbertia acicularis*  
*Hibbertia linearis*  
*Hibbertia obtusifolia*  
*Hibbertia riparia*

## DROSERACEAE

*Drosera peltata*

## — EPACRIDACEAE

*Brachyloma daphnoides*  
*Lissanthe strigosa*  
*Melichrus urceolatus*

## EUPHORBIACEAE

*Poranthera microphylla*

## FABACEAE

*Glycine tabacina**Hardenbergia violacea**Indigofera australis**Swainsona galegifolia**Swainsona microphylla**\*Trifolium arvense**\*Trifolium dubium**\*\*Trifolium repens*

## GERANIACEAE

*Geranium solanderi*

## GOODENIACEAE

*Goodenia hederacea**Scaevola hookeri*

## HALORAGACEAE

*Haloragis elata*

## HYPERICACEAE

*Hypericum gramineum*

## JUNCACEAE

*Juncus sp.**Luzula densiflora*

## LILIACEAE

*Burchardia umbellata**Dianella laevis**Stypandra glauca*

## LOBELLIACEAE

*Isotoma axillaris**Isotoma fluviatilis*

## LORANTHACEAE

*Amyema pendulum*

## MIMOSACEAE

*Acacia implexa**Acacia neriifolia**Acacia rubida*

## MORACEAE

*Ficus rubiginosa*

## MYRTACEAE

*Angophora floribunda**Eucalyptus andrewsii**Eucalyptus bridgesiana**Eucalyptus elliptica**Eucalyptus laevopinea**Eucalyptus malacoxylon**Eucalyptus macrorhyncha**Eucalyptus melliodora**Leptospermum polygalifolium subsp. montanum*

## ONAGRACEAE

*Epilobium blillardierianum*

## ORCHIDACEAE

*Dendrobium linguiforme**Diuris abbreviata**Pterostylis parviflora*

## OXALIDACEAE

*Oxalis corniculata*

## PITTOSPORACEAE

*Bursaria longisepala**Bursaria spinosa*

## POACEAE

*Aira caryophylla**Aristida contorta**Dactylis glomerata**Imperata cylindrica**Poa annua**Poa sieberana**Themeda australis*

## POLYPODIACEAE

*Pyrrosia rupestris*

## PORTULACACEAE

*Calandrinia pickeringii*

## RANUNCULACEAE

*Clematis aristata**Ranunculus lappaceus*

## ROSACEAE

*Acaena anserinifolia*  
\**Rosa rubiginosa*  
*Rubus parvifolius*  
\**Rubus procerus*

## RUBIACEAE

*Asperula charophyton*  
*Opercularia aspera*

## RUTACEAE

*Correa reflexa*

## SANTALACEAE

*Exocarpus cupressiformis*

## SAPINDACEAE

*Dodonaea cupressiformis*

## SCROPHULARIACEAE

\**Anthirrhinum orontium*  
\**Verbascum thaspus*

## SOLANACEAE

\**Solanum hermanii*

## STERCULIACEAE

*Brachychiton populneum*

## THYMELAEACEAE

*Pimelea linifolia*

## URTICACEAE

\**Urtica urens*

## VIOLACEAE

*Viola betonicifolia*

## XANTHORRHOEACEAE

*Lomandra filiformis*  
*Lomandra longifolia*  
*Xanthorrhoea australis*

Notes on Species List :

\* denotes a naturalized taxon

references used include Beadle et al. (1972), Beadle (1972-1978), and Harden (1990, 1991, 1992).

mosses and lichens have not been identified to generic and species level.

number of Families recorded: 46.

number of species recorded: 106.

## RESULTS OF TRANSECT SAMPLING.

### SP 1 (Sampling Point 1) at coordinate 1591600N/323300E:

Open forest (eM3) dominated by *Angophora floribunda* and *Eucalyptus laevopinea* with rocky outcrops to the north. Juvenile *Angophora* trees present with ground cover of grasses (mainly *Poa annua* and *Aristida*), with sedges, mosses and *Helipterum australe* and *Cheilanthes sieberi*.

### SP 2 at coordinate 1591600N/323400E:

Open forest (eM3) with an association of *Angophora floribunda*, *Eucalyptus elliptica* and juvenile *Eucalyptus melliodora*. Groundcover is sparse but diverse with *Aristida*, *Hibbertia obtusifolia*, *Helichrysum apiculatum*, *Oxalis corniculata*, *Cheilanthes*, *Acaena*, *Asperula*, *Wahlenbergia stricta*, *Lissanthe strigosa*, and *Hypochoeris glabra*.

### SP 3 at coordinate 1591600N/323500E:

Open forest (eM3) with *Angophora floribunda* and *Eucalyptus laevopinea* dominant. Tall (6-7m) *Acacia neriifolia* present. Shrub layer consisting of *Olearia viscidula*. Sparse groundcover of *Aristida*, *Rubus procerus*, *Geranium solanderi*, and *Glycine tabacina*.

### SP 4 at coordinate 1591600N/323600E:

Low open forest (eL3) with *Eucalyptus laevopinea* and *Angophora floribunda* dominant. Shrub layer consisting of *Acacia rubida* and *Acacia*

*neriifolia*, with *Olearia viscidula* prominent. Groundcover of grasses and sedges with some *Cheilanthes* and *Lomandra longifolia*.

SP 5 at coordinate 1591000N/323300E:

Open forest (eM3) association of *Eucalyptus laevopinea*, *Eucalyptus elliptica* and *Angophora floribunda*. Shrub layer consisting of *Acacia neriifolia*, *Olearia viscidula* and juvenile *Angophora* and *Eucalyptus laevopinea*. A diverse herb layer with *Poa sieberana*, *Lissanthe strigosa*, *Cheilanthes*, *Geranium*, *Rumex*, *Wahlenbergia*, *Drosera*, *Trachymene*, *Haloragis* and *Hypericum*.

SP 6 at coordinate 1591000N/323400E:

Low woodland (eL2) association of *Angophora floribunda* and *Eucalyptus laevopinea*. Shrub layer of *Acacia neriifolia*, *Olearia viscidula*, *Cassinia*, *Bursaria longisepala*, *Correa reflexa*, *Melichrus urceolatus*, *Lissanthe strigosa*, *Dodonaea* and juvenile *Angophora*. Herb layer of *Goodenia hederacea*, *Helichrysum apiculatum*, *Drosera*, *Cheilanthes*, *Haloragis*, *Aristida*, *Hibbertia obtusifolia*, *Lomandra*, *Poa annua*, *Poa sieberana*, *Helipterum australe*, and lichen. (Plate 1).

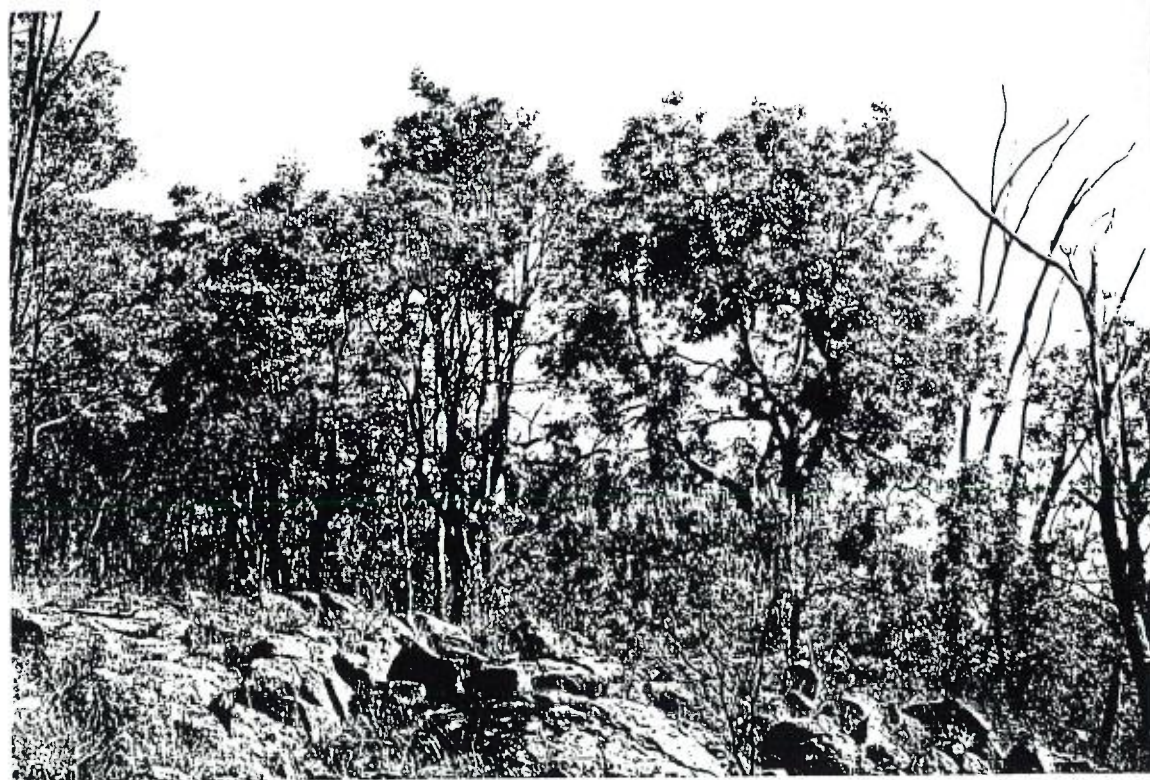


Plate 1. Low woodland (eL2) association of *Angophora floribunda* and *Eucalyptus laevopinea*.

SP 7 at coordinate 1591000N/323500E:

Low woodland (eL2) association of *Angophora floribunda* and *Eucalyptus melliodora*. Shrubs mainly *Olearia viscidula* and *Acacia neriifolia* with *Clematis aristata*. Herbaceous layer of *Poa annua*, *Aristida*, *Rubus parvifolius*, *Rubus procerus*, *Helichrysum apiculatum*, *Stellaria angulata*, *Wahlenbergia*, *Acaena*, *Anthirrhinum orontium*, and *Luzula densiflora*.

SP 8 at coordinate 1591000N/323600E:

Low grassy woodland (eL2) association of *Eucalyptus melliodora* and *Angophora floribunda* with some *Eucalyptus elliptica*. No shrub layer, and grasses mainly *Aristida*. Other species present are *Helichrysum apiculatum*, *Cheilanthes*, *Drosera*, *Anthirrhinum*, *Asperula*, *Pterostylis* and *Trifolium dubium*. (Plate 2).



Plate 2. Low grassy woodland (eL2) association of *Eucalyptus melliodora*, *Angophora floribunda* and *Eucalyptus elliptica*.

SP 9 at coordinate 1591000N/323700E:

Low grassy woodland (eL2) association of *Eucalyptus elliptica* and *Angophora floribunda* with a few taller emergents of both species. Shrub layer mainly consists of juveniles of the dominant trees and some *Rubus procerus* and one plant of *Leptospermum polygalifolium*. Herb layer with *Aristida*, *Helichrysum apiculatum*, *Hypochoeris*, *Drosera*, *Hibbertia obtusifolia* and *Lissanthe strigosa*.

SP 10 at coordinate 1591500N/323600E:

Open forest (eM3) association of *Eucalyptus laevopinea*, *Eucalyptus andrewsii* and *Angophora floribunda*. Understorey of *Olearia viscidula*, *Olearia* sp. aff. *elliptica*, *Cassinia*, *Davallia pyxidata*, *Acacia neriifolia*, *Correa reflexa*, *Isotoma axillaris* (in crevices), *Bursaria longisepala*, *Asplenium flabellifolium*, *Trachymene incisa*, *Wahlenbergia*, *Cheilanthes*, *Oxalis corniculata*, *Urtica*, and *Hypochoeris*. (Plates 3 and 4)

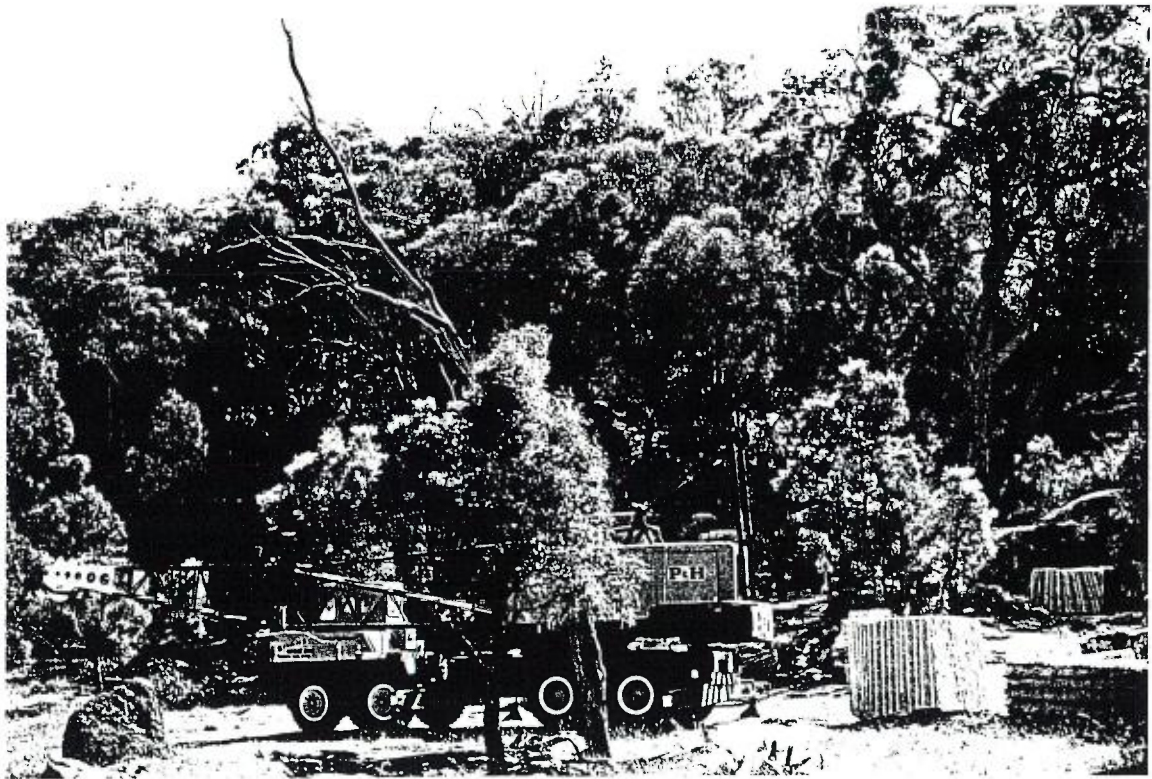


Plate 3. Open forest (eM3) association of *Eucalyptus laevopinea*, *Angophora floribunda* and *Eucalyptus andrewsii* at site of sample quarry.



Plate 4. *Eucalyptus laevopinea* with nest of Wedgetail Eagle at site of sample quarry.

SP 11 at coordinate 1591350N/323600E:

Open forest (eM3) association of *Eucalyptus laevopinea*, *Eucalyptus melliodora* and *Angophora floribunda*. Understorey of very dense *Olearia viscidula* with sparse *Poa sieberana*. Other species present are *Bursaria longisepala*, *Lomandra filiformis*, *Isotoma*, *Pellaea falcata* var. *falcata*, and juvenile *Acacia neriifolia*.

SP 12 at coordinate 1591200N/323650E:

Low open forest (eL3) association of *Angophora floribunda* and *Eucalyptus melliodora*. Low shrub layer of *Olearia viscidula*, *Melichrus urceolatus*, *Brachyloma daphnoides*, *Rubus procerus* and *Rosa rubiginosa*. Diverse herbaceous layer with *Hibbertia acicularis*, *Hypochoeris*, *Hypericum*, *Swainsona galegifolia*, *Acaena*, *Wahlenbergia*, *Burchardia umbellata*, *Viola*, *Asperula*, *Helichrysum apiculatum*, *Geranium*, and *Urtica*. Sparse grass cover with *Poa annua* and *Aristida*.

A vegetation community not encountered at a sampling site was the open grassy woodland (eM1) and the low open grassy woodland (eL1), which are depicted in Plates 5 and 6.

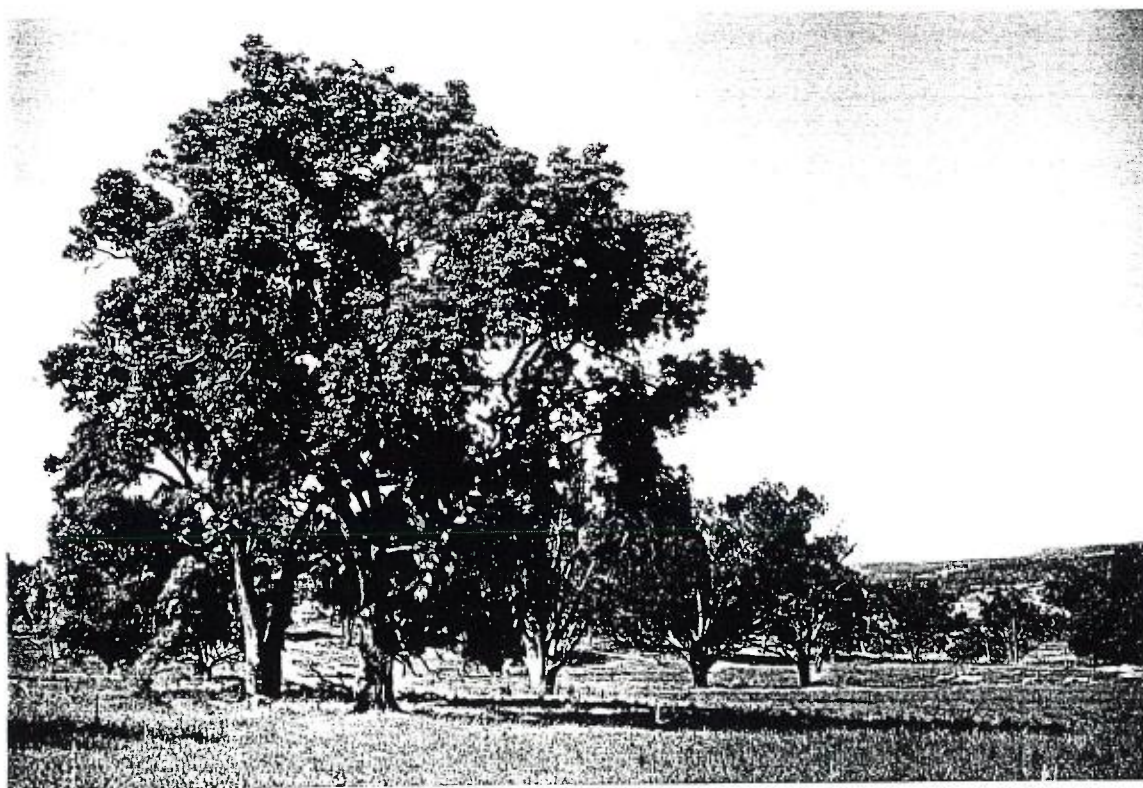


Plate 5. Grassy open woodland (eM1) with large *Angophora floribunda* trees left for shelter.



Plate 6. Low open grassy woodland (eL1) community with some large *Eucalyptus melliodora* trees to the right of the picture. Mt. John is in the background to the left. Photo was taken from the southern boundary gate.

Information gathered from the 12 vegetation sampling points, together with copious notes taken of significant features of the survey area, assisted with the interpretation of the aerial photo's, so that a Vegetation Map of the Project area could be drawn (Figure 1).



**KEY TO VEGETATION MAP**

- Open Forest (M3)
- Woodland (M2)
- Open Woodland (M1)
- Low Open Forest (L3)
- Low Woodland (L2)
- Low Open Woodland (L1)
- Sedgeland (G4)
- Rock Outcrop

SCALE 0 50 100m

Each square represents approx. 4 hectares.  
 Map compiled from 1:12,500 scale aerial  
 photography flown on 11-5-92 for Clutha  
 Minerals Limited.

200E 323 400E 323 600E 323 800E



**ARNHEM ENVIRONMENTAL  
 IMPACT ASSESSORS**  
 'SANDON PARK' TILBUSTER N S W 2350  
 PHONE (0671) 711259

**VEGETATION MAP - Mt. JOHN PROJECT**

Figure 1.

Data gathered for density and basal areas of trees is presented in Table 2.

Table 2. Density and basal areas of trees.

SP	Sp	D	cbh	BA	Sp	D	cbh	BA	Sp	D	cbh	BA	Sp	D	cbh	BA
1	E.l	46.7	264	0.55	A.f.	33.7	70	0.04	A.f.	3.3	112	0.10	A.f.	3.3	122	0.12
2	A.f.	3.0	45	0.02	A.f.	5.0	71	0.04	E.m.	5.2	50	0.02	E.m.	4.4	46	0.02
3	A.f.	2.3	61	0.03	A.f.	3.4	96	0.07	A.f.	4.6	56	0.02	E.l.	9.4	52	0.02
4	A.f.	4.0	97	0.07	E.l.	5.1	138	0.15	E.l.	4.4	58	0.03	E.l.	5.9	85	0.06
5	A.f.	13.1	120	0.11	A.f.	9.6	65	0.03	A.f.	6.6	86	0.06	E.l.	7.9	110	0.10
															84	0.06
6	A.f.	10.3	51	0.02	E.l.	4.5	113	0.10	A.f.	2.1	48	0.02	A.f.	5.2	72	0.04
							99	0.08								
							50	0.02								
7	E.m	4.4	45	0.02	A.f.	15.1	48	0.02	A.f.	3.9	44	0.02	A.f.	5.3	60	0.03
8	E.m.	12.1	47	0.02	E.m.	9.7	49	0.02	A.f.	10.5	68	0.04	E.m.	26.6	53	0.02
9	A.f.	11.8	220	0.38	A.f.	24.0	53	0.02	A.f.	5.2	51	0.02	E.e.	5.1	57	0.03
11	E.e.	7.4	61	0.03	E.l.	14.8	81	0.05	E.l.	17.4	95	0.07	E.m.	11.5	116	0.11
			105	0.09												
SUM		114.9				124.9				63.2				84.6		

Notes on Table2: (use of abbreviations)

SP=sampling point; Sp=species; D=distance in metres; cbh=circumference at breast height in cm; BA=basal area in m<sup>2</sup>.

A.f.=*Angophora floribunda*, E.e.=*Eucalyptus elliptica*, E.l.=*Eucalyptus laevopinea*, E.m.=*Eucalyptus melliodora*

total distance of 40 measurements was 387.8m, hence a mean distance of 9.7m and thus a mean area of 94.1m<sup>2</sup>. Mean density of trees per hectare may be calculated as 106.

basal area may be calculated from:  $BA=(cbh)^2/12.57$

## DISCUSSION

Results of the survey indicated that the area, although fairly small, had a very diverse vegetation, i.e., 106 species from 46 families. It must be stressed, nonetheless, that the species list presented is not to be taken as a complete list of plants which occur on the area. Some ephemeral plants have probably not been recorded, whilst others may not have been detected because they were not conspicuous at the time the survey was carried out. Nevertheless, the data presented give an accurate account of the vegetation communities occupying the Project area, and they also give a fair indication of the status of threatened or endangered species. None were recorded, although a number of plants were on the list of Protected Plants in Schedule 13 of the National Parks and Wildlife Act 1974 No. 80. All native species of orchids are usually included, as is the Hare's Foot Fern *Davallia pyxidata*.

The Mt. John vegetation survey recognised 7 vegetation communities. These have been colour coded, and were presented in Figure 1. The key to the letter code is based on structural types attributed to Specht (1970) with the notation used by Beard and Webb (1974). The system combines growth form and foliage cover with floristic codes for the dominant taxonomic group of plants in any stratum. For simplicity, the Mt John survey only used the code for the upper stratum. For example **eM3**, represents an *Eucalyptus* open forest, since the dominant trees belong to the genus *Eucalyptus* (**e**). It is furthermore an open forest because the trees are of medium height (**M**) in the order of 10-30m, with a foliage cover of **3** (30-70%), hence **eM3**.

Other communities dominated by medium trees were **woodland (M2)** with a foliage cover of 10-30%, and **open woodland (M1)**, with a foliage cover less than 10%. Similarly, where the tree height is less than 10m the communities are structurally described as **low open forest (L3)**, **low woodland (L2)** and **low open woodland (L1)**. The terminology for the **sedgeland (G4)** community is self explanatory.

Data from the quantitative analysis of the vegetation, must be treated with caution, since the number of sampling points (10) and measurements (40) were rather small. The exercise was outside the brief of the consultancy, but was carried out nevertheless to give a better appreciation of the vegetation communities present on the Project area. The results indicated that *Angophora floribunda* was the most common species with an estimated basal area of 76.96 m<sup>2</sup>/ha, followed by *Eucalyptus laevopinea* (BA 30.77m<sup>2</sup>/ha), *Eucalyptus melliodora* (BA 2.04m<sup>2</sup>/ha), and *Eucalyptus elliptica* (BA 0.80m<sup>2</sup>/ha). In order to obtain more accurate figures it would be necessary to take a larger number of measurements in each of the communities delineated on the Vegetation Map. Nevertheless the figures confirm that the communities described are largely composed of *Angophora floribunda* and *Eucalyptus* species. Of the latter, *Eucalyptus laevopinea* is by far the most abundant.

## ANIMAL SURVEY

### METHODS

Three vertebrate groups (birds, reptiles and mammals) and one invertebrate group (ants) were surveyed at the project area over the same time periods as the vegetation survey.

A general reconnaissance of all animal groups was made while traversing the project area at various times during the day and night in order to build up as broad a species list as possible in the limited time at the site.

Birds - were surveyed with the help of field glasses, recognition of bird calls and observation of nests on the project area.

Reptiles - were surveyed by visually scanning likely sites such as exposed rock faces and on vegetation for actively foraging individuals and by searching under fallen logs and surface rocks for those seeking shelter.

Mammals - In addition to visual scans (by day using field glasses and with the aid of a spotlight at night) a series of 50 Elliot traps were set out over two 24hr periods in October and November covering a number of different habitats (from the rocky hillside to the lower creek line). Each Elliot trap was baited with one tablespoon of a mixture of rolled oats, fatty bacon and peanut butter. Further evidence of mammals which inhabit the area was obtained from the identification of skeletal remains found under rock overhangs and in rock crevices.

Ants - were surveyed by making hand collections of actively foraging individuals found on the ground and on vegetation and those encountered under logs and rocks during the reptile survey. Ants attracted to the bait in the Elliot traps were also collected.

## RESULTS

Twenty five species of birds, seven species of reptiles, seven species of mammals (5 native and 2 introduced - excluding sheep) and twenty seven species of ants were recorded at the project area (Tables 3-6).

**Table 3 - Mount John - Bird List**

<u>Common Names (alphabetical order)</u>	<u>Scientific Names (s,n,m)#</u>
Brown Treecreeper	<i>Climacteris picumnus</i> (s)
Buff-tailed Thornbill	<i>Acanthiza reguloides</i> (s)
Channel-billed Cuckoo	<i>Scythrops novaehollandiae</i> (m)
Crimson Rosella	<i>Platycercus elegans</i> (-)
Double-barred Finch	<i>Poephila bichenovii</i> (s)
Flame Robin	<i>Petroica phoenicea</i> (s,n,m)
Galah	<i>Cacatua roseicapilla</i> (-)
Grey Fantail	<i>Rhipidura fuliginosa</i> (m)
Grey Shrike-thrush	<i>Colluricincla harmonica</i> (s)
Horsefield's Bronze Cuckoo	<i>Chrysococcyx basalis</i> (m)
Kookaburra	<i>Dacelo gigas</i> (s)

## Mt. John - Bird List (cont.)

Magpie	<i>Gymnorhina tibicen</i> (s)
Mistletoebird	<i>Dicaeumhir hirundinaceum</i> (-)
Noisy Friarbird	<i>Philemon corniculatus</i> (n,m)
Noisy Miner	<i>Manorina melanocephala</i> (s)
Olive Whistler	<i>Pachycephala olivacea</i> (s)
Pied Butcherbird	<i>Cracticus nigrogularis</i> (s)
Pied Currawong	<i>Strepera graculina</i> (s,m)
Raven	<i>Corvus coronoides</i> (s,n)
Red-browed Finch	<i>Emblema temporalis</i> (s,n)
Red Wattlebird	<i>Anthochaera carunculata</i> (m)
Superb Blue Wren	<i>Malurus cyaneus</i> (s)
Wedge-tailed Eagle	<i>Aquila audax</i> (-)
White-eared Honeyeater	<i>Lichenostomus leucotis</i> (s,n)
Yellow-rumped Thornbill	<i>Acanthiza chrysorrhoa</i> (s)
#(s) - sedentary	
(n) - nomadic	
(m) - migratory	
(-) - information not available	

Table 4: Mount John - Reptiles

<u>Common names (alphabetical order)</u>	<u>Scientific names</u>
Blue tongue Lizard	<i>Tiliqua scincoides</i>
Coppertailed Skink	<i>Ctenotus taeniolatus</i>
Cunningham's Skink	<i>Egernia cunninghami</i>
Eastern Brown Snake	<i>Pseudonaja textilis</i>
Lace Monitor	<i>Varanus varius</i>
Skink (small)	<i>Morethia boulangeri</i>
Skink (small)	<i>Menetia greyii</i>

Table 5: Mount John - Mammals

<u>Common names (alphabetical order)</u>	<u>Scientific names</u>
<u>Native:</u>	
Common brush-tailed possum	<i>Trichosurus vulpecula</i>
Eastern Wallaroo	<i>Macropus robustus</i>
Echidna	<i>Tachyglossus aculeatus</i>
Grey Kangaroo	<i>Macropus robustus</i>
Swamp Wallaby	<i>Wallabia bicolor</i>
<u>Introduced:</u>	
Fox	<i>Vulpes vulpes</i>
Rabbit	<i>Oryctolagus cuniculus</i>

Table-6: Mount John - Ants

<u>Subfamily</u>	<u>Genus</u>
Myrmeciinae	<i>Myrmecia spA</i>
Ponerinae	<i>Bothroponera spA</i>
	<i>Rhytidoponera spA</i>
	<i>Rhytidoponera spB</i>
Myrmicinae	<i>Aphaenogaster spA</i>
	<i>Crematogaster spA</i>
	<i>Pheidole spA</i>
	<i>Pheidole spB</i>
	<i>Pheidole spC</i>
Dolichoderinae	<i>Pheidole spD</i>
	<i>Anonychomyrma spA</i>
	<i>Iridomyrmex spA</i>
	<i>Iridomyrmex spB</i>
	<i>Leptomyrmex spA</i>
Formicinae	<i>Papyrius spA</i>
	<i>Papyrius spB</i>
	<i>Camponotus spA</i>
	<i>Camponotus spB</i>

## Mt. John - Ants (cont.)

*Camponotus spC**Melophorus spA**Melophorus spB**Notoncus spA**Notoncus spB**Paratrechina spA**Polyrachis sp A**Polyrachis spB**Polyrachis spC***DISCUSSION**

Only one species of bird, the Olive Whistler (*Pachycephala olivacea*), is listed as "vulnerable & rare" in schedule 12 pt2 of the 1972 Act, N.P.W.S.. No other rare or threatened species were recorded during the fauna survey.

Conventional trapping methods for fauna surveys require time periods of one week or more to adequately sample particular animal groups. Thus it is not surprising that no mammals were recorded during the two 24Hr periods when Elliot traps were set at the site.

As with the plant survey, the animal survey does not represent a complete list of all species occurring at the project site. The greater mobility and behavioural flexibility of animals (compared to plants) and variation in diel and seasonal activity result in a lower probability of certain species being recorded during the survey period. Species belonging to the vertebrate groups surveyed may be sedentary, nomadic, or migratory. Territoriality may depend upon social and/or sexual status, season (breeding cycle), population density and availability of food. Unless a part of the project area is a permanent part of an individual's territory, the species recorded may be temporary residents or just passing through the site.

Ants, though not usually represented in fauna surveys of this type, were sampled because they are useful ecological indicators of environmental change over small areas (as is often the case with mining and post-mining rehabilitation). The mobility of ants is limited by the wingless state of the workers, and foraging ranges are restricted to walking distance for a return trip to a central nesting site, where food is processed and brood are reared. Some species may relocate nest sites (depending on seasonal conditions), but only within a few meters of the previous site. Thus each record of a worker ant in the survey represents a species with a more or less permanent territory at the survey site.

#### ACKNOWLEDGEMENTS:

Arrangements made by Mr Malcolm Robinson to allow access to the Project area, and the provision of aerial photographs and maps are much appreciated and facilitated the survey to be carried out. Information given by the Armidale office of the National Parks and Wildlife Service and the Department of Mineral Resources is gratefully acknowledged.

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# Mt John Project - Archaeological Survey

by  
Sue Rutten and R. Faulkner

## 1. INTRODUCTION

This survey was undertaken as part of an environmental survey commissioned by Clutha Minerals Ltd. The company proposes to establish a granite quarry on private property just north of the New England Highway about 32 km south of Uralla. (Figure 1). The company has taken out an Exploration Licence of nine units over privately owned land. Part of the EL comprises the Project area. The dominant feature of the Project area is a hill, rising to over 1000 metres Australian Height Datum, and approximately 100 metres above the surrounding plain (Plates 1 and 2). The project involves the quarrying of this granite which, over a period of years would result in the destruction of the hill. It is understood that few ancillary buildings and other constructs will be required at the site, so it is anticipated that the only other impact on the site will be the movement of heavy vehicles to and from the hill.

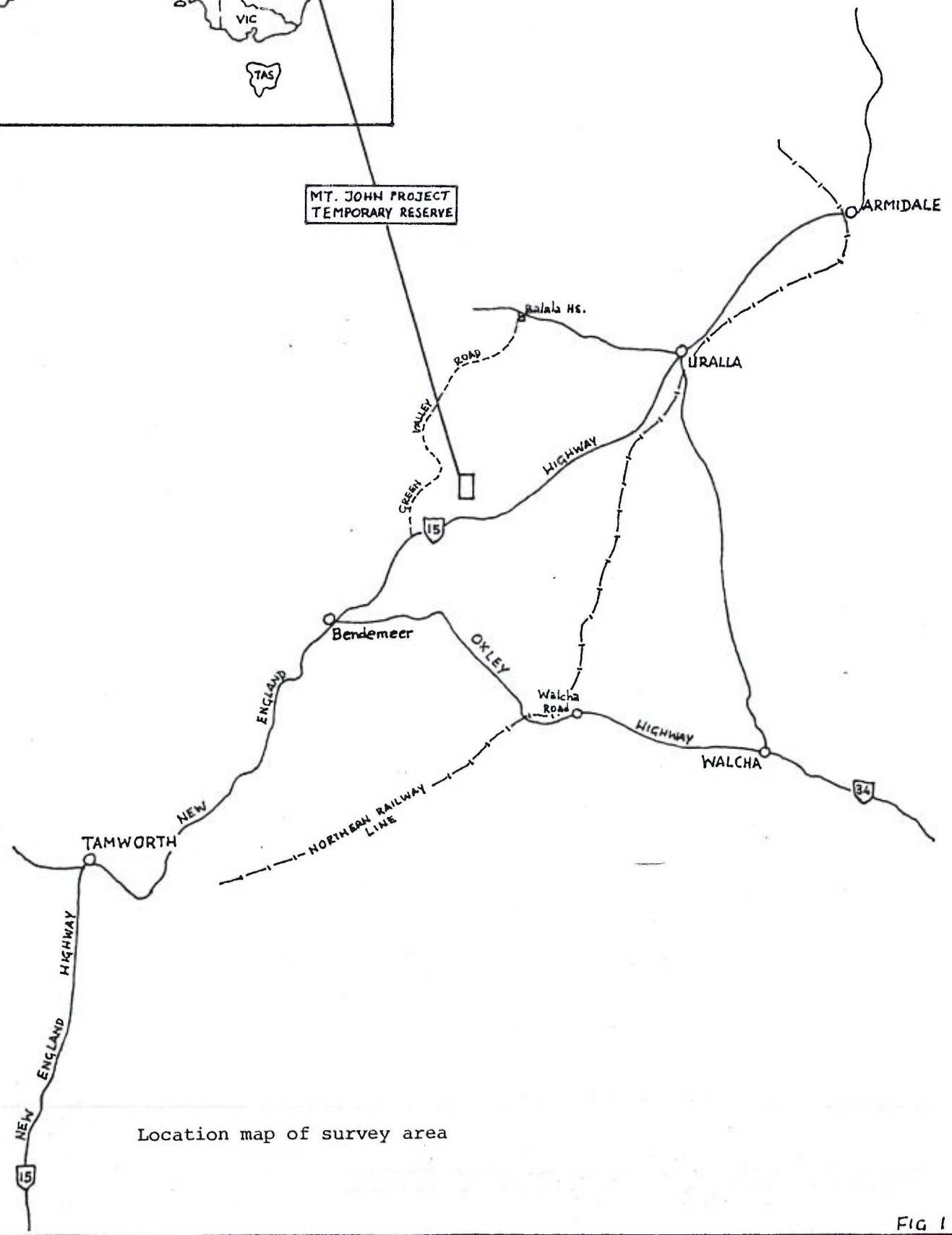
This archaeological survey was commissioned to determine if there is anything of heritage significance within the area of the Project area.

## 2. Environmental Features

The area in question is part of the New England Tablelands granite belt and is roughly 32km south of Uralla. This part of the Tablelands is quite hilly with frequent granite outcrops. Numerous gullies, combined with the jointed nature of the granite rock provide a freshwater source by way of springs. At the time this fieldwork was undertaken there had been several weeks of rain and the watercourse running through the main gully of the Project area carried water in the lower region.



MT. JOHN PROJECT  
TEMPORARY RESERVE



Location map of survey area



PLATE 1: Main hill at Mt John Project, looking south

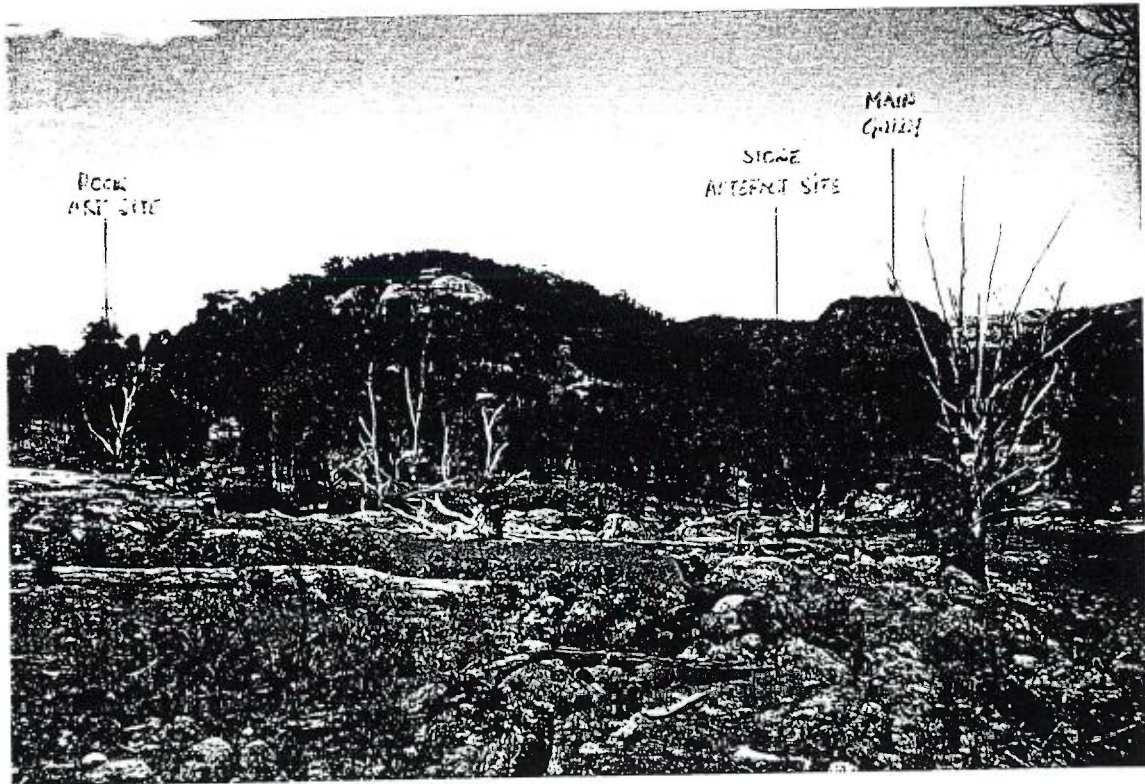


PLATE 2: Mt John Project western slopes and main gully (looking south).

The area has been a pastoral holding since the early years of settlement of the New England region. The accessible parts of the Project area have been cleared and grazed (Plate 3). Grazing (mainly by sheep) is on native pastures, and there is no evidence of cultivation. The more rugged sections, comprising the main hill and adjacent gully are heavily timbered with denser ground cover (Plate 4).

### 3. Archaeological Background

This particular area of the New England Tablelands to date has provided little by way of archaeological information. In 1964 Isabel McBryde excavated two sites at Hall's Creek near Bendemeer (McBryde, 1974). These were both deposits under granite overhangs with associated rock art. Similar art sites were also found at nearby Haning, further south of Moonbi and to the north at Mt Yarrowyck (McBryde, 1974, p105). These tablelands art sites are characterised by a combination of human figures, circles and bird tracks in red ochre. One of the authors (RF) has recorded more such sites throughout this area of the tablelands. No sites have been recorded in the immediate vicinity of the survey area. The NPWS Register has record of a burial discovered in 1964, and registered by Isabel McBryde. This burial was on Kia-Ora Station, a few kilometres south-west of the survey area.

### 4. Ethnography

It is difficult to find any reference to this area in the ethnographic literature. E.G.Cory passed this way in 1832 on his way north but the closest settlement for some time was that at Bendemeer (Walker, 1966). The area does not offer a great attraction to pastoralism because of its ruggedness and even today the area is only sparsely populated.

One of the authors (RF) has extensive knowledge of the area both through personal experiences as a boy growing up there and from family knowledge. The Project area in question was once part of a larger property known as "Banalasta". Many people from the Anaiwan tribe lived and



PLATE 3: General view from western slopes of Mt John Project  
(looking south-west)

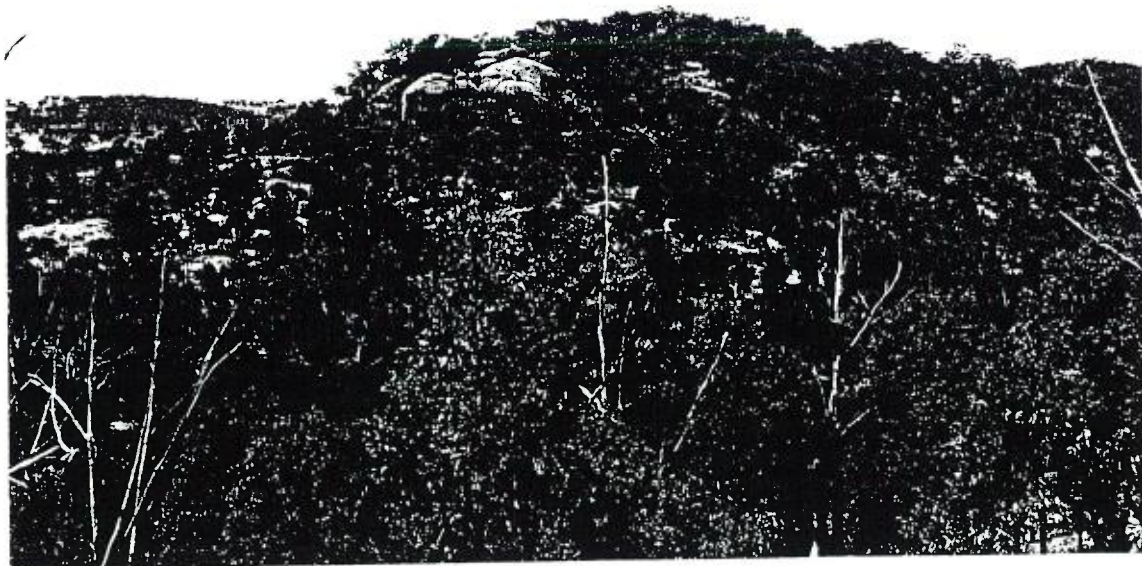


PLATE 4: Mt John Project hill, looking south-east.

worked on this property. While scattered sites were known throughout the region stories associated with them were not known.

## **5. Survey Strategy**

The survey area consisted of a well-defined section of land of 72 hectares encompassing several different environmental features with ground cover ranging from very light to very dense. Given the variable nature of the area and its relatively small size it was decided to undertake a full survey. Limits of the reserve were determined from aerial photographs.

## **6. Survey Effectiveness**

The two authors and an assistant spent a full day in the survey area and were able to survey all accessible areas.

The main hill and its immediate surrounds were particularly rugged due to the large granite outcrops and dense vegetation (Plate 4). This created problems with accessibility and visibility. Further away from the hill there were fewer outcrops and the cleared, grazed country provided greater accessibility and visibility (Plates 1 & 2). Much of the granite exhibited heavy weathering with thick growths of lichens on most southern and western facing rocks. The nature of this granite country with its crumbly rock and fairly grainy soils created some difficulty when surveying for stone artefacts. The entire area was littered with stone debris, the result of weathering of the granite. It was expected, therefore, that only stone artefacts made of different stone types would be observable. There had been some disturbance on the north-east corner of the hill due to sampling of the granite with the use of explosives and by movement of heavy machinery (Plates 5 & 6), so it was not possible to make an assessment of this particular area.



PLATE 5: The authors, planning survey at sample quarry.

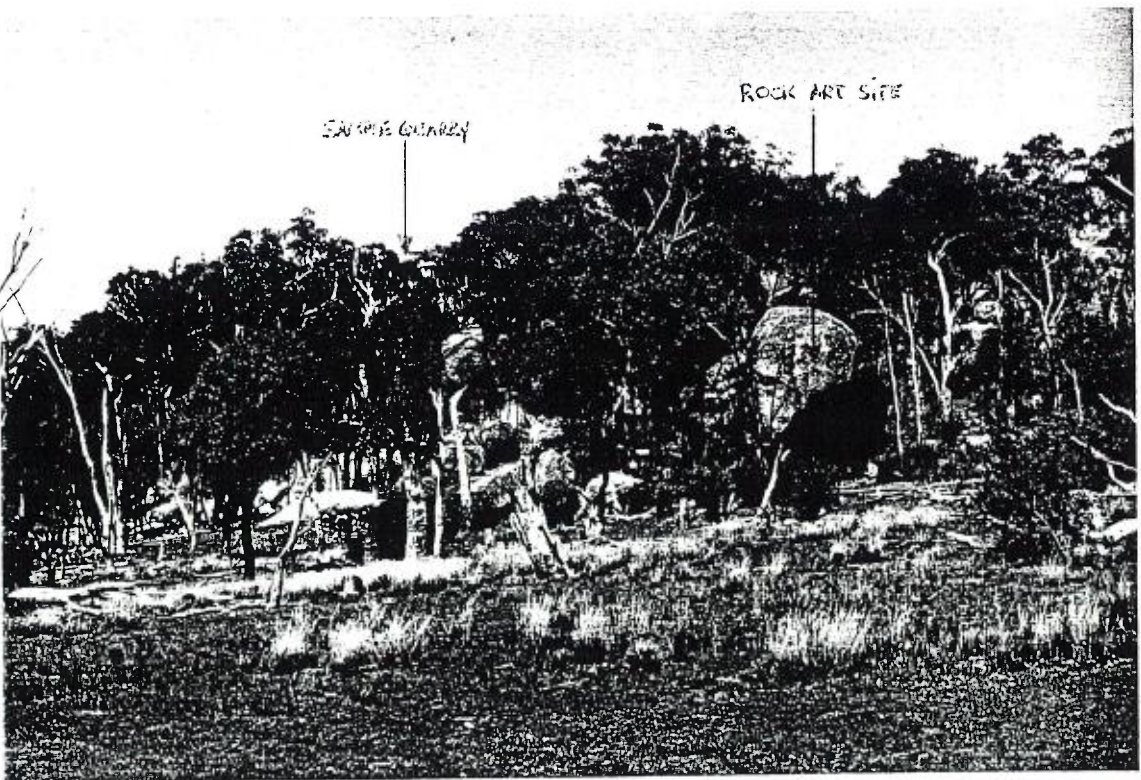


PLATE 6: North-eastern corner of Mt John Project hill, showing sample quarry and rock art site (looking south-west).

## 7. Aboriginal Consultation

The survey area is at the southern end of the tribal territory of the Anaiwan tribe. One of the authors (RF) is a member of this tribe and also Northern Regional Manager for the Aboriginal and Torres Strait Islander Commission. RF was born near Uralla, not far from the survey area and is familiar with the country and with Aboriginal interests in the area. He is well known through his representation of Aboriginal interests in the public arena.

## 8. Results of Survey

Two sites were recorded during the survey (Figure 2).

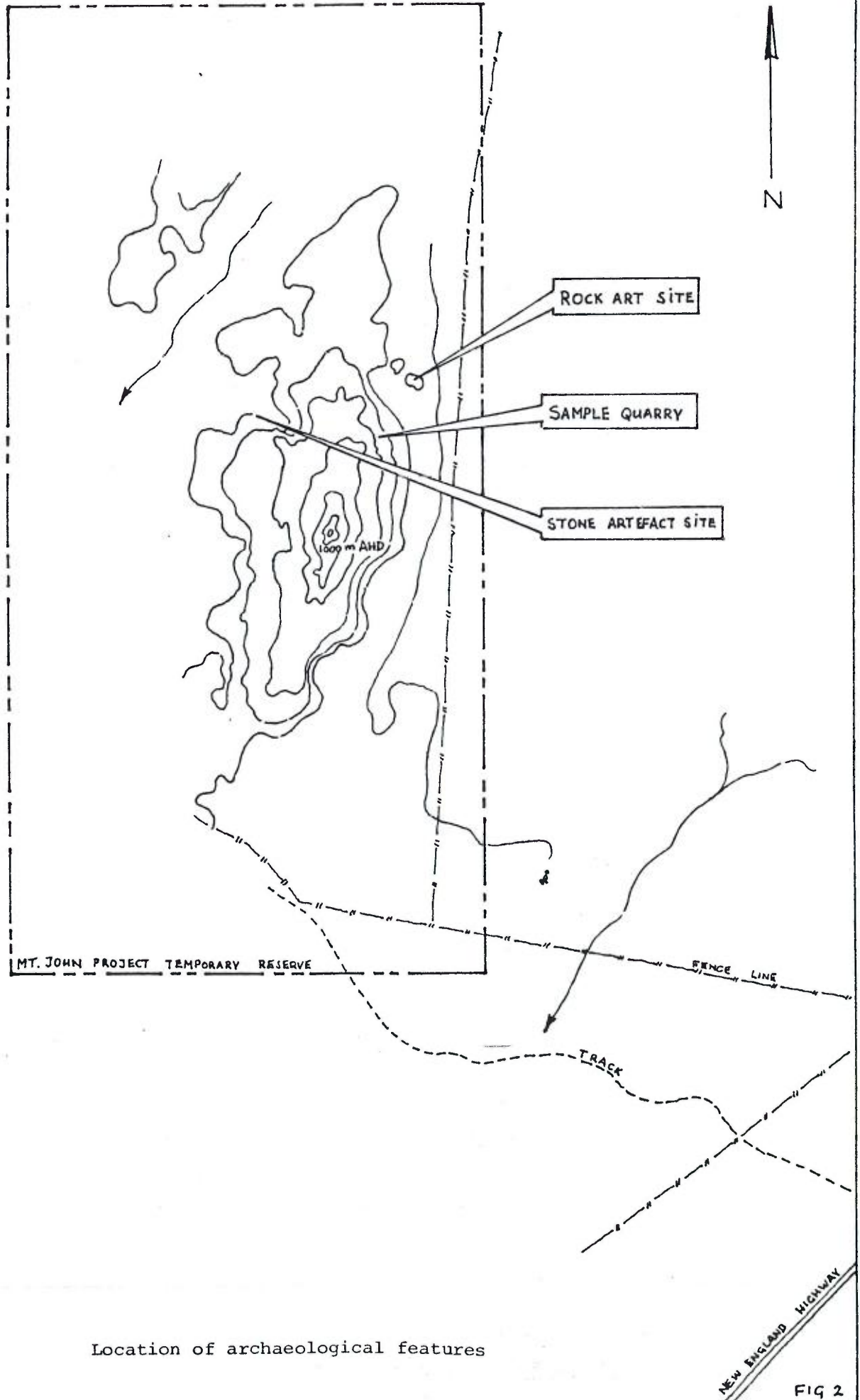
(a) *Rock Art Site*: located on a large granite outlying boulder (Plate 7) on the north-east corner of the hill. Much of the art appears to have been badly weathered. The remaining portion is just below a joint in the rock which appears to have protected it from water damage. The image appears to be part of a human stick figure plus ancillary circular items, painted in red ochre (Plate 8). No associated artefacts were observed.

(b) *Stone artefact* (1) made from basalt, found on the western side of the hill. There were several narrow bands of basalt in the granite (approx. 30-40cm wide) on this side of the hill. The artefact was a modified flake approx. 5cm long and 2cm wide at the base (Plate 9). Despite the lack of artefactual and other evidence, other overhangs and features were of considerable interest to one of the authors (RF), who felt that because of the nature and orientation of the overhangs and rock features, Aboriginal use of the area would probably have occurred, particularly for ceremonial purposes.

## 9. Assessment of Significance of Sites

### (a) *Aboriginal*

A full assessment of the significance of the area to Aboriginal people is not able to be made due to the activities surrounding the sample quarry. Some



Location of archaeological features

FIG 2



PLATE 7: Rock art site.



PLATE 8: Rock art, showing protective joint plane above.

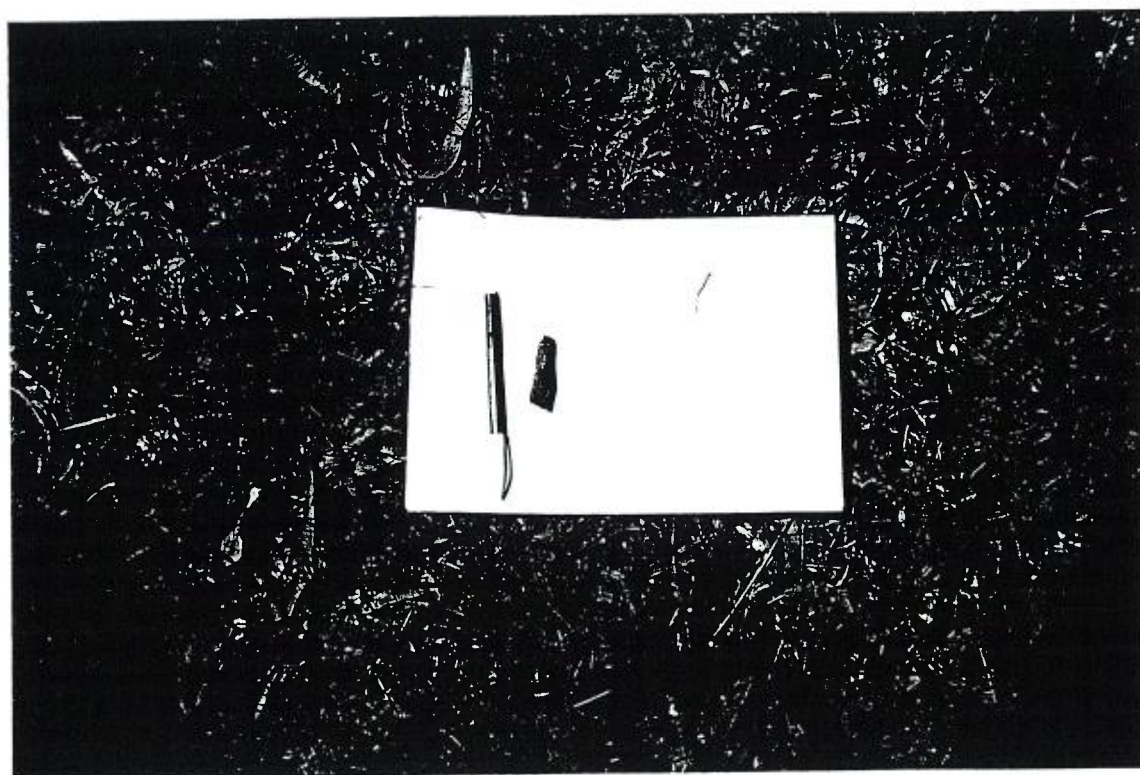


PLATE 9: Stone artefact.

concern is expressed that the sample quarry is located close to a site and the sample quarry itself, because of the north-eastern aspect which would have been favourable to habitation, may have contained further sites. Evidence (or not) of this is now impossible to obtain by visual inspection.

The sites recorded are considered to be of significance to contemporary Aboriginal people because they demonstrate that Aboriginal occupation of the area did occur. There is no traditional knowledge of the sites, nor are there any associated stories but the evidence that these sites provide will contribute to the consolidation of Anaiwan culture.

It is requested that the rock art site be fenced off to provide protection from damage. It would be acceptable for the stone artefact to be removed to a place of safekeeping.

*(b) Scientific*

Because archaeological evidence on the Tablelands has been fairly scattered any recorded sites have considerable scientific value. One current debate concerns the degree of Aboriginal occupation of places on or above 1000m ASL (See Appleton, 1990, 20-23 for a brief review). These sites are on the 1000m contour so their existence provide significant evidence for the study of the past pattern of Tableland use by Aboriginal people.

The fact that the art site seems to have been saved from water destruction by a joint plane in the rock (Plate 8) may indicate that, while the area was not used recently, it was probably used more frequently in bygone times and other art has since been worn away.

There are no observable artefacts in the vicinity of the artwork but this may also be due to the fact that the deposit is an old one and artefacts may be found deeper in the deposit.

The isolated stone artefact (Plate 9) was of interest because of its raw material use and typology but was not found with any associated features.

*(c) Educational*

Educational value would result from knowledge gained from scientific study of the site.

**10. Recommendations**

1. It is recommended that the isolated artefact be salvaged after a Consent to Destroy permit has been approved by NPWS. The housing of the artefact should be at the Aboriginal Keeping Place after obtaining clearance from the Australian Museum.

2. Because the art site is not threatened directly by quarrying activities no immediate action needs to be taken. It is recommended that Clutha Minerals Ltd. provide suitable protection for the rock art site to prevent accidental damage. Ancillary activities should be located away from the area.

The area does not provide sufficient evidence of anything which would prevent the activities intended by Clutha Minerals Ltd.

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**APPENDIX 3**

**Preliminary Report on Archaeological Survey**

**Bendemeer Project**



# ARNHEM ENVIRONMENTAL IMPACT ASSESSORS

'SANDON PARK' TILBUSTER, N.S.W. 2350

PHONE: (067) 711259

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## Preliminary Report on Archeological Survey Bendemeer Project

AEIA Report 940502  
17 May 1994

Preliminary Report on Archaeological Survey:  
Bendemeer Project

by  
Sue Rutten

1. Introduction

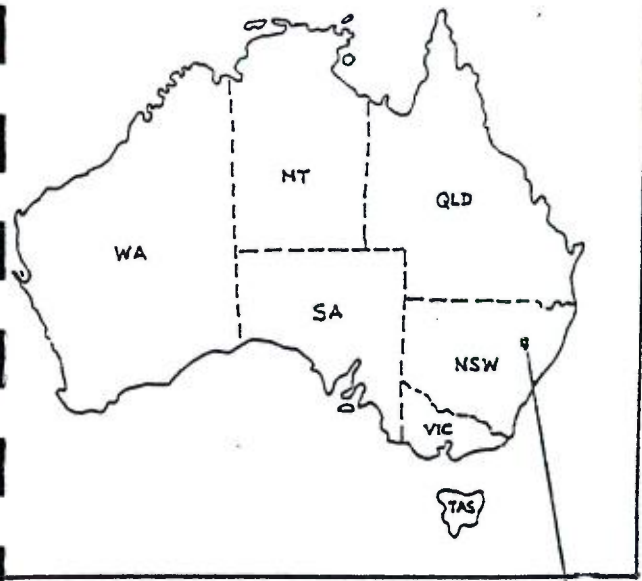
This survey was undertaken as part of an environmental survey commissioned by Clutha Minerals Ltd. The company proposes to establish a granite quarry on private property but east of the New England Highway about 35 km south of Uralla (Figure 1). The area to be quarried is a hill with granite outcrops, involving an area of about 9\* hectares. Also involved in the project is a waste disposal area adjacent to the hill of an equivalent size, an area for offices, stockpiles and associated activities, a proposed dam and an access road to the Highway(Figure 2). All these activities will have a profound impact on the area involved, resulting in the destruction of any existing archaeological features.

\* incorrect  
4.5 hectares

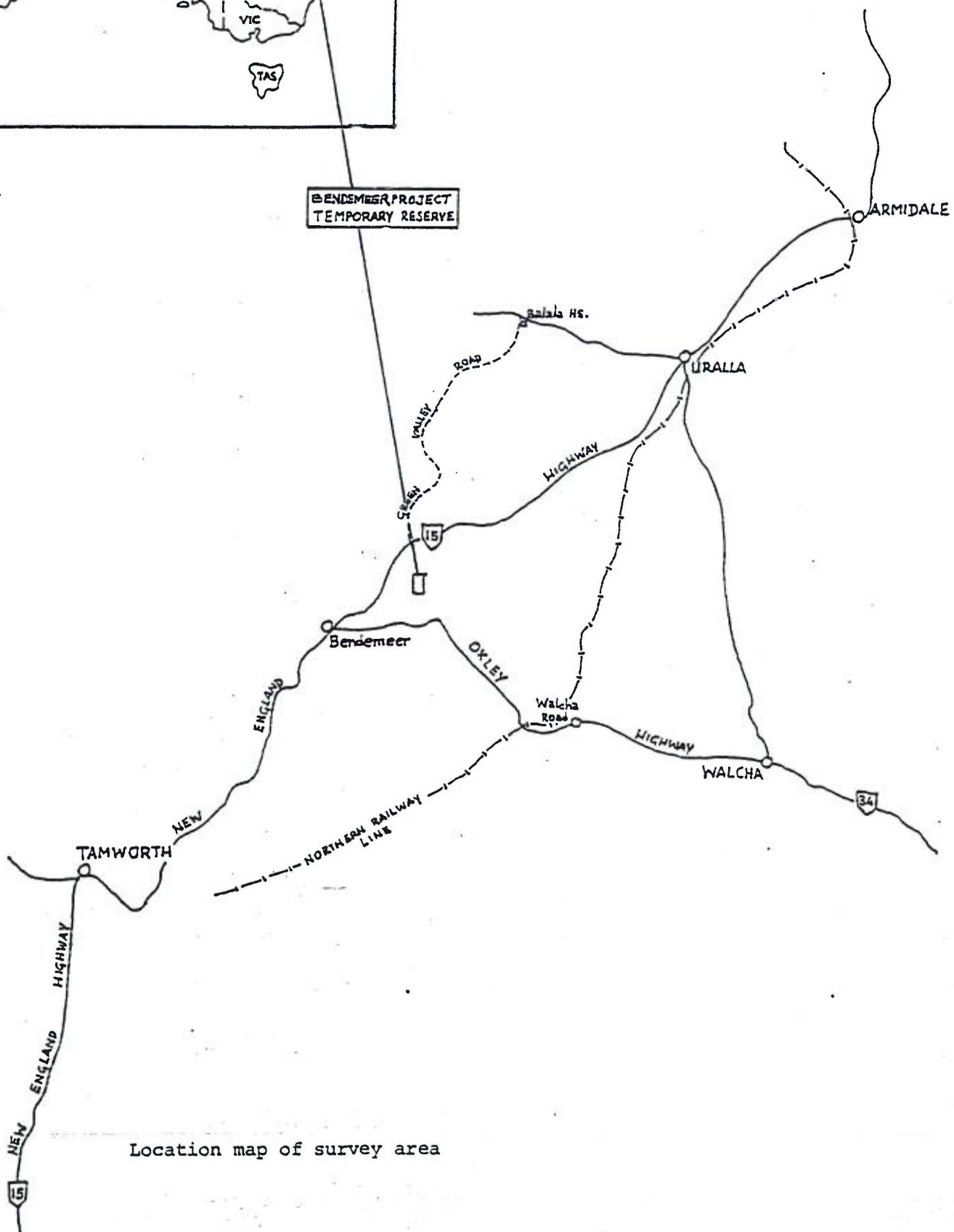
2. Environmental Features

This area is a continuation of an area a few kilometres north in the New England Tableland granite belt which was previously surveyed for Clutha Minerals and both areas possess many similar features. Granite outcrops, sandy soils, low scrub and a variety of taller eucalypts characterise the environment of the area. The granite is very crumbly and easily weathered by both wind and water. There is little in the way of permanent water in the vicinity but the granite country lends itself to a profusion of springs. Several gullies nearby have been dammed by the landholders and contain substantial amounts of water, despite the lack of rain for some months.

The surrounding country has been used as pastoral land since European settlement of the New England region. The area to be quarried shows little indication of being disturbed by grazing or cultivation, a consequence of its quite rugged nature, but the lower slopes have been cleared and have been subject to disturbance resulting from cultivation and grazing.

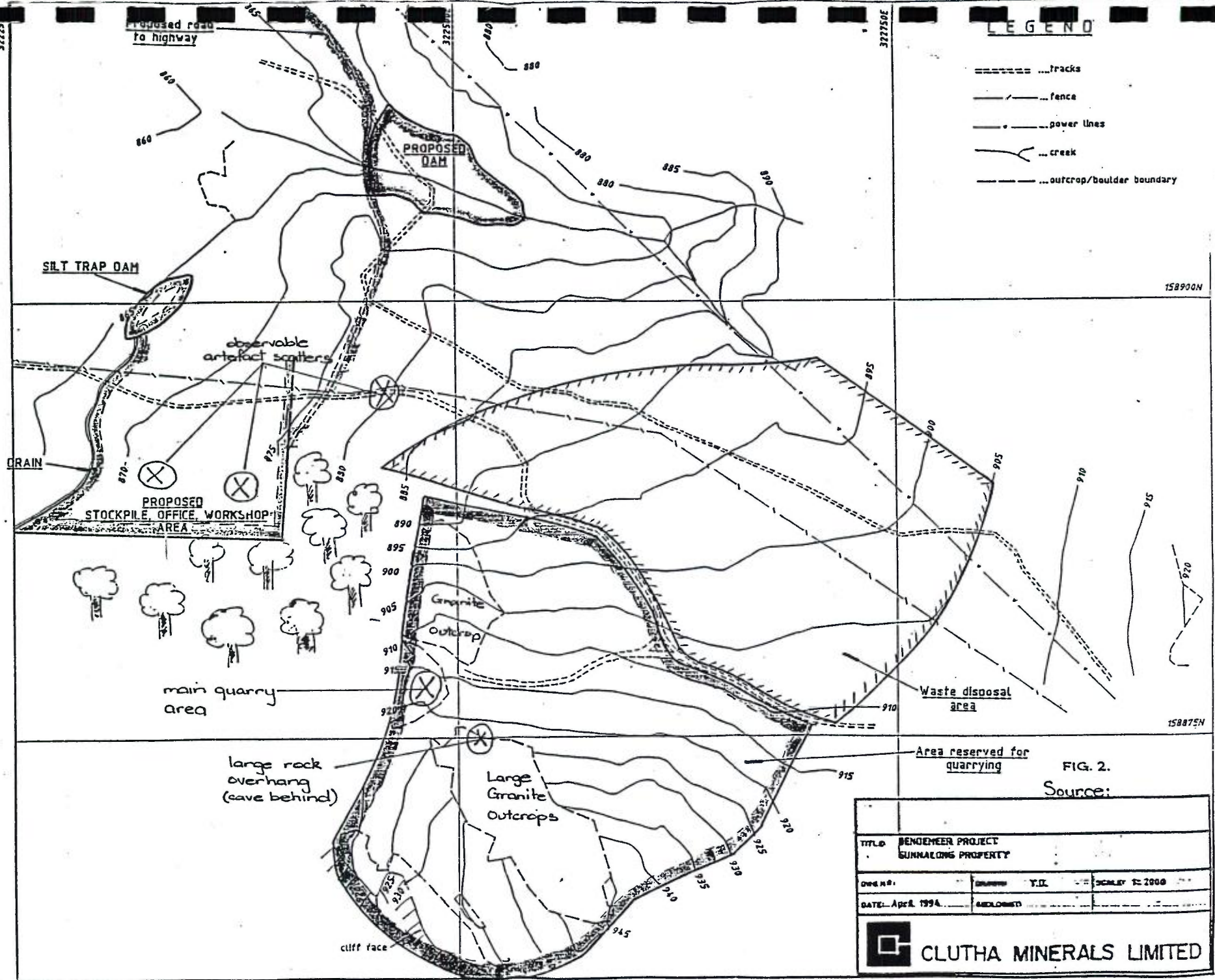



BENDEMEEER PROJECT  
TEMPORARY RESERVE



Location map of survey area

FIG 1



TITLE: BENEHEER PROJECT SUNNALONG PROPERTY			
Drawn by:	Checked: Y.D.	SCALE: 1:2000	
DATE: April 1994	AMENDED:		
 <b>CLUTHA MINERALS LIMITED</b>			

### 3. Archaeological Background

This area of the New England Tablelands has provided only a small amount of archaeological information. In 1964 Isabel McBryde excavated two sites at Hall's Creek near Bendemeer (McBryde, 1974). These were both deposits under granite overhangs with associated rock art. Similar art sites were also found at nearby Haning, sites further south of Moonbi and to the north at Mt Yarrowyck (McBryde, 1974, p.105). These tableland art sites are characterised by a combination of human figures, circles and bird tracks in red ochre. A small art site of this nature was found during the previous survey for Clutha in the area a few kilometres to the north. The NPWS Register has record of a burial discovered in 1964, recorded by Isabel McBryde. This burial was on Kia-Ora Station which is visible from the western side of the survey area. Further south towards Moore Creek, near Tamworth, many sites containing artefacts manufactured from the volcanic raw material prolific in the Moore Creek area have been found in recent years. Information on these sites are the subject of unpublished reports held with NPWS. The information these reports contain should be considered should further archaeological assessment be required in the survey area.

### 4. Ethnography

This area has not received much attention in the ethnographic literature. Even today the area is sparsely populated and much of the area would not have been settled until some time after initial European settlement in the Tablelands. E.G.Cory passed this way in 1832 but the closest settlement for some time was that at Bendemeer (Walker, 1966). Bob Faulkner, who assisted with the survey, has extensive knowledge of the area both through personal experience as a boy growing up there and from family knowledge. Many people from the Anaiwan tribe lived and worked on surrounding properties. While scattered sites were known throughout the region, stories associated with them were not known.

## 5. Survey Strategy

The survey area consisted of the proposed quarry site of 9 hectares<sup>\*</sup>, a waste disposal area of equivalent size, an area reserved for offices and associated activities of 2-3 hectares<sup>\*\*</sup>, a small dam area and a proposed road to the highway. The area was defined using survey drawings provided by Clutha. The proposed areas of impact covered a range of different environmental zones so it was decided, given the small size of the total area, to undertake a full survey. Three adults spent a day in the field and surveyed the total area.

\* Incorrect - 4.5 hectares  
 \*\* " " - 1-1.5 hectares

## 6. Survey Effectiveness

### a) Quarry Area

Vegetation was dense and visibility poor except in areas of granite outcrops and where vehicular access to the area had been gained by construction of a rough track. There was little in the way of grass or leaf litter on the ground which allowed some visibility at close proximity, but low scrub made much of the hill difficult to negotiate and observations of the ground were only possible within 0.5m radius of the transect. (Plates 1, 2, 3).

### b) Waste Disposal Area

Some clearing had occurred in this area and there were few trees or shrubs but visibility was obscured by long grass. Accessibility to the area was not hampered but again visibility was possible for only 0.5m radius of the transect. Some disturbance had occurred in one corner of the waste disposal area which enhanced visibility. (Plates 5, 6, 7).

### c) Office/Stockpile Area

Similar in nature to the waste disposal area but with a few exposed granite patches which improved visibility. The outcrops represented about 2% of the total area.

### d) Dam Site and Proposed Road

These were in areas heavily grazed by sheep. Access was trouble free with almost total visibility of the ground surface.



Plate 1: Western side of proposed quarry area looking South East, showing some of the exposed granite and vegetation cover.



Plate 2: Groundcover on eastern side of proposed quarry area.



Plate 3: Groundcover and exposed granite in central section of proposed quarry area.



Plate 4: Vehicle track through proposed quarry area. Red spot on left of plate indicates position of isolated artefact.



Plate 5: Waste dump area from eastern edge of proposed quarry area



Plate 6: View of waste dump area taken from its western edge.



Plate 7: Disturbed ground on western edge of waste dump area



Plate 8: Exposed granite littered with artefacts

## 7. Aboriginal Consultation

The survey area is at the southern end of the tribal territory of the Anaiwan tribe. Bob Faulkner is a member of this tribe and also Northern Regional Manager for the Aboriginal and Torres Strait Islander Commission. Bob was born near Uralla, not far from the survey area and is familiar with the country. He is actively involved with local Aboriginal groups.

## 8. Results of Survey

One site was recorded during the survey.

The survey in the quarry area revealed an observed area of about 30 sq m on an exposed granite outcrop containing both artefacts and debitage (Plate 8). This archaeological quarry site is on the western edge of the proposed quarry area. During the survey of the proposed office/stockpile area further clusters of artefacts were observed on the outcropping granite. On the road between the proposed quarry site and the proposed office/stockpile area artefacts were observed in a cluster. Because of the relationship of the areas surveyed to each other it was felt that the observed artefacts represented the limits of one site. The intervening area was not surveyed as it would not have been immediately impacted by the development but the evidence provided by the survey indicates that the area not surveyed could contain more artefacts, and be part of the one site (Figure 2).

Artefacts and debitage were all made from basalt which is a raw material available in the immediate vicinity. Many lumps of basalt were observed on the ground over much of the survey area and it appears that these lumps have been collected and worked on the site. Artefacts varied in size from 10 cm long modified flakes to waste flakes of less than 1 cm. Some of the artefacts were of a typology frequently referred to as 'axe blanks'. Density of artefacts varied across the site from 1-2/sq m to 10-15/sq m (this is a conservative estimate). Because of poor visibility it is quite possible that the extent of the site is further than was observed in this survey (Plates 9, 10, 11).



Plate 9: Basalt artefacts and lichen covered lumps of basalt



Plate 10: Basalt artefacts. Large reworked flake on left of picture.  
Smaller debitage visible in the leaf litter.



Plate 11: Artefacts were also evident in the surrounding scrub-covered ground.

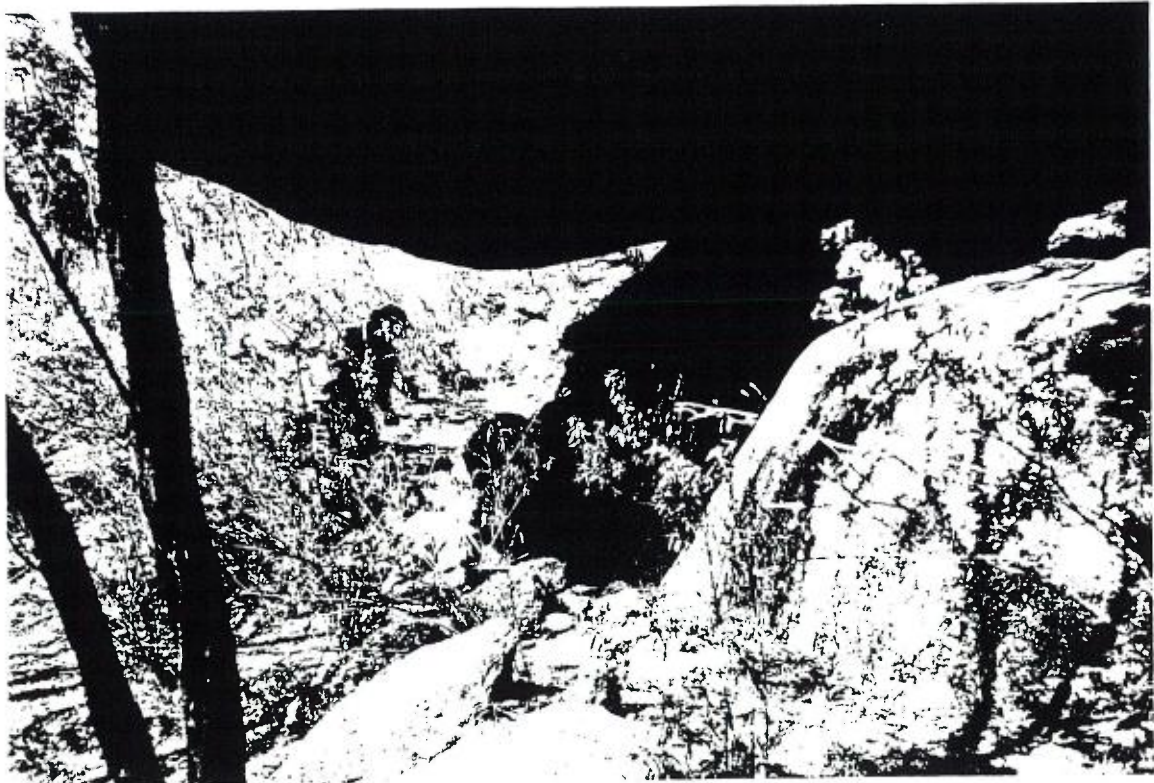


Plate 12: Large rock overhang

One quite large rock overhang and a small cave, both facing north, were located within 50 m of this site (Plates 12, 13, 14, 15). No indications of habitation were observed but there were substantial soil deposits in both places and it was felt that, given the other evidence of human activity in the area, habitation was likely to have occurred. Close attention was paid to the recently exposed surface of the road as it is in close vicinity to the overhang and cave. Only one isolated artefact was found (see Plate 4). No evidence was found in the waste disposal area, the dam site, or the proposed road site.

## 9. Assessment of Significance of Sites

### (a) *Aboriginal*

A full assessment of the significance of the sites to Aboriginal people is dependent on the presentation of this data to a meeting of the Local Land Council (Tamworth). This is a necessary prerequisite step to any formal applications for development.

Indications from Bob Faulkner are that the sites are of significance to contemporary Aboriginal people because they demonstrate that Aboriginal occupation of the area did occur. There is no traditional knowledge of the sites, nor are there any associated stories but the evidence that the site provides will contribute to the consolidation of Anaiwan culture.

### (b) *Scientific*

Archaeological evidence on the Tablelands has been fairly scattered so any recorded sites have considerable scientific value. This site is an archaeological quarry site and is valuable for research into the movement of Aboriginal peoples in the Tablelands by identifying other areas where this particular raw material appears. Study of the assemblage itself is also of scientific interest. The rock overhang and cave may be able to provide data on chronology and resource base which would be of interest in establishing a clearer picture of the past use of the Tablelands.

### (c) *Educational*

Educational value would result from knowledge gained from scientific study of the site.



Plate 13: Large rock overhang

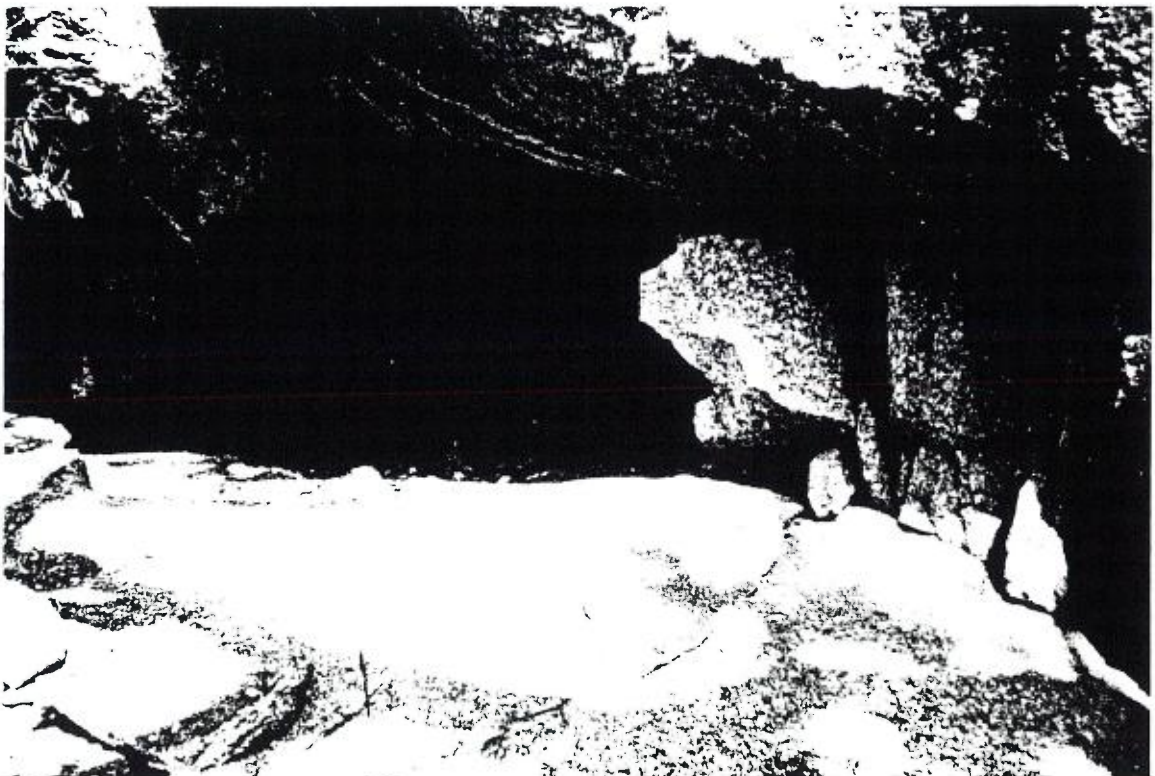


Plate 14: Cave behind rock overhang



Plate 15: Northwestern aspect from point close to stoneworking area and rock overhang

## 10. Recommendations

1. It is recommended that a full survey of the suggested site be undertaken to determine its extent and that following such a survey as much as possible of the artefact materials under threat be collected and analysed. This would seem to be especially necessary for that area proposed to be quarried. For the remaining area proposed to be used for an office/stockpile site it would be advisable to find an alternative location to avoid the need for intensive salvage operations. The area should be suitably protected from accidental damage from quarrying activities (i.e. adequate fencing and location of vehicular access away from the area).
2. Given the evidence of human activity and the destructive nature of the proposed activity in the area a subsurface investigation of the floor of the rock overhang and cave would be advisable.

The implementation of the above recommendations is subject to:

- (a) Approval by Local Land Council;
- (b) Assessment by National Parks and Wildlife;
- (c) Issue of necessary permits by National Parks and Wildlife.

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