PROPOSED HARD ROCK QUARRY

MUNDIJONG

CONSULTATIVE ENVIRONMENTAL REVIEW

RANSBURG PTY LTD

MAN BISHAW GORHAM

CONSULTATIVE ENVIRONMENTAL REVIEW

PROPOSED HARD ROCK QUARRY

LOT 344 SOUTH WESTERN HIGHWAY
MUNDIJONG

August, 1992

Prepared for:

Ransburg Pty Ltd
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Report No. MI2128

PROPOSED HARD ROCK QUARRY
CONSULTATIVE ENVIRONMENTAL REVIEW

The Environmental Protection Authority (EPA) invites people to make a submission on this proposal.

The Consultative Environmental Review (CER) for the proposed Hard Rock Quarry at Lot 344 South Western Highway, Mundijong and has been prepared in accordance with Western Australian Government procedures. The report will be available for comment for 4 weeks beginning Wednesday 2nd September, 1992.

Comments from government agencies and from the public will assist the EPA to prepare an Assessment Report in which it will make recommendations to the Government.

Following receipt of comments from government agencies and the public, the EPA will discuss the issues raised with the proponent and may ask for further information. The EPA will then prepare its assessment report with recommendations to Government, taking into account issues raised in the public submissions.

WHY WRITE A SUBMISSION?

A submission is a way to provide information, express your opinion and put forward your suggested course of action including any alternative approach. It is useful if you indicate any suggestions you have to improve the proposal.

All submissions received will be acknowledged.

DEVELOPING A SUBMISSION

You may agree or disagree, or comment on, the general issues discussed in the CER or with specific proposals. It helps if you give reasons for your conclusions, supported by relevant data.

You may make an important contribution by suggesting ways to make the proposal environmentally more acceptable.

When making comments on specific proposal in the CER:

- clearly state your point of view;
- indicate the source of your information or argument if this is applicable; and
- suggest recommendations, safeguards or alternatives.

POINTS TO KEEP IN MIND

By keeping the following points in mind, you will make it easier for your submission to be analysed.

Attempt to list points so that the issues raised are clear. A summary of your submission is helpful. Refer each point to the appropriate section, chapter or recommendation in the CER. If you discuss sections of the , keep them distinct and separate, so there is no confusion as to which section you are considering.

Attach any factual information you wish to provide and give details of the source. Make sure your information is accurate.

Please indicate whether your submission can be quoted in part or full, by the EPA in its Assessment Report.

REMEMBER TO INCLUDE:

Your name, address and date.

THE CLOSING DATE FOR SUBMISSIONS IS: Wednesday 30th September, 1992

SUBMISSIONS SHOULD BE ADDRESSED TO:

The Chairman
Environmental Protection Authority
8th Floor, Westralia Square
38 Mounts Bay Road
PERTH WA 6000

Attention: Mr Jim Treloar

SUMMARY

1. Ransburg Pty Ltd (Ransburg) proposes to establish a hard rock quarry at a property on the Darling Scarp, located approximately 4 kilometres east of the Mundijong townsite (Lot 344 South Western Highway). The Environmental Protection Authority (EPA) has previously issued a Works Approval for the crushing operations associated with the proposed quarry, for a former proponent in 1990. During the transfer of ownership to Ransburg, renewal of the Works Approval was inadvertently overlooked and the subsequent renewal application was appealed, resulting in formal assessment of the project at the level of Consultative Environmental Review.

2. Material extracted from the site is intended to enhance the proponents position as an independent and efficient supplier of basic raw materials, including armour rock for breakwaters and asphalt for roads. Ransburg is a fully Western Australian owned company and aims to develop the quarry for the long term benefit of its shareholders and the consumers of hard rock materials.

3. Planning of the quarry proposal recognises that the site is located on the Darling Scarp in the valley of Manjedal Brook, and in a locality that is largely forested (except to the west). In this regard, the initial quarry operation and the crushing and processing plant will be located in the northern sector of the property on land that has previously been cleared for pasture. After approximately 10 years, quarrying will commence in the southern sector of the property under carefully managed and staged conditions.

4. From a social perspective, the quarry proposal is located in an area with few immediate neighbours. Fortunately, land surrounding the site is under the control or management of only 4 'stakeholders' and most residences are in excess of 1.4 kilometres from the proposed quarry. Accommodation centres at the Manjedal Scout Camp and the Whitby Falls Hostel are located approximately 1km and 1.5kms from the quarry respectively.

5. The proponent recognises that noise and dust emissions are key issues which need to be managed to avoid disruption to nearby residents and has made a number of commitments to mitigate potentially adverse impacts. Noise from the crushing, screening and transport of rock is not expected to be disruptive due to the relative isolation of the site

and the 'enclosed' nature of the valley terrain. There is an ample water supply on site to control dust. Intermittent blasting will be conducted in accordance with regulations under the Mining Act and conditions of the EPA's Works Approval and operating licence.

6. Runoff from the quarry operations and water used for dust suppression will be managed via settling basins (including a recycling facility) to preclude sedimentation of the on-site watercourse. A significant buffer zone of native vegetation will be maintained along Manjedal Brook to further protect water quality and retain the habitat values of this segment of the system.

7. Given that the proposed quarry will be located on the Darling Scarp, aesthetic considerations have been a primary influence on the mine plan and layout of the quarry. The work area in the northern sector of the property will not be visible off-site, and quarrying will be conducted in the southern sector of the property (on north-facing slopes) for many years without viewshed constraint. Quarrying will proceed in southerly then westerly directions, to enable the eastern benches to be rehabilitated before they become visible from distant view-points. Ultimately, final rehabilitation of the quarry is expected to embrace some form of recreational opportunity, which will be addressed in detail considering surrounding land use at the appropriate time.

TABLE OF CONTENTS

TABLE OF CONTENTS

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

1.0 INTRODUCTION

1.1 Development Proposal and Location

Ransburg Pty Ltd, a fully Western Australian owned company, proposes to establish and operate a basic raw material quarry on Lot 344 South Western Highway, Mundijong. The primary objective is to extract hard rock, which is a general term describing various rock types, mostly granite and dolerite. Some lateritic gravels may also be sold in the early years of development, as there is a laterite veneer over the granite, particularly in the northern end of the property.

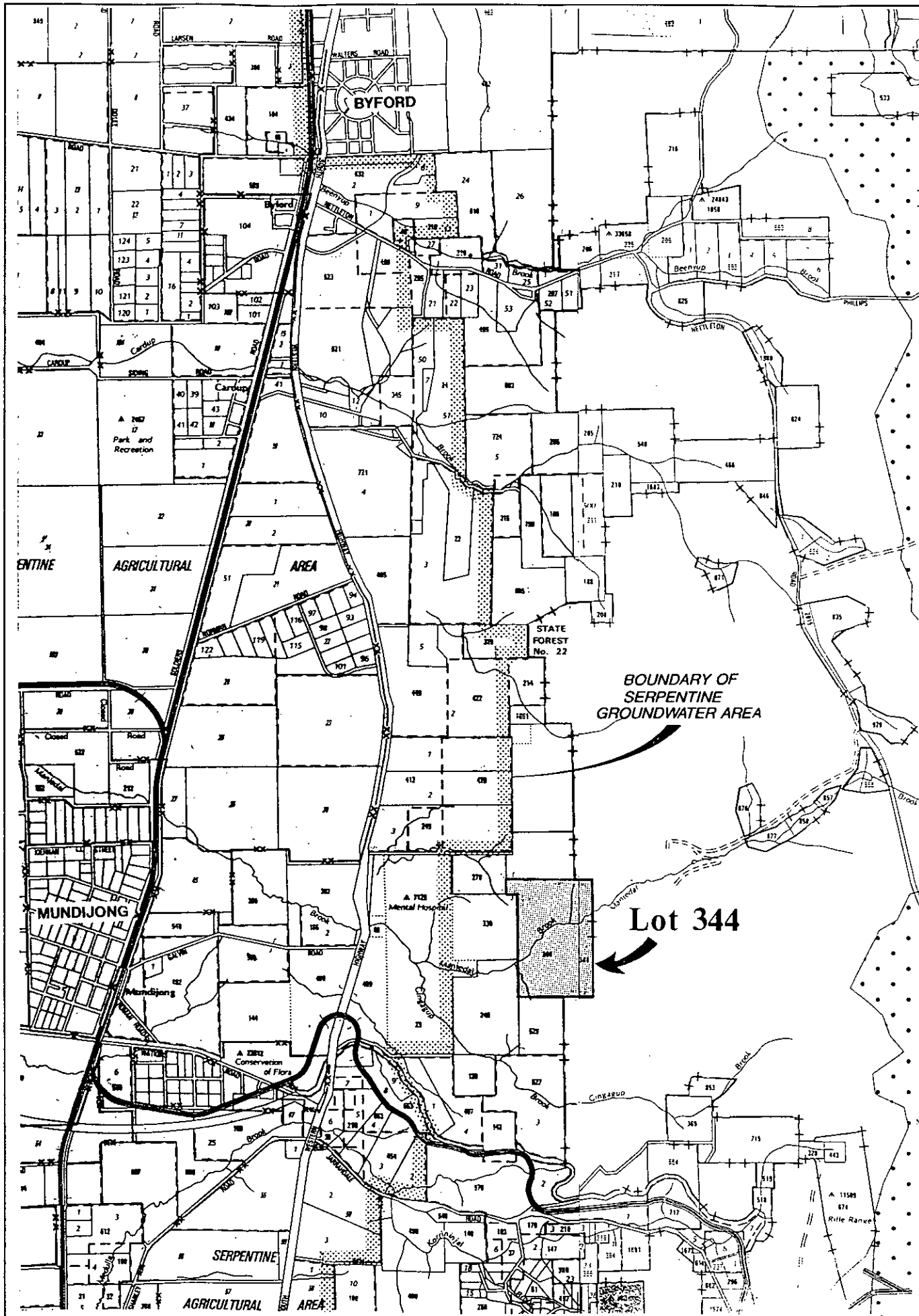
Extraction of the hard rock will necessitate intermittent blasting to quarry the resource and will require establishment of a crushing and screening plant on the site .

Lot 344 is located on the Darling Scarp approximately 40 kilometres south-east of the Perth CBD and 3.6 kilometres east of the Mundijong townsite. A locality map showing the site relative to Mundijong and Byford is provided on Figure 1.1. The total area of Lot 344 is 80.9 hectares.

1.2 Background

The property has been the subject of previous applications for quarry development over approximately the last 5 years by two former proponents. W.A. Limestone was invited to participate in the project in 1990 and has essentially been involved since that time, although the company only acquired a majority shareholding in Ransburg Pty Ltd in 1992.

There is a long history to the approvals process for this development, which need not be repeated here. However, it is relevant to point out that the Environmental Protection Authority (EPA) has previously issued a Works Approval for a 'grinding and milling works' as part of the proposed quarry operation (Works Approval No. 486 of 29 June 1990, issued to Hanscon Holdings Pty Ltd).



LOCATION OF THE PROPOSED QUARRY SITE

Figure 1.1

The Works Approval was valid for one year only. During the transfer of ownership of the property to Ransburg Pty Ltd, the application for renewal of the Works Approval prior to the expiry date was inadvertently overlooked.

When the renewal application was eventually made and the EPA advertised that the project would be assessed under the works approval and licensing provisions of the Environmental Protection Act, 1986, a number of appeals against the project and the level of assessment were submitted to the Minister for the Environment. The Minister upheld the appeals and determined, upon consultation with the EPA, that the proposal should be formally assessed by the EPA. The level of formal assessment has been set at Consultative Environmental Review (CER).

1.3 Proponent

The proponent is Ransburg Pty Ltd, a company which is two-thirds owned by W.A. Limestone Co. and one-third owned by Hanscon Holdings Pty Ltd.

W.A. Limestone Co. will be the manager and operator of the proposed quarry. The company operates numerous quarries between Bunbury and Geraldton and has vast experience in the basic raw material industry.

Ransburg Pty Ltd may be contacted via the head office of W.A. Limestone:

41 Spearwood Avenue
Bibra Lake WA 6163

Telephone: 434 2299

1.4 Statutory Approvals

1.4.1 Environmental Approval

This CER document is the means by which environmental approval is sought for the hard rock quarry proposal.

Consultative Environmental Review is the lowest level of formal assessment and involves consultation with relevant government agencies and members of the public directly affected or interested in the proposal. The proponent is obligated to provide details of the project and describe the anticipated environmental impacts and the measures that are proposed to ameliorate potential adverse effects.

Guidelines which specify aspects to be addressed by the review were provided by the EPA; a copy of these is included as Appendix A. The period of consultation on the CER document is normally of four weeks duration, during which submissions may be made regarding the proposal.

Public submissions are confidential, however the proponent will be asked to comment on any issues which are raised by the public, as summarised by the EPA. The EPA will assess the proposal and prepare a report which will summarise the issues and state whether the project is environmentally acceptable and under what conditions. Anyone can appeal against the content or recommendations of an EPA assessment report.

A project undergoing formal assessment by the EPA can not proceed until the Minister for Environment gives his approval. The Minister will advise the proponent accordingly and specify the conditions upon which the project may proceed.

Following Ministerial approval, the proponent will apply for a Works Approval and subsequently, a Licence for the screening and crushing plant.

1.4.2 Planning and Local Government Approvals

Under the terms of the Environmental Protection Act, 1986, when a proposal is undergoing formal assessment no other decision-making authority may allow the project to proceed until the Minister for the Environment grants his approval.

As indicated previously, there is a complex background to the approvals process for this proposal. It is recognised that all planning and local government approvals sought will be conditional upon receiving the Minister for Environment's consent to this CER.

2.0 COMMUNITY CONSULTATION AND INVOLVEMENT

A two stage public consultation program has been devised to help identify the potential impacts and issues of concern within the community, and to create a better understanding of the project and its objectives.

The first stage has been conducted during initial preparation of the CER and the second stage is proposed for the 4 week formal review period. It is also likely that the proponent will be consulting with some or all of the immediate neighbours during the initial development period, subject of course to obtaining Ministerial approval to proceed.

2.1 Public Consultation During Preparation of the CER

Initial consultation focussed on the immediate neighbours to the property and key community representatives. In the latter instance, key personnel were identified following initial discussions with the Social Impact Unit and by referrals during the consultation process.

The program comprised the following consultations to the personnel and groups listed in Appendix B:

(i) An introductory letter supported by follow-up telephone contact;

(ii) Direct telephone communication only;

(iii) Formal presentation to a community committee.

Written submissions were received from Nanwall Investments Pty Ltd and the Armadale Kelmscott Health Service; both parties are 'stakeholders' of properties which abut Lot 344.

2.2 Principal Issues Identified During Consultations

A summary of the issues raised during consultation is provided below. In each case, a brief response from the proponent is provided, with a referral to other sections of the report for a more detailed response.

- Too much mining in the area

It is apparent that a relatively strong 'anti-mining' sentiment has developed in the Mundijong locality in recent years, following announcement of the mineral sands prospects north-east of Mundijong between the railway and South West Highway. There is a belief that the rural atmosphere and lifestyles would be adversely affected and land values decline with these new proposals. There is disillusionment that once one proposal is approved and commences, approval of the next mining operation is inevitable.

(Each proposal is assessed on its merits in relation to environmental impacts, with due regard to potential cumulative effects in the context of existing land uses. Management considerations must obviously be cognizant of any potential cumulative impacts - refer to Section 6.0).

- Why is there another hard rock quarry required?

There was criticism from some people that the Darling Scarp should be protected from further quarry operations because there are already sufficient hard rock quarries on the Darling Scarp to supply the long term demand for aggregate.

(Refer to Section 3.0 for the justification for this proposal).

- Aesthetic problems - visual intrusion to neighbours and 'visitors'

The amenity value of the locality is high, with the major features comprising the Darling Scarp, Manjedal Brook valley and Whitby Falls. People expressed concern that the quarry, access road and traffic would be incompatible with these values and would have an impact on tourism use of the area, e.g. Whitby Falls Coach House Centre.

(Refer to Section 6.1 and Appendix E for an assessment of the potential visual intrusion of the quarry and access. In the absence of any significant impacts in the short term, management planning for the quarry will focus on mitigation of potential impacts in the long term).

- Dust control - especially during periods of strong easterly winds.

The area experiences very strong easterly winds, particularly during the drier summer months, and there is concern that dust emissions will not be controlled effectively. Strong wind gusts, accentuated by the Manjedal valley, would carry dust for long distances over properties to the west of the quarry site.

(Dust control measures are described in Section 6.3. Evaluation of the potential for adverse dust effects must recognise the small source of dust generation and the nature of the 'buffer zone' available within and adjacent to the site).

- Noise

Noise emissions from the quarry operation (particularly during blasting) and haulage road would be a disruption to rural residential areas and the Whitby Falls Hostel, which is a facility for people requiring long term psychiatric care and/or undergoing rehabilitation. Most people consulted have sought assurances that noise levels will be kept to acceptable levels.

(Management of noise and an assessment of residual noise levels is described in Section 6.2).

- Damage to Property from Blasting

Residents in the area have reported experiencing vibrations and tremors as a result of blasting at the existing Pioneer hard rock quarry to the north and, occasionally, from Alcoa's blasting in the Jarrahdale bauxite mining area. Some people have stated a desire to be informed of blasting times.

(The effects of blasting may be mitigated by controls on blasting technique, timing and size of blast etc. Monitoring of tremors may also be conducted and blasting operations scheduled in relation to other blasting in the locality.

Management and monitoring strategies are outlined in Section 6.2 and commitments provided in Section 7.0).

- Effects on Manjedal Brook

The issues raised with respect to the effects on Manjedal Brook include the potential for reduced flow, a deterioration in water quality, impacts on stream fauna and concern regarding groundwater recharge when the brook discharges across the coastal plain.

(The company's management responses to protect the integrity of Manjedal Brook are outlined in Sections 6.4, 6.6 and 6.7).

- Safety

Safety is a prominent concern of the Scout Association, due to the regular presence of youth groups in the adjoining State forest. The Manjedal Scout Camp is located a short distance (1.6km) 'upstream' from the proposed quarry.

(The company intends to liaise closely with the Scout Association to ensure that the safety measures adopted cater adequately for the more 'curious' and 'adventurous' members of youth groups, as described in Section 6.12).

- Proposed Darling Range Regional Park

Comment was made that the site may be included in the proposed Darling Range Regional Park, which is focussing on the Darling Scarp, and that the area is subject to a landscape protection policy. The proposed quarry would be incompatible with these initiatives.

(The Regional Park does not include the site and indeed, it does not include the majority of freehold land on the Scarp. However, landscape protection is recognised to be important and the anticipated impacts of the proposal on the existing landscape qualities are assessed

in Section 6.1. It is anticipated that with the management measures proposed in Section 6.1, the site can be quarried and still conform to the intent and objectives of the proposed Regional Park).

- End Use

Concern was expressed at the long term nature of hard rock quarries in general and how they may be rehabilitated.

(The primary objective of the Company's rehabilitation plan, described in Section 6.9, is to prevent the operation becoming visually intrusive in the landscape. Potential end uses are also addressed in this section).

2.3 Proposed Public Consultation Following Preparation of the CER

The proponent anticipates maintaining an on-going liaison with adjoining landholders and leaseholders during implementation of the proposal. The company wishes to be a 'good neighbour' and minimise inconvenience to others as a result of the quarry activities.

During the four week public review period, it is proposed that further discussions will be held with the nearest neighbours to obtain direct feedback and provide explanations of the management strategies. Contact will be made with Council and specific interest groups with a view to arranging a presentation of the project, should they so wish.

3.0 PROJECT JUSTIFICATION

As mentioned in Section 1.2, a Works Approval has previously been issued by the EPA for a hard rock quarry on Lot 344, but this approval was allowed to lapse prior to implementation of the project by a previous proponent. Ransburg Pty Ltd became involved in the project on the understanding that **the quarry had all of the regulatory approvals necessary to proceed.** W.A. Limestone became the majority shareholder in Ransburg Pty Ltd in 1992.

Whilst a hard rock quarry has been proposed for the site for several years and by a number of proponents, it is most relevant to provide the justification for the project from the perspective of the current proponent, and in particular from the viewpoints of the two owners of Ransburg Pty. Ltd, as below.

3.1 Corporate Position

(i) W.A. Limestone

In many instances Contractors find it practical and convenient to source their soft rock (limestone) and hard rock (granite) for a particular development from the same supplier. W.A. Limestone has always been very competitive in the soft rock market but is disadvantaged by not being able to offer the full range of soft and hard rock products to Clients as do it's major competitors. In many cases this results in them losing work even when having the lowest rate on the soft rock component of a project when clients believe it better to deal with one supplier for logistic and other considerations.

W.A. Limestone also specializes in the construction of marinas and breakwaters. In its own right, or in partnership, it has successfully completed almost all of these including the Mindarie Keys, Hillary's and North Mole along with the Fishing Boat , Success and Challenger Harbours in Fremantle. The company has also produced the rock for and constructed breakwaters in Geraldton, Jurien Bay, Bunbury and Esperance. Some of the metropolitan area projects have required large amounts of hard rock armour. W.A. Limestone has experienced problems with consistency, continuity and pricing when forced to buy hard rock off existing hard rock quarries. This is primarily due to the fact

that the method of production of hard rock armour, the irregularity of demand, and the structure of the pricing framework for other hard rock products are seen as strong disincentives for hard rock armour production by the existing quarries. The resultant delays, double handling and intermittent supply has made it difficult for W.A. Limestone to fulfill its contractual responsibilities on projects where hard rock armour is specified to be placed on the inner soft rock core. This is in direct contrast to the excellent reputation W.A. Limestone has with the relevant Authorities for consistently completing projects under budget and ahead of time where soft rock only is required.

(ii) Hanscon Holdings Pty Ltd

The other partner in Ransburg Pty Ltd is Hanscon Holdings Pty Ltd. The Director of Hanscon Holdings Pty Ltd operates a large Contracting Company and recently opened an asphalt plant. These are both end users of hard rock quarry products. The existing hard rock quarries own or control three contracting companies and three asphalt plants. These operations are logical vertically integrated users of the products produced by the quarries. The competitiveness of these operations is very dependent on their raw material prices including those for their hard rock supplies. The asphalt operations of the Hanscon Holdings Pty Ltd Director are of course similarly affected by its raw material prices, nevertheless it must source these off the hard rock quarries who own and run the asphalt operations which are its main opposition.

Apart from W.A. Limestone and Hanscon Holdings Pty Ltd there are a number of independent end users, both existing and proposed, that are keen for a truly independent raw material supplier to enter the hard rock market. The proponent has been greatly encouraged by the strong indications of support received from them. Ransburg Pty Ltd believe their entry into the hard rock market will have both immediate and long term advantages for the community. These will include, but are not limited to, investment both by itself and end users, cheaper raw materials, and employment and job creation, especially for the local community.

3.2 Alternatives Considered

Formulation of this development proposal did not involve consideration of alternative sites by Ransburg Pty Ltd. The company was approached to invest in the project on the basis that it was approved for quarry development. It was considered at the time that the site was ideally located to supply hard rock materials to the southern Metropolitan Area and to Mandurah. The site is also conveniently located with respect to the company's regional headquarters at Bibra Lake.

Location of a hard rock quarry on Lot 344 is consistent with regional planning considerations for basic raw materials, as discussed below.

3.3 Regional Planning Aspects

The Darling Escarpment is the principal source of hard rock material in the Perth Metropolitan Region. Whilst resources of hard rock suitable for aggregate are therefore relatively vast, the accessibility of reserves is limited by economic and environmental factors, and pressure from competing land uses.

3.3.1 Basic Raw Material Policies

In 1984, the (then) Metropolitan Region Planning Authority (MRPA) formulated a Draft Statement of Planning Policy for Basic Raw Materials with accompanying mapping, the overall aim of which was to identify and protect basic raw material reserves and avoid future land use conflicts.

The MRPA mapping classified the granite outcrops on Lot 344 as a Category 1 (highest priority, Recommended for Consideration) hard rock resource, based on economic and environmental assessment of suitability for extraction. The site was one of only five to receive this classification south of Byford.

In March 1992, the Department of Planning and Urban Development (DPUD) released a Basic Raw Materials Policy Statement for the Perth Metropolitan Region, which is a revision of the previous MRPA policy by the State Planning Commission. Working plans released with the Policy fail to identify that Lot 344 as situated in a hard rock resource

area, as well as the existing Pioneer hard rock quarry to the north. Rather, the associated mapping classifies both sites within an area prospective for shale resources. This is in conflict with the environmental geology mapping by the Department of Mines (Jordan, 1986), which correctly identifies the site as containing granites and gneisses. The relevant extract from the Working Plans is shown on Figure 3.1.

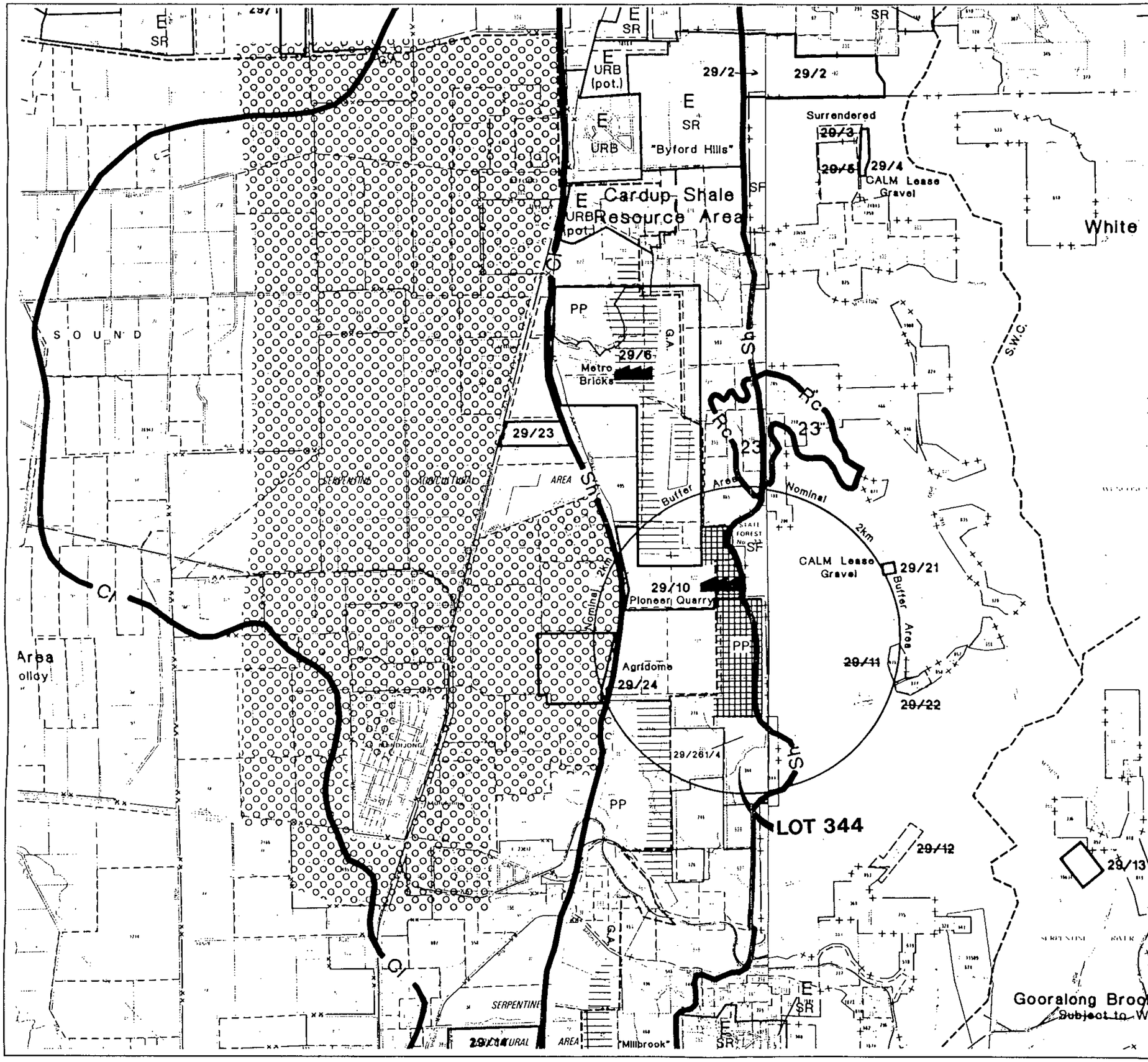
Note that the Pioneer quarry is denoted as a Key Extraction Area, which refers to an existing operation of regional importance which has been approved under the Mining Act, Local Government Act, provisions of a Town Planning Scheme or the Metropolitan Region Scheme, or any other relevant statute.

An important consideration is that Lot 344 lies almost wholly within the nominal 2 kilometre buffer zone surrounding the Pioneer quarry area. (In fact, the southern boundary of Lot 344 is only 1.5 kilometres away from the future southern extent of Pioneer's quarry).

The State Planning Commission's Basic Raw Materials Policy provides a mechanism to control development within land zoned Rural under the Metropolitan Region Scheme, in order to protect valuable deposits of basic raw materials. For example, the policy requires that relevant Town Planning Schemes shall be amended as follows:

- "areas designated as 'key extraction areas' in the Policy Map shall be included in an Extractive Industry Zone or Policy Area, extractive industry being permitted as the only 'P' use. Such areas shall include surrounding buffers." (p17 DPUD, 1992).

Consequently, when assessing proposals in the vicinity of Key Extraction Areas, government agencies and local authorities must give due consideration to planning and land use decisions which may lead to a possible conflict with existing excavation rights. Clearly, the establishment of a similar quarrying operation is a compatible and regionally important land use, and one which will consolidate the continued operation of extractive industry in an area which has previously been identified as fulfilling both economic and environmental criteria.



LEGEND

RESOURCE AREA

Areas of high resource potential (including proven reserves) where future extraction operations are likely to occur.(1)

(In the case of the hard rock resource, only some selected areas identified in the Darling Escarpment Aggregate Resources Report (D.E.A.R.) are designated. Numbers correspond to (D.E.A.R.) report reference's)

24

KEY EXTRACTION AREA

"Extraction areas" of regional importance. Upon acceptance of a plan of management/rehabilitation by the Department of Planning and Urban Development these areas shall be protected in the relevant town planning scheme.

Works processing plant

Quarry access road (3)

Buffer area-Quarry impact areas, within which, land use and development proposals need to be compatible with the quarry operation.(3)

2km Rad

RESOURCES		LAND USES	
Limestone	Ls	State Forest	SF
		Water Catchment	WC
Limesand	Lsd	Special Rural	SR
Sand	Sd	Proposed Urban (4)	
		Category A	
		Category B	
Clay	Cl	Industrial	IND
		Parks and Recreation	PR
Shale	Sh	National Parks	NP
		Government Reserves	PP
Hard Rock	Rc	Landscape	LS
Gravel	G	System 6	S6

SOURCE: DPUD (1992)

0 1 2
KILOMETRES

LOT 344 IN THE CONTEXT OF THE BASIC RAW MATERIAL WORKING PLAN

Figure 3.1

Development of a quarry on Lot 344 would only require an adjustment of the nominal buffer zone by expansion to the south, to conform to the 1992 Basic Raw Material Policy.

3.3.2 Future Urban Expansion

The release of Metroplan and the Urban Expansion Policy in 1990 established the State Government's metropolitan strategy for the future planning of Perth. This strategy identified a vast tract of land surrounding Mundijong and extending north to Byford (shown on Figure 3.1) for future urban expansion. The area is Category B land, i.e. one or more constraints to overcome prior to consideration for urban development and presumed to be available in about 30 years.

Eventual urbanisation of this land would place the Pioneer quarry and a quarry on Lot 344 in a similar situation to the existing quarries at Gosnells, where a narrow strip of Rural and Special Rural land separates the quarries from urban development to the west.

Of more relevance is the strategic location of Lot 344 to supply materials in respect to the expansion of urban development in the South-East and South-West corridors.

3.4 Benefits

The principal benefit of this proposal is to enable Ransburg Pty Ltd to compete efficiently in the broader basic raw material market by establishing independent competitive price structures for the various hard rock products, including armour rock for breakwaters.

The new quarry is anticipated to provide direct employment opportunities for up to 15 persons and 20 subcontractors. All profits and dividends will remain in Western Australia with substantial reinvestment in the company for future growth.

4.0 DESCRIPTION OF THE EXISTING ENVIRONMENT

This section of the report presents a description of the environmental characteristics of the proposed quarry site from both local and regional perspectives, to provide a basis for the assessment of potential environmental impacts given in Section 6.0.

4.1 Physical Environment

4.1.1 Climate

There are no climatic data available which relate specifically to the site, however records for nearby locations may be utilised. Meteorological data for Karnet, 16km south-south-east of the site, indicates that the area experiences the Mediterranean climate typical of the Swan Coastal Plain, with hot dry summers and cool wet winters. Rain falls mainly in winter, with 80% falling from May to September. Mean annual rainfall at Whitby Falls has been recorded at 975mm. Evaporation exceeds rainfall in all months with the exceptions of May to August inclusive.

Wind data for Karnet indicates that winds prevail from either the south-west (sea breeze), west or north-west for about 60% of the year. Morning easterlies occur approximately 15-20% of the time, predominantly during Autumn, Spring and Summer. This pattern also typifies the diurnal patterns of the Swan Coastal Plain.

A climatic phenomenon which may have potential impact on the proposal is known as temperature inversion. Temperature inversions occur when near-ground air is cooler than the higher layers of the atmosphere, and when ground temperatures cool and there is insufficient wind to mix the stratified air layers. This may result in restricted dispersal of airborne pollutants and the possibility of sound, such as that occurring during blasting, carrying a greater than usual horizontal distance.

Temperature inversions occur most commonly during autumn, winter and spring, when approximately half the days have the potential for an inversion to occur. In summer, sea breezes and other winds mix the air, reducing the likelihood of inversions occurring.

Stephens (1991) has presented data which indicates that 90% of inversions are broken up by solar heating alone by 12.30pm, and 100% by 2.00pm.

4.1.2 Topography

The site is bissected by Manjedal Brook, and consequently the terrain rises from the position of the brook in generally north-west and south-east directions from approximately 200mAHD to 270mAHD. Topographical and existing features are shown on Figure 4.1.

The brook itself falls from approximately 205mAHD at the eastern boundary of the site, to 170mAHD in the west.

4.1.3 Landform and Soils

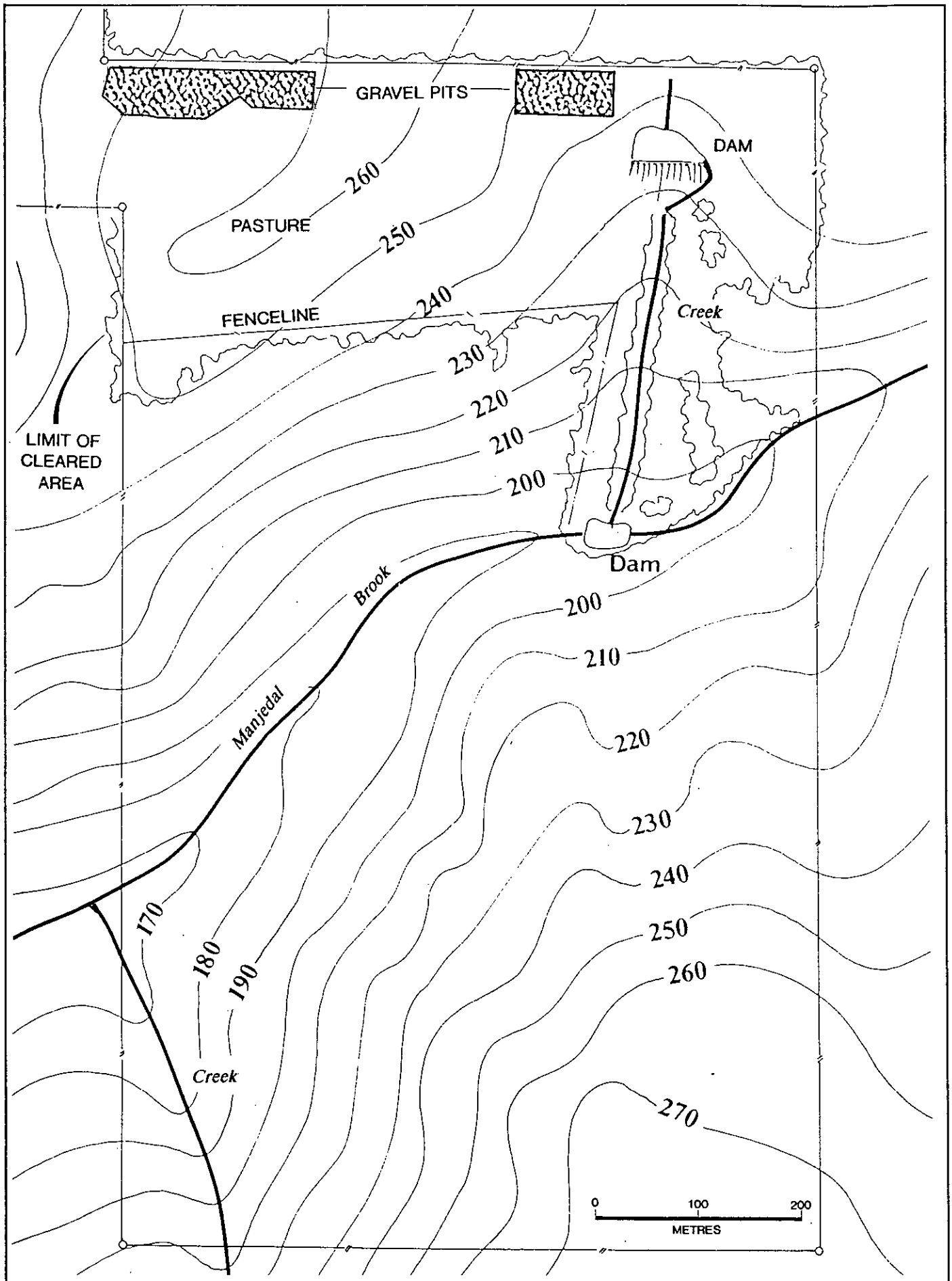
The site has representations of the Dwellingup and Myara Land Units. The Dwellingup Land Unit comprises a gently undulating landscape with low flat or rounded ridges, shallow depressions and a general slope towards the Scarp. The Dwellingup soils are generally thin, discontinuous brownish gravelly sandy loams, with scarce or no clay in shallow depressions, and duricrust, boulders or outcrops on the ridges.

The Myara Land unit comprises V-shaped irregular valleys, which slope steeply from the top of the Scarp to the coastal plain, carrying drainage from the Plateau. This land unit corresponds to the landform surrounding Manjedal Brook. Soils are derived from fresh crystalline rocks (dolerite intrusives and granites), and are red to yellowish-red clayey loams.

More specifically, lateritic gravels occur in the north-west of the site, and fine-grained granites outcrop over the southern portion of the property. The north-east quadrant appears to contain white kaolin clays overlain with loams and gravels.

4.1.4 Surface Water Hydrology

Manjedal Brook is a perennial stream which flows through the site in approximately a south-west direction (Figure 4.1). The headwaters of Manjedal Brook are located approximately 3.5 km to the east.



TOPOGRAPHICAL AND EXISTING FEATURES OF LOT 344

Figure 4.1

Manjedal Brook is joined by Gingagup Brook approximately 1.5km to the west of the site below the cascade known as Whitby Falls. It eventually discharges into Oaklands drain and the porous sediments of the Swan Coastal Plain.

The site is not located within an existing urban surface water catchment, nor was the brook identified as a management priority area for future requirements of the Perth-Bunbury region by the Western Australia Water Resources Council (WAWRC, 1987).

The site also contains two seasonal streams which flow following rain events. Water quality within Manjedal Brook has not been intensively studied, however the Water Authority has provided data (1976-77) which indicate the brook was fresh, with colouration (turbidity) episodically increasing over winter corresponding to the entry of run-off to the system.

Several small privately owned dams occur on Manjedal Brook which are primarily used for irrigation or stock watering purposes, notably the orchard area at the headwaters of the brook

4.1.5 Groundwater Hydrology

Groundwater in the scarp area tends to occur in isolated pockets within the weathered section of granite rock, at variable depth. Groundwater in the area of the site is sometimes slightly saline.

The proposed quarry site is located outside the eastern boundary of the Serpentine Groundwater Area (refer to Figure 1.1).

4.2 Biological Environment

The vegetation and flora of the proposed quarry site are described below, followed by a description of the fauna.

4.2.1 Vegetation and Flora

The vegetation and flora of the site was examined by field survey and collation of existing records, with the objective to provide the following:

- A survey of the vascular plant species on the site, including those species considered to be rare and endangered, geographically restricted, or outlier populations.
- A description of the general characteristics of these flora, and their relationship to topography and soils.
- A description of the plant communities on the site, including mapping.
- A review of the local and regional significance of the plant communities.
- A comparison of the floristic composition of the site's vegetation in relation to nearby reserves.
- Provision of management strategies to reduce or ameliorate the impact of the project on the vegetation and flora.

4.2.1.1 Regional Perspective

Vegetation over the Darling Plateau has been classified by Heddle *et al.* (1980) into 28 complexes. Several complexes and sub-complexes have been defined, with the structural and floristic diversity of the plant communities reflecting the large range of climatic conditions, landforms and soils which occur over the Darling Range. More recently and at a more specific level, the (then) Department of Conservation and Environment mapped the distribution of vegetation types throughout the Darling Range region as part of the unpublished Darling Escarpment Environmental Study (DCE, 1986). This study included the subject site and surrounds, and has been used here to gain a regional appreciation of the extent to which the vegetation of the site is represented elsewhere.

Variation in rainfall, steepness, relief and rock outcropping has resulted in a north-south trend in the vegetation along the length of the Darling Scarp (Heddle, 1980). Further

differentiation occurs as a result of major valleys and river systems which dissect the Scarp on the western edge of the Darling Plateau. The east-west orientation of the valleys transporting water to the coastal plain has resulted in the northern (south-facing) slopes and the valley floors receiving less sunshine, leading to the development of varying vegetation associations as a response to microclimatic differences.

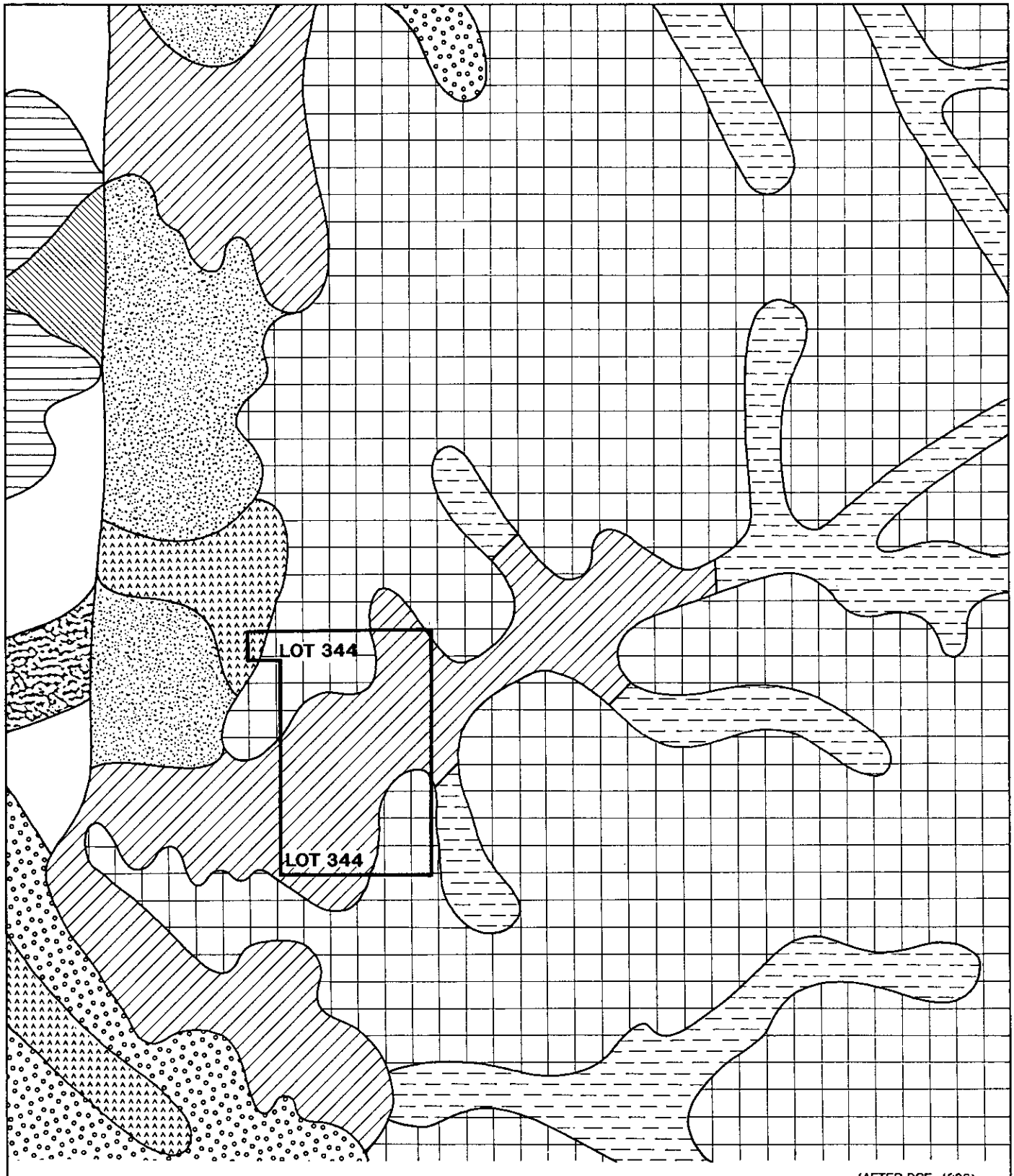
Most areas of forest over the Darling Scarp and Darling Plateau, particularly jarrah (*Eucalyptus marginata*) forest, have been influenced in some way by forestry practices and other land uses. These uses have resulted in altered vegetation structure from forest to more open woodland, and have also varied the floristic composition through changes in light intensity, fire management strategies, and the spread of introduced weeds and dieback disease.

As the "hills" region became more populated, a large proportion of the valley slopes in the region were cleared for agricultural activities, particularly for grazing pasture. This has resulted in large areas of cleared land with few remnant trees and understorey species in many instances. The pasture is usually a combination of introduced annual grasses and legumes, in particular subterranean clover (*Trifolium subterraneum*). Clearing land for orcharding was also common in the region.

Figure 4.2 shows the delineation of vegetation types over the site and surrounds as identified by DCE in 1986. The vegetation type of the site falls into two categories; Type 18 (Myara Subcomplex - medium/high rainfall zone) and Type 2 (Dwellingup Complex - medium/high rainfall zone).

The Myara Subcomplex is associated with moderately incised rocky valleys within the western portion of the plateau, on a mixture of duplex and gradational soils with rock outcrops common. This corresponds approximately to the steeper area of the site surrounding Manjedal Brook. On valley slopes, this vegetation type is generally a mixture of Wandoo (*Eucalyptus wandoo*) woodland and jarrah-marri-yarri (*E. marginata-E. calophylla-E. patens*) open forest. Associated with rock outcrops are areas of heath and herblands, with a fringing woodland of flooded gum and swamp paperbark.

The Dwellingup Complex is associated with well-drained undulating terrain, with shallow to moderately deep gravelly and lateritic sands overlaying duricrust, corresponding to the



(AFTER DCE, 1986)

LEGEND

- DWELLINGUP COMPLEX (M/H)
- YARRAGIL COMPLEX (M/H)
- MAMBU SUB-COMPLEX
- DARLING SCARP SUB-COMPLEX-NORTH
- BALGOBIN SUB-COMPLEX
- MYARA SUB- COMPLEX
- FORRESTFIELD COMPLEX
- FORRESTFIELD SUB-COMPLEX-GRAVEL
- FORRESTFIELD SUB-COMPLEX-SAND

(LETTERS IN PARENTHESIS INDICATE MEDIUM-HIGH RAINFALL ZONE)

VEGETATION TYPES FROM REGIONAL MAPPING

Figure 4.2

more upland areas of the site. The vegetation of the Dwellingup Complex is also dominated by an open forest of jarrah-marri in the uplands, with variation in understorey dependent on climatic characteristics.

Both of the above vegetation complexes are relatively well represented in the area, and extend into adjacent State Forest as discussed in Section 6.6.2.

4.2.1.2 Vegetation of the Proposed Quarry Site

To gain a more specific appreciation of the vegetation of the proposed quarry area, the vegetation of the site has been mapped following a detailed site survey. In some areas the site has been cleared and planted with clovers for grazing, other areas have previously been logged for timber production, whilst in some areas natural (previously logged) stands of vegetation remain. Figure 4.3 shows the relationship of each vegetation type to the site.

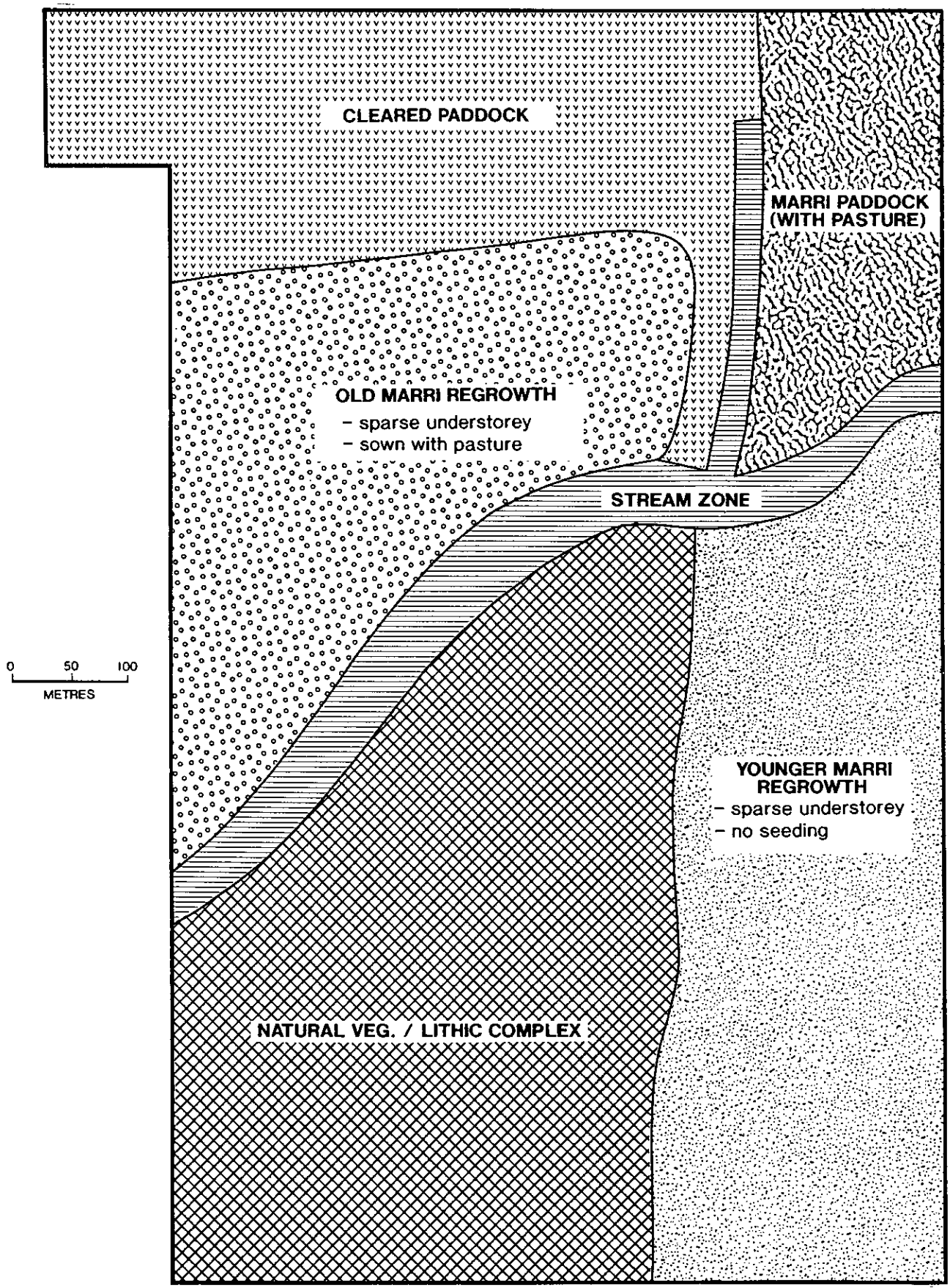
Mapping was undertaken in accordance with fauna habitats for ease of reference. The vegetation areas corresponding to the fauna habitats are:

1. Cleared upper slopes containing pasture grasses and subterranean clover (*Trifolium subterranean*) and weed species (*Hypochaeris* sp).

2. Open marri (*Eucalyptus calophylla*) regrowth on south-facing slopes, with pasture grass. Sparse native understorey.

3. Narrow fringing woodland with scattered Western Australian Blackbutt (*Eucalyptus patens*) and marri overstorey along Mandejal Brook, with dense understorey dominated by Swamp Peppermint (*Agonis linearifolia*), *Agonis flexuosa*, *Restio sp.*. and sedges (*Lepidosperma tetraquetrum*).

4. Lithic complex with shrubs of variable density and composition according to depth of skeletal soils and exposed granite. Deeper soils consist of marri overstorey with understorey species of *Macrozamia riedlei*, *Hibbertia hypericoides*, *H. lineata*, *Grevillea bipinnatifida* (Fuschia grevillea), *Acacia pulchella*, *A. alata*, *Darwinia citriodora* (Lemon-scented Myrtle), *Baeckea camphorosmae*, *Calothamnus lehmannii*, *C. sanguineus*, *Hakea lissocarpha* (Honey Bush), *H. linearis*, *Dryandra armata*, *D. nivea* and *D. bipinnatifida*,



VEGETATION OF THE SITE

Figure 4.3

Eremophila maculata, *Allocasuarina huegeliana*, *Hypocalymma angustifolium* (White Myrtle), *Dampiera alata* with *Mesolomaena stygia*, *Drosera sp.*, *Stylidium sp.* and several ferns (*Pteridium* and *Chelianthus*) in moister areas. *Borya nitida*, *Petrophile biloba* (Granite petrophile) and mosses are associated with the granite outcrops.

5. Open marri regrowth following clearing on north-facing slopes, with scattered open understorey regrowth of predominantly *Grevillea*, *Acacia* and *Hakea sp.*.

6. Cleared paddocks with scattered marri.

7. Adjacent forests. Predominantly Crown land, this habitat is a composite of jarrah (*Eucalyptus marginata*) and marri forest, with representative lithic complex and creek zones.

4.2.1.3 Rare and Restricted Flora

In addition to the site survey previously described, the Declared Rare Flora (DRF) database at the Department of Conservation and Land Management (CALM) has been accessed to determine if any DRF or Priority Species populations are known from this area.

CALM has indicated that no DRF populations are known from the area (Appendix C), however six Priority Species have previously been recorded from the general Armadale-Byford-Mundijong area. Appendix C lists these species and their respective Priority Codes. One species, *Centrolepis caespitosa*, is presumed to be extinct. The five remaining species have Priority Codes of 1, 2 or 3 indicating that they are poorly known rather than rare or endangered. None of these species have previously been recorded from the site, or identified during the site survey.

4.2.1.4 Jarrah Dieback Disease

CALM's mapping of the Jarrahdale area indicates that the site is not contained within a Disease Risk (Quarantine) Area.

Site inspections indicated that dieback indicator species such as the Blackboy

(*Xanthorrhoea preissii*) and Zamia Palm (*Macrozamia riedlei*) are common over the site, and appear in a healthy condition. Jarrah trees have been removed from the site due to logging, with regrowth dominated by marri trees. No evidence of dieback was observed over the site during superficial inspection.

Major valleys are not as susceptible to the spread of the dieback fungus due to the fertile free-draining soils associated with these areas. These conditions do not provide an optimum environment for the multiplication and spread of the soil-borne fungus.

4.2.2 Fauna

To assess the potential impact of the proposed quarrying operation on the vertebrate fauna, a survey of the site was undertaken by specialist sub-consultants to achieve the following objectives:

- documentation of the fauna present by survey of the site (day and night);
- listing all vertebrate species likely to occur at other times of the year based on the number and type of habitats present and fauna records for the area;
- assessment of the regional and local conservation status of the vertebrate fauna;
- determination of whether any fauna gazetted as Rare or Endangered in Schedules 1 and 2 of the Wildlife Conservation Act (1950) are present or likely to occur;
- provision of management strategies to reduce or ameliorate the impact of the project on the vertebrate fauna, in particular any rare and endangered species.

This section of the report summarises the findings of the vertebrate fauna survey. A copy of the full report is at the EPA library or is available on request. Only species actually recorded on the site by field investigation are tabulated in the following sections, however "likely to occur" species are discussed in terms of rare and endangered fauna.

4.2.2.1 Habitat Types

Seven vertebrate habitats were identified over the site. Each of these habitats is basically homogeneous according to the dominant upper stratum, however variation in the understorey composition does occur. Nonetheless, the overstorey species were deemed to be the major habitat components as most vertebrates have considerable mobility and are unlikely to differentiate between understorey plants.

The seven habitats identified are described in Table 4.1.

4.2.2.2 Mammals

The survey recorded six species of native mammal from the site, however an additional thirteen may occur based on known distributions. Three introduced species were recorded, with 2 additional species possibly occurring based on species distribution. Table 4.2 presents the mammal species recorded from the site.

The Western Pygmy-Possum and the Honey Possum are likely to mostly occur in areas with dense understories such as the granite shrublands of Habitats 4 and 7. The Mardo and the Water Rat are likely to be restricted to the stream zone habitat (Habitats 3 and 7). All the bats are likely to be non-habitat specific. Grey Kangaroos are common in the area and appear to inhabit all areas.

4.2.2.3 Reptiles and Amphibians

The site survey recorded 14 species of reptiles, and based on known distributions a further 22 species may occur. Most of these species are wide-ranging in the south-west of Western Australia. Table 4.3 presents the reptile species recorded from the site.

Most reptiles are only active seasonally and autumn surveys are likely to record few individuals and species. Nonetheless, the site survey, in conjunction with the literature search for species distribution and likely occurrence, is an accepted approach to identifying the reptile species for the site.

Table 4.1

Habitat Types Identified Over the Site

Habitat	Characteristics
1	Paddocks with exotic grasses and weeds.
2	Marri (*Eucalyptus calophylla*) regrowth after clearing on south facing slopes. This area has previously been sown with pastures and has practically no native understorey.
3	Creek zones with WA Blackbutt (*Eucalyptus patens*) and marri overstorey with dense understorey dominated by Swamp Peppermint (*Agonis linearifolia*) and sedges (*Lepidosperma tetraquetrum*).
4	Lithic complex with shrubs of variable density according to depth of skeletal soils and exposed granite.
5	Marri regrowth after clearing on north-facing slopes. This area differs from Habitat 2 in that it was not previously sown with exotic pastures.
6	Paddocks with scattered marri trees.
7	Adjacent forests. Predominantly Crown land, this area contains a habitat which is a composite of jarrah (*Eucalyptus marginata*) and marri forest, and includes lithic complex and creek zones.

Table 4.2

Mammal Species Recorded from the Site

Species	Common Name	Record Type
Tachyglossus aculeatus	Echidna	diggings (4)
Isoodon obesulus	Quenda	diggings (4)
Trichosurus velpecula	Brushtailed Possum	sighted (1)
Macropus fuliginosus	Western Grey Kangaroo	sighted (92)
Tadarida australis	White-striped Mastiff Bat	sighted (2)
Chalinolobus gouldii	Gould's Wattled Bat	sighted (5)
	Introduced	
Mus musculus	House mouse	scats (4)
Vulpes vulpes	Fox	scats (7)
Oryctolagus cuniculus	Rabbit	scats (5)

Note: Number in parenthesis following the recording mode is the number of recordings of each species, however some individuals may have been recorded on more than one occasion e.g. Grey Kangaroos.

Table 4.3

Reptile Species Recorded from the Site

Species	Common Name	Record Type
Diplodactylus polyopthalmus	Gecko	sighted (2)
Cryptoblephorus plagiocephalus	Skink lizard	sighted (6)
Ctenotus fallens	Skink lizard	sighted (1)
C. labillardieri	Skink lizard	sighted (2)
Egernia napoleonis	Skink lizard	sighted (6)
Hemiergis inialis	Skink lizard	sighted (12)
Leiolopisma trilineatum	Skink lizard	sighted (3)
Lerista distinguenda	Skink lizard	sighted (4)
Menetia greyi	Skink lizard	sighted (1)
Morethia obscura	Skink lizard	sighted (2)
Tiliqua rugosa	Skink lizard	sighted (1)
Unidentified monitor	Monitor	burrow (3)
Pseudonaja affininis	Front-fanged snake	sighted (1)
Rhinoplocephalus gouldii	Front-fanged snake	sighted (2)

Table 4.4

Amphibian Species Recorded from the Site

Species	Common Name	Record Type
Crinia georgiana	Ground frog	sighted (7)
Heleioporus binornatus	Ground frog	sighted (1)
Ranidella glauerti	Ground frog	sighted (50)
R. pseudinsignifera	Ground frog	sighted (50)
Litoria adelaidensis	Tree frog	sighted (1)

Note: Numbers in parenthesis following the recording mode is the number of recordings of each species.

The survey recorded five species of amphibians, and based on known distributions, five additional species may occur. All of these species are also wide-ranging in the south-west of Western Australia. Table 4.4 presents the species of amphibians recorded during the surveys of the site.

All of the frogs breed within the creek zones of Habitat 3 and some move in the non-breeding zone to adjacent habitats.

4.2.2.4 Birds

The site survey recorded 39 species of birds, and based on known distributions an additional 62 species may occur. Table 4.5 presents the bird species recorded from the site. All species are wide ranging in the south-west of Western Australia, however some are restricted to specific habitat types. Some species, such as the grebes and cormorants, do naturally occur in the vicinity and have only recently colonised the two dams present on the site.

Many bird species such as the Sacred Kingfisher, Rainbow Bee-eater, cuckoos, White-winged Triller and Rufous and Brown Songlarks are migratory and only visit the area seasonally. Others such as some of the honeyeaters, the Pardalotes, Black-faced Cuckoo-shrike, the cockatoos and some of the owls are seasonal and visit the area when particular food resources are available.

4.2.2.5 Aquatic Fauna

An intensive study of aquatic stream fauna was not undertaken, however two introduced species of fish were recorded in dams in the stream zone (Habitat 3). These were the Mosquito Fish (*Gambusia affinis*) and the Brown Trout (*Salmo trutta*). Based on known distributions, five native fish may also occur in the stream zone.

4.2.2.6 Rare and Restricted Fauna

The Quenda (*Isoodon obesulus*, or Southern Brown Bandicoot) has been recorded as common along the streams in State Forests adjacent to the site. Diggings were recorded in Habitats 3 and 5 along the site's streams. This small mammal is listed as a Schedule 1 species under the Wildlife Conservation Act (1950).

Table 4.5

Bird Species Recorded from the Site

Species	Common Name	Record Type
Ardea pacifica	Pacific Heron	sighted (3)
Tadorna tadornoides	Mountain Duck	sighted (2)
Anas superciliosa	Black Duck	sighted (4)
Chenonetta jubata	Wood Duck	sighted (2)
Elanus caeruleus	Black-shouldered Kite	sighted (3)
Phaps chalcoptera	Common Bronze-Wing	sighted (8)
Platycercus zonarius	Ring-necked Parrot	sighted (33)
P. spurius	Red-capped Parrot	sighted (12)
Calyptorhynchus latirostris	Carnaby's Cockatoo	sighted (10)
C. *magnificus*	Red-Tailed Black Cockatoo	sighted (6)
Cacomantis falbelliformis	Fan-tailed Cuckoo	sighted (2)
Ninox novaeseelandiae	Boobook Owl	sighted (2)
Podargus strigoides	Tawny Frogmouth	sighted (5)
Dacelo gigas	Laughing Kookaburra	sighted (5)
Hirundo nigricans	Tree Martin	sighted (34)
Anthus novaeseelandiae	Richard's Pipit	sighted (5)
Coracina novaehollandiae	Black-faced Cuckoo Shrike	sighted (2)
Petroica multicolor	Scarlet Robin	sighted (5)
Eopsaltria australis	Yellow Robin	sighted (2)
Pachycephola pectoralis	Golden Whistler	sighted (6)
Colluricincla harmonica	Grey Shrike-thrush	sighed (1)
Rhipidura fuliginosa	Grey Fan Tail	nests (6), sighted (4)
Gerygone fusca	Western Flyeater	sighted (2)
Acanthiza apicalis	Broad-tailed Thornbill	sighted (3)
A. inornata	Western Thornbill	sighted (4)
A. chrysorrhoa	Yellow-rumped Thornbill	nests (3), sighted 22
Sericornis frontalis	White-browed Shrubwren	sighted (6)
Malurus splendeno	Splendid Fairy-wren	sighted (10)
M. elegans	Red-winged Fairy-wren	sighted (1)
Daphoenositta chrysoptera	Australian Sittella	sighted (8)
Dicaeum hirundinaceum	Mistletoebird	sighted (1)
Pardalotus punctatus	Spotted Pardalote	sighted (1)
Zosterops lateralis	Grey-breasted White-eye	sighted (1)
Melithreptus lunatus	White-naped Honeyeater	sighted (3)
Phylidonyris novaehollandiae	New Holland Honeyeater	nests (1), sighted (1)
Acanthorhynchus superciliosus	Western Spinebill	sighted (7)
Artamus cyanopterus	Dusty Woodswallow	sighted (2)
Cracticus tibicen	Australian Magpie	sighted (19)
Corvus coronoides	Australian Raven	sighted (11)

Note: Numbers in parenthesis indicate number of individuals or nests recorded.

The Chuditch (*Dasyurus geoffroii*, or Western Quoll) may occur in the area based on it's known distribution. This is also a Schedule 1 species.

No amphibians or reptiles recorded or likely to occur in the area have been gazetted as rare or endangered.

One bird species listed in Schedule 2 of the Wildlife Conservation Act 1950, Carnaby's Cockatoo, was recorded in the study area in Habitat 6. This highly mobile species is found throughout the south-west wherever suitable food resources are available. It is likely to visit all habitats except the paddocks without trees.

The Red-Eared Firetail is also listed on Schedule 2 of the Act, and although not recorded during this survey, may occur in the stream zones (Habitat 3).

Two other species listed on Schedule 2, the Peregrine Falcon and Baudin's Cockatoo, although not recorded during the present study, may occur during their seasonal movements away from their breeding areas. The Peregrine Falcon breeds chiefly in steep rocky locations such as the Stirling Ranges, and moves north with the onset of winter. Baudin's Cockatoo breeds in the far south-west in karri (*Eucalyptus diversicolor*) trees and ranges widely in search of food.

4.3 Social Environment

The existing social environment is described below in terms of land zonings, land use, adjacent landholders and the number of residences in close proximity to the site. Aboriginal heritage is also briefly discussed.

4.3.1 Zonings

There are four MRS zonings in the immediate vicinity of the site. These are:

(i) Rural - includes the site and most land to the north-west, south-west and west, excluding (iii) and (iv) below;

(ii) State Forest - a vast tract of land to the east, north-east and south-east;

(iii) Public Purposes (Hospital) - a large parcel of land which lies mostly between the site and the highway;

(iv) Urban - the town-site of Mundijong on the western side of the railway.

The principal variations to these zonings under the Shire of Serpentine-Jarrahdale's Town Planning Scheme No. 2 are as follows:

- Whitby Falls Special Rural - located between the highway and Mundijong;
- Mundijong Suburban - a built-up area between Watkins Road and the Alcoa railway (south-east of Mundijong town-site);
- Medulla Road Special Rural - located on the southern side of Jarrahdale Road, in the Korrininjal Brook Valley;
- Special Use (Quarrying) - the existing Pioneer quarry site to the north of Lot 344.

4.3.2 Land Use

A variety of land uses occur in the vicinity of the site, in accordance with the range of activities allowed under the different zonings.

The State forest to the east supports multiple uses, of which recreation and timber production are the priority purposes as designated by CALM, the relevant management authority. An area of the forest to the immediate east of the site is leased to the Scout Association; the Manjedal Scout Camp caters for organised youth and adult groups. The forest is also used for other recreational pursuits (bushwalking, horseriding etc.) by residents in the vicinity and visitors to the area. Alcoa also conducts bauxite mining in the locality and some horticultural activity occurs on freehold land along the headwaters of Manjedal Brook.

The land zoned Rural and Public Purposes between the scarp and South Western Highway has, for the most part, been cleared or semi-cleared for pastoral purposes. A notable

exception is an approximate 40 hectare parcel of land on the northern side of Whitby Falls which has not been disturbed to any significant degree.

Other land uses which occur on this strip of land include the Agridome tourist complex (currently not utilised) and the Whitby Falls Hostel (rehabilitation centre for the Health Department's Mental Health Unit).

On the western side of the highway, the land has also been predominantly affected by pastoral activity. Notable uses also include the Whitby Falls Coach House Centre (historical buildings, arts and crafts, restaurant, railway coach accommodation etc.) and a Special Rural subdivision (comprising approximately 45 allotments, of which about two-thirds have established residences).

Directly north of the site is a large parcel of land that is fully vegetated. A small portion of this land is under the control of the Health Department, whilst the balance is owned by Pioneer Concrete (WA) Pty Ltd and is scheduled for future hard rock quarrying.

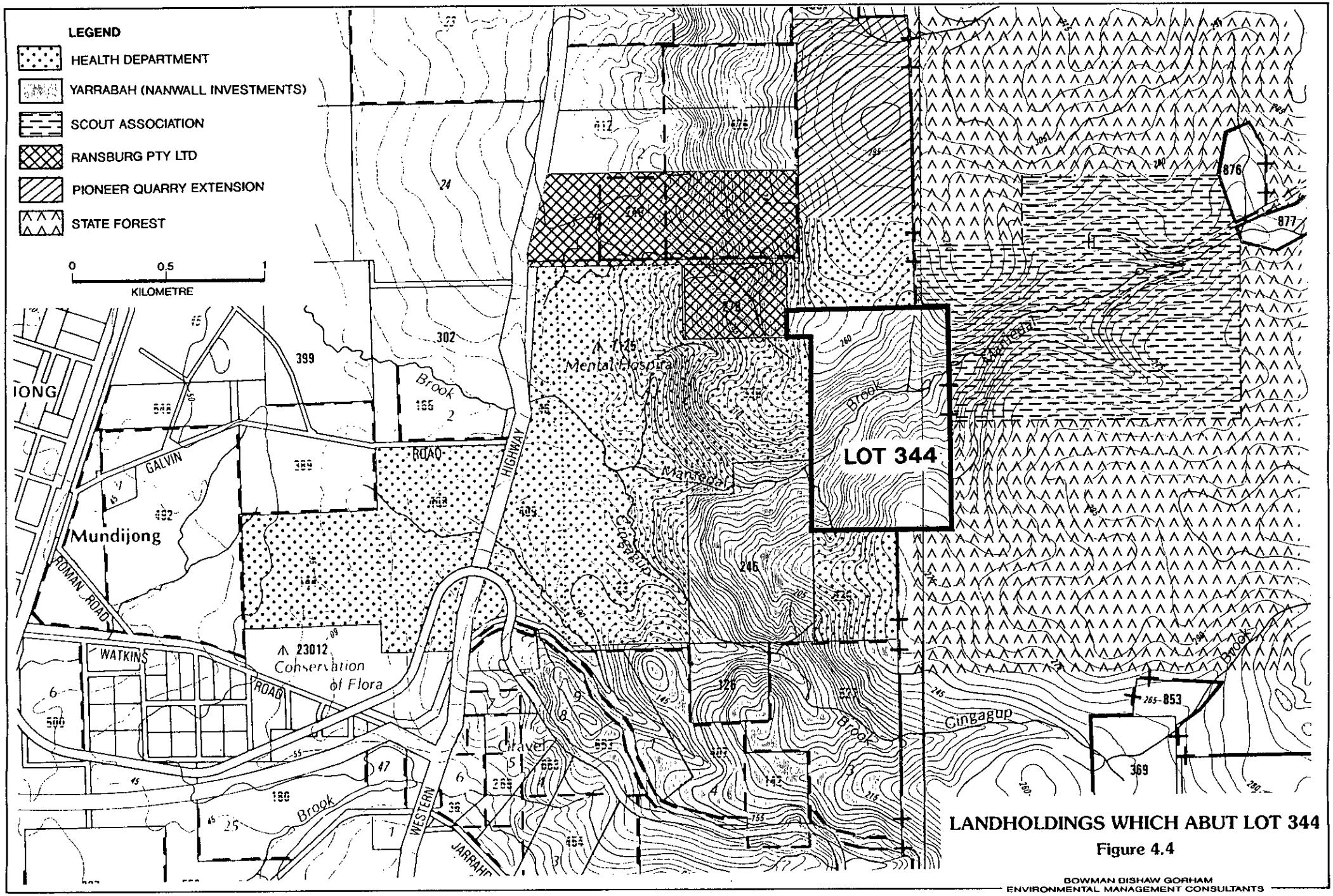
4.3.3 Nearest Neighbours

The nearest "neighbours" to the proposed quarry operation are characterised below in terms of:

- the tenure and ownership of the landholdings which have common boundaries with Lot 344;
- the principal buildings of human use (residential and day-use only) within a nominal 2 kilometre radius of the site;
- the residential areas at more distant locations within the primary aesthetic viewshed of the site, i.e. west of the site on the coastal plain.

The landholdings which abut Lot 344 are highlighted on Figure 4.4. There are five 'stakeholders' involved; listed below along with the respective land tenure.

- Ransburg Pty Ltd - freehold.



LANDHOLDINGS WHICH ABUT LOT 344

Figure 4.4

BOWMAN BISHAW GORHAM
ENVIRONMENTAL MANAGEMENT CONSULTANTS

- Health Department - Crown land.
- Nanwall Investments Pty Ltd - freehold.
- CALM - Crown land (State forest No. 22).
- Scout Association - leasehold of State forest.

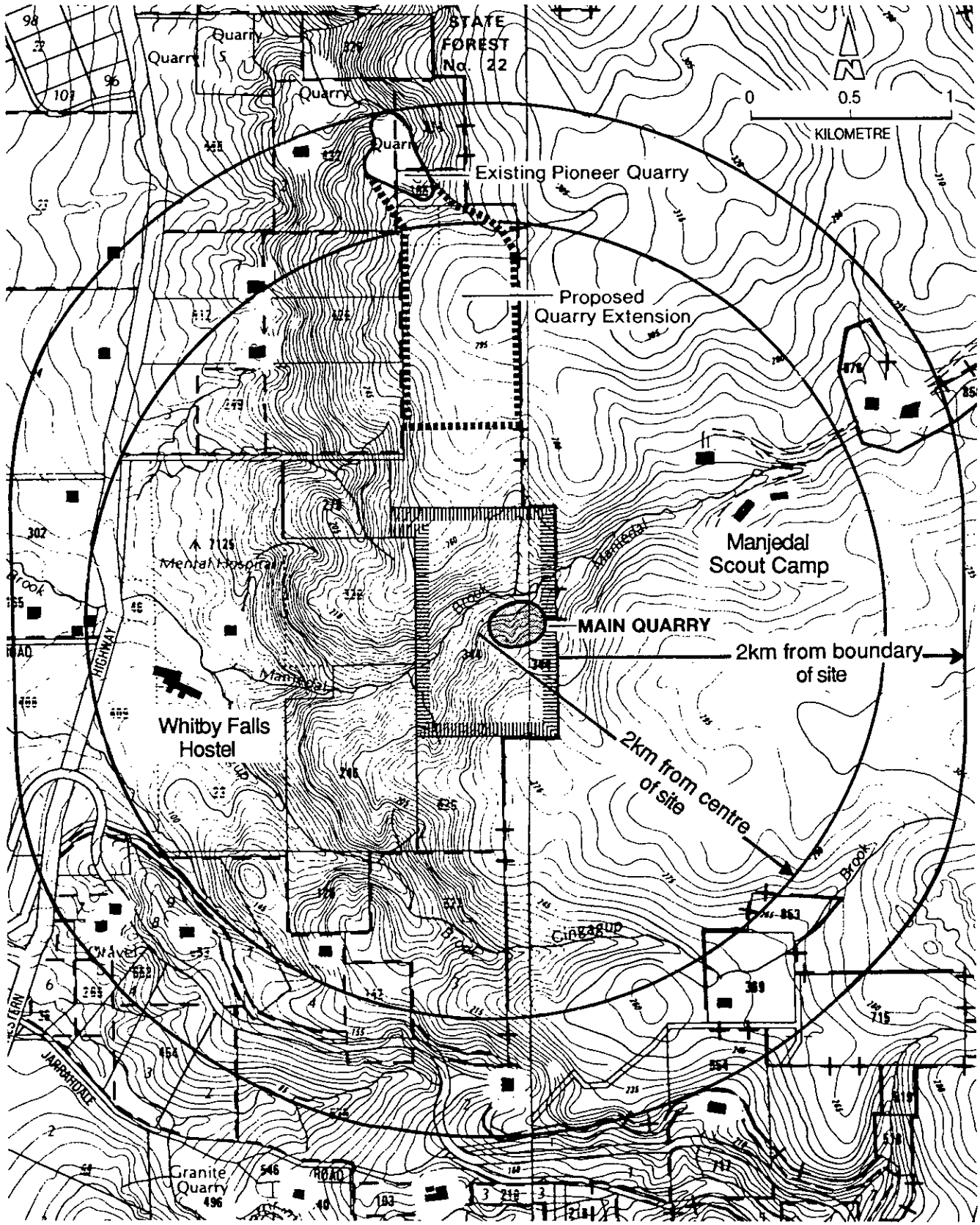
Figure 4.4 shows that these 5 stakeholders (one of which is the proponent) have jurisdiction over a substantial area of land surrounding the site.

All residences within a nominal 2 kilometre radius of the site are identified on Figure 4.5. The 2 kilometre zone was selected to ensure consistency with the 1992 Basic Raw Materials Policy, in which existing hard rock quarries have been allocated a similar **nominal** buffer zone.

Most residences are in excess of 1.4 kilometres from the site, with two notable exceptions; Manjedal Scout Camp accommodation centres and the Whitby Falls Hostel.

4.3.4 Aboriginal Heritage Sites

The Department of Aboriginal Sites at the Western Australian Museum has previously advised that no Aboriginal sites have been recorded on the site or in the vicinity of the site. However, should any sites be discovered during the operation of the quarry, the Department will be notified immediately.



NEAREST "RESIDENCES"

Figure 4.5

■ RESIDENCE

5.0 PROJECT DESCRIPTION

A broad description of the proposed quarry operation is provided below. At this stage, it should be recognised that detailed planning and design has not been conducted, pending the outcome of current initiatives to re-confirm previous approvals. Specific details of the proposed operations are included as part of the management strategies in Section 6.0, to enable correlation with the assessment of potential environmental impacts.

5.1 Overview

5.1.1 Project Components

The aim of the project is to supply crushed hard rock for the expanding urban area, in which it has been estimated that the demand per new dwelling is 190 tonnes of hard rock for the dwelling and associated infrastructure. Hard rock is mainly used for:

- concrete aggregate
- asphalt aggregate
- road basecourse material
- lump rock in harbours, breakwaters and water storages
- drainage filters, railway line ballast.

There are also recoverable quantities of gravels in the north-west sector of the site, which may be sold as road basecourse material in the immediate locality. Alternatively, the gravels may be used to rehabilitate hard rock quarry benches.

All of the quarrying and processing activity will be confined to Lot 344. The adjoining properties owned by the proponent will only be utilised for access to the site from South Western Highway. Lot 344 comprises approximately 81 hectares, whilst the other two landholdings have an area of about 86 hectares. This represents a substantial and secure buffer area in the sector to the north west of the site.

The principal site components of the proposed operation may be summarised as follows:-

- an active quarry zone
- internal access and haul roads
- crushing and screening plant
- stockpile areas for product
- water storage basins and settlement sumps
- office, amenities and weighbridge
- fuel storage and workshop
- rehabilitation and landscaping areas.

5.1.2 Conceptual Development Plan

The proposed layout of the quarry operation will be generally as shown on Figure 5.1 for the initial development period of say 10-15 years.

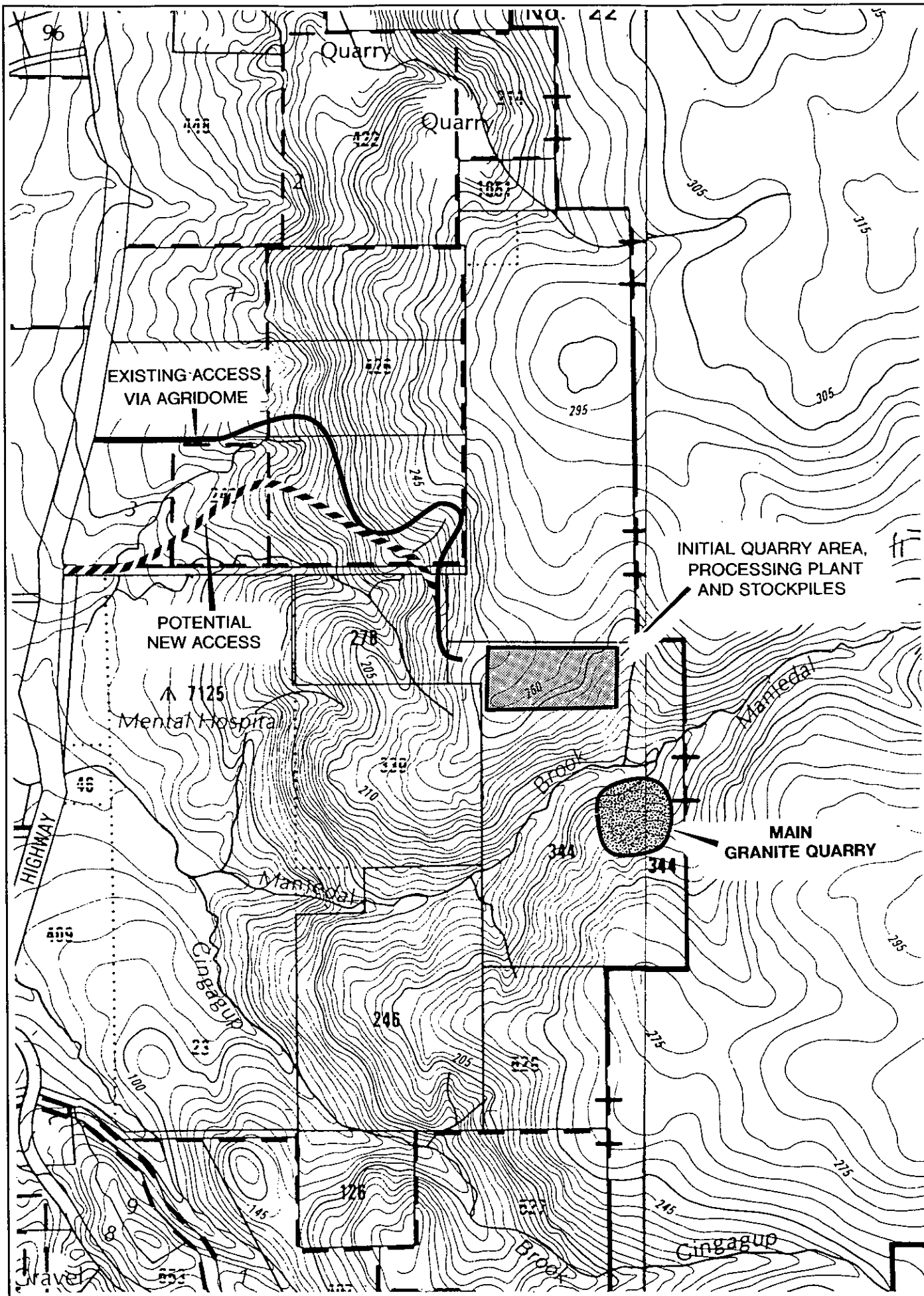
Basically, all of the ancillary quarry infrastructure will be located on the area of cleared land to be levelled in the north-western sector of the site. The main granite quarry will be established in the southern sector of the site, but confined to the eastern side of the property for many years. Manjedal Brook will not be disturbed by quarrying, other than a single access route with appropriate culverts to allow unrestricted natural flow.

The existing dam in the north-eastern corner of the site will be retained under an agreement with the present Agridome owners as it is utilised for water supply. It is evident from the construction of the dam and the watercourse below the dam, that there are deposits of white kaolin clay in this sector of the property. At present, there are no plans to excavate any of this material.

5.2 Site Preparation and Implementation

5.2.1 Access

Access will be obtained via the company's landholdings which are between Lot 344 and South Western Highway. At present, there is an access track which 'climbs' the scarp from the Agridome complex (the approximate route is shown on Figure 5.1). This track



QUARRY CONCEPT AND ACCESS

Figure 5.1

would need to be substantially upgraded to enable heavy transport utilisation, however there are sections of the alignment which would still not be suitable as a haul road.

A new access will be constructed which will be cognisant of the following factors:

- A potential requirement to gain access to the highway via the existing Road Reserve aligned along the southern boundary of Lot 412 (to be confirmed with the Main Roads Department and the Shire of Serpentine/Jarrahdale);
- The need to minimise road gradients and 'tight' corners for safety purposes;
- To maximise the use of existing remnant trees for screening purposes and to utilise these remnants as the basis for additional landscaping for visual screening;
- Provision of an adequate road drainage network to prevent erosion and disruption to natural drainage patterns (particularly at watercourse crossings);
- Provision of sealed pavement may be required along most of the access route because of the gradients involved and the heavy vehicle usage.

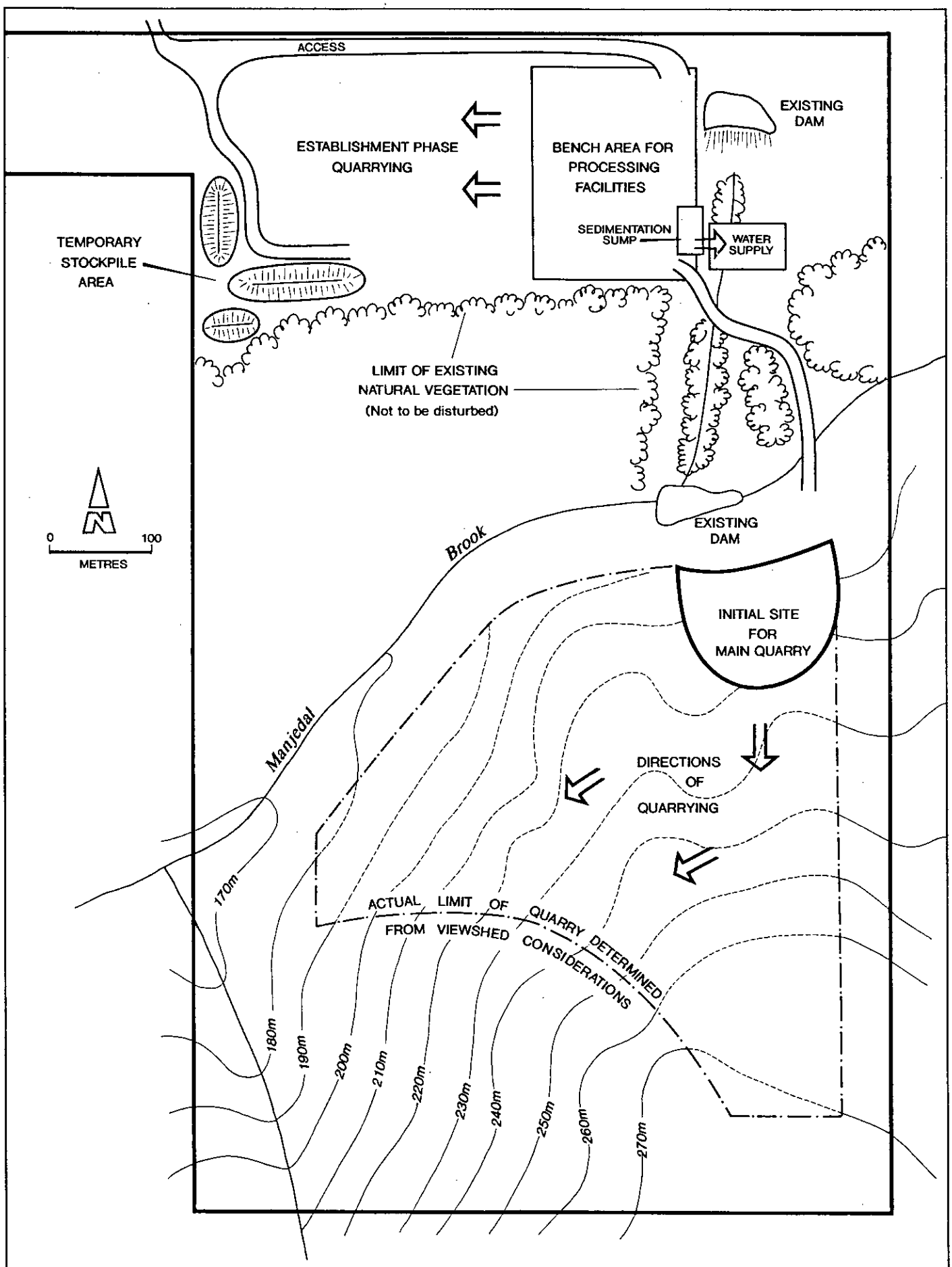
It is obvious from the contours shown on Figure 5.1 that the existing Road Reserve would not be suitable as an access road to the top of the scarp. A potential route for the new access is also indicated on the Figure.

However, a more detailed alignment survey would need to be conducted on-site to enable selection of an optimum route; based on consideration of all of the factors listed above.

5.2.2 Site Preparation

To prepare the site for quarrying, it will be necessary to establish the stockpile and processing area, which is to be located at the northern end of the site. **This will not involve clearing of native vegetation; all facilities and operations in this area will be confined to land previously cleared for pasture.**

A schematic layout of the initial site development is provided on Figure 5.2 at a scale of 1:5000. This layout reflects the following sequence of development:



SCHEMATIC LAYOUT QUARRY OPERATION

Figure 5.2

(i) Topsoil and Overburden Removal

Removal of surface materials will commence at the eastern end of the development area and proceed in a westerly direction. Topsoil, nominally defined as the first 150 millimetres of material, will be skimmed and stockpiled separately. Overburden will then be removed to the level of the initial bench required for establishment of the main processing area.

The overburden in this location is expected to comprise a variety of material, including lateritic gravels, clay, granitic boulders and friable, weathered granite. These materials will be separately stockpiled in the area indicated on Figure 5.2, until utilised in subsequent rehabilitation works or transported from the site as product.

(ii) Processing Facilities

At present, the design level for the processing 'bench' has not been selected, as this may require some exploratory drilling to determine the overburden thickness etc for planning purposes. The crushing and screening plant and associated facilities could likely be accommodated in an area of approximate dimensions 200 x 150 metres. This area is shown on Figure 5.2.

All of the processing facilities will be located in this area (e.g. ramp and feeder, crushing and screening plant, mobile conveyor and product stockpiles, maintenance workshop, ablutions, turning area for loaders, dump trucks and haulage trucks).

It is envisaged that a new water supply dam may be constructed adjacent to the processing site, in the small watercourse that is already dammed at the northern end of the property.

(iii) Internal Access

The main access will be aligned adjacent to the northern boundary fence.

Two other internal access tracks will be required:

- a road to the temporary stockpile areas (in the north-west sector);

- a road to the main granite quarry in the southern sector of the property.

These roads will be about 10 metres in width and will be completed to a standard to enable optimum control of dust and water erosion. The crossing at Manjedal Brook will be designed for a 1-in-5 year storm event and will be protected from potential flood damage.

5.2.3 Quarry Development

Development of the quarry will comprise two distinct phases of activity on Lot 344, as indicated on Figure 5.2.

The initial "establishment" phase will occur at the northern end of the site and it may take a number of years before the crushing plant is fully operational. In addition, it may be up to 10 years before development at this end of the site reaches the point where the second phase of quarrying in the southern sector would be implemented.

High quality granite occurs in the southern sector of the site and there is a very favourable overburden ratio, as evidenced by the frequent outcrops of granite 'domes'. Expansion of operations into the main quarry area would involve the following sequential activities:

- Clearing of vegetation and pushing into windrows for subsequent burning (all saleable or useable timber will be offered to third parties for fence posts, firewood etc).

- Stripping of topsoil and overburden (where present) for temporary stockpiling prior to use in the rehabilitation program.

- Establishing a series of benches on the east, south and west faces of the quarry as the granite profile is removed to the design floor level of the particular cell that is being excavated.

The method of excavation is to drill a pattern of blast holes at a spacing which is designed to rupture the massive granite into 'lumps' which can be processed by the primary crusher. The lumps are loaded at the base of the exposed face with front-end loaders and

transported via large dump trucks along the benches and haul road to the crushing and screening plant.

The quarry would be enlarged by steadily moving in a southerly direction and then excavating to the west. A fundamental objective of the excavation plan is to complete the eastern face of the quarry as early as possible to enable instigation of the rehabilitation program.

Early rehabilitation of the upper benches of the eastern face is a vital ingredient to the successful management of aesthetic effects, as outlined in Sections 6.1 and 6.9.

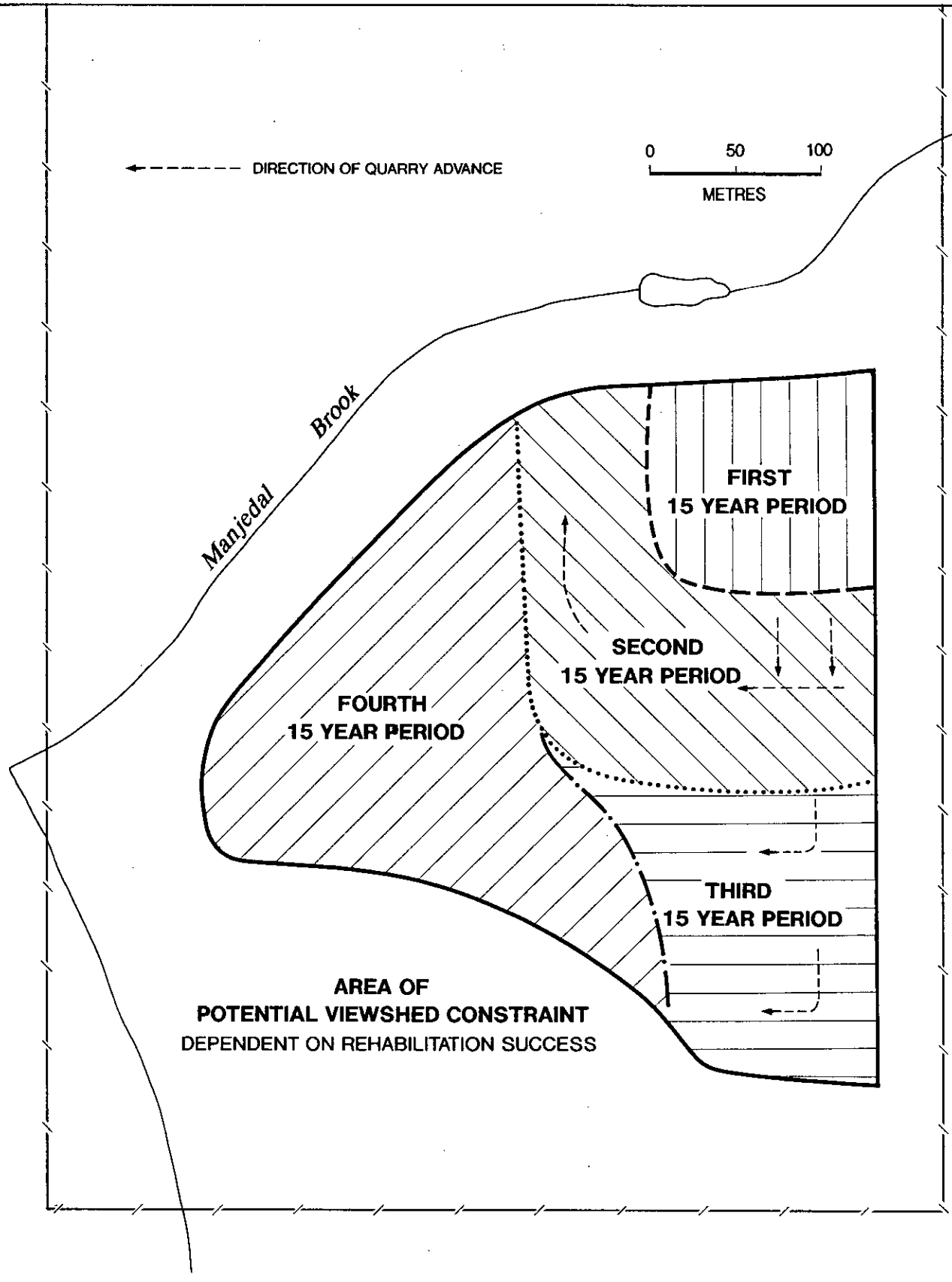
5.3 Staging and Lifetime

The various stages of the quarry operation and the overall lifetime of the project are somewhat speculative due to the uncertainty in determining, amongst other things, the annual production rate. For the purposes of this document, it will be assumed that Ransburg Pty Ltd attains 10% of the hard rock market within about 5-10 years. Given a total hard rock demand which fluctuates between 2 million and 3 million tonnes per annum, the target annual output is about 250,000 tonnes.

The reserves of hard rock have previously been estimated at about 25 million tonnes for the southern sector of the site. However, landscape management requirements will likely preclude the removal of all of the reserves, in particular the extreme southern and south-western sectors of the site.

Consideration of the landscape issue (Section 6.1) suggests that at least 12-15 million tonnes could be extracted without constraint. Therefore, the lifetime of the quarry would be expected to be about 60 years if the above parameters remain relatively constant.

A probable staging plan on the basis of 15 year periods is shown on Figure 5.3.



PROBABLE STAGING PLAN – MAIN QUARRY

Figure 5.3

6.0 POTENTIAL ENVIRONMENTAL IMPACTS AND IMPACT MANAGEMENT STRATEGIES

The principal environmental and social issues and potential impacts associated with the project are described in the sections which follow, together with the proponent's strategies for the acceptable operation and management of the proposed hard rock quarry.

6.1 Landscape and Visual Amenity

6.1.1 Potential Impacts

It is recognised that the Darling Scarp is a visual resource which has regional significance. The Scarp represents an important landscape backdrop to the Perth region.

Large areas of the Darling Scarp landscape have been modified through human land uses, such as clearing of vegetation for grazing and orcharding, construction of roads, buildings and transmission lines, and quarrying. The effects of these changes to the natural landscape will impact upon people in different ways, due to their different social and cultural backgrounds which give rise to their perceptions of visual quality.

The position adopted for assessment of this project is that the quarry operation should not be visually intrusive in the Darling Scarp landscape. Furthermore, comprehensive screening and rehabilitation is recognised as a prerequisite for quarry planning in visually sensitive areas. This position is considered to be particularly relevant in the context of the local population, because there is no doubt that the reasons for people settling in the area would include the landscape value of the Scarp and its value as a recreational resource. However, it also needs to be recognised that freehold land along the Darling Scarp is not available to the general public for recreational purposes.

The areas of the site where quarry operations have the potential to be visually intrusive are indicated by way of viewshed analyses presented in Appendix D.

6.1.2 Management

(i) Regional

Given the significance of the Scarp's amenity values, it is relevant to consider the existing regional management regime for this landform, prior to listing Ransburg Pty Ltd's specific management proposals for the site.

The Darling Range Regional Park Study is presently nearing completion and has the broad objective of protecting the intrinsic values of the Scarp. Whilst this is a regional planning initiative, the proposed boundaries of the Park will essentially be confined to land that is currently reserved for parks and recreation under the Metropolitan Region Scheme and the recommended areas from the System 6 report. Freehold land will not be included in the proposed Park, although the State Government occasionally purchases land to add to the inventory of Crown land along the Scarp.

There has been a suggestion that a specific "landscape protection" zoning should be declared under the Metropolitan Region Scheme to enable broad controls on private land uses within visual resource areas. This management initiative may not eventuate for several years, and would be subject to broad community consultation to canvas the degree of support for an additional 'control' on existing land uses on freehold land.

The Shire of Serpentine-Jarrahdale has a Landscape Protection Policy for the Darling Scarp and environs, which is mainly directed at residential developments. Legally binding conditions may be set on proposals subject to environmental impact assessment through the EPA process.

(ii) Site-Specific

Management of potential visual intrusion is a primary objective of Ransburg's development strategy for the site. This will be achieved by careful design of the project, in particular:

- the location of quarry operations;
- the staging of development, and
- adherence to a sequential rehabilitation program.

Consideration of the topographic characteristics of the site and environs, and the two areas that will be disturbed by quarrying activity (refer to Figure 5.2), indicates that only the quarry activity at the southern end of the site has the potential to be visually intrusive to locations west of the site. The viewshed analysis included in Appendix D should be referred to in support of the comments below.

The northern quarry area will not be visible from nearby rural-residential locations or South Western Highway. This is because the area will be developed as a 'bench' that is lower than the surrounding terrain, therefore views into the disturbed area would only be possible by standing at the site's boundary. In addition, the existing trees on the western and southern sides of the proposed 'bench' will provide effective screening of the temporary stockpiles which will be located adjacent to the trees (see Figure 5.2).

The quarry area in the southern sector of the site has the potential to be visually intrusive in the later stages of development. To overcome this potential visual intrusion, the quarry plan will be carefully staged to minimise 'exposure' of the quarry to views from the west, until the exposed faces have been rehabilitated so that they present a similar visual back-drop to adjoining undisturbed land. This will be achieved by quarrying on the eastern side of the property and rehabilitating the upper benches before they become exposed when the quarry moves in a westerly direction.

6.2 Noise and Vibration

Potential noise impacts may occur from two main sources. Those associated with quarry operations (blasting, crushing, equipment noise) and noise produced through the transport of materials from the site. The following section describes the likely sources of noise and vibration from the operation of the quarry, potential impacts, noise level compliance criteria, and details management strategies to ensure compliance with these criteria.

It should be noted at this point however, that the proponent will be required to meet the conditions specified in the Works Approval which will be issued by the EPA in respect to noise (and ground vibration) levels associated with the proposal.

6.2.1 Blasting

It is anticipated that blasting may occur at a frequency of up to 2 times per week, on an "as-needed" basis subject to current bench characteristics and material demand. All blasts conducted in the quarry will have millisecond delays to produce sequential shots. While this slightly extends the duration of the blast, the airblast pressure is reduced, thereby reducing noise intensity and travel.

Blasting will most commonly take place in the afternoon when any temperature inversions have dissipated (temperature inversions have the potential to reduce the effects of "noise attenuation with distance from source" due to atmospheric reflection within stable air layers). No blasting will be carried out on weekends or public holidays.

6.2.2 Equipment Noise

Day-to-day noise produced by quarry equipment will predominantly be from loaders and haul trucks and the crushing/screening plant.

Noise levels produced by the quarry will need to conform to limits specified under Category B1 of the Assigned Outdoor Neighbourhood Noise Levels for adjacent land, and within the limit of 90dB(A) set by the Occupational Health, Safety and Welfare Regulations (1988) for site workers. Table 6.1 below shows the Category B1 standards for operational noise.

Table 6.1

Assigned Outdoor Neighbourhood Noise Levels (dB(A))

Category B1: Residential, Educational, Hospital or the like. Other residences with schools, hospitals or the like, or with medium density transportation.

Day	Time	Noise Level
Monday-Saturday	0700-1900hrs	50 dB(A)
Monday-Saturday	1900-2200hrs	45 dB(A)
Sundays & Public Holidays	0700-2200hrs	45 dB(A)
Always	2200-0700hrs	40 dB(A)

The above noise level criteria apply when measured at adjacent premises not occupied by the proponent, and used for residential purposes or other noise sensitive activity e.g. Whitby Falls Hostel.

6.2.3 Transportation Noise

The transport of processed material from Lot 344 will occur via an access road which does not pass any residential premises. Access will be to South Western Highway, a major arterial route. Given that the Main Roads Department (pers. comm., 1992) measured an annual average daily traffic flow of 5,500 vehicles at the Mundijong overpass in 1990/91, the small increase in traffic is not expected to significantly increase noise associated with the highway.

6.2.4 Potential Impacts

The distance to which noise may cause undue disturbance is dependent upon the distance from the source (quarry) to the recipient (e.g. residence), weather conditions prevailing at the time, the degree of tolerance of people affected and whether they are indoors or outdoors etc. Additionally, in this case there may also be a cumulative impact as a result of the existing Pioneer hard rock quarry which operates approximately 1.5km north of Lot 344, and is proposed to extend in a southerly direction.

Potential noise impact within the "zone of overlap" between the two quarries would be limited to operational noise, as the infrequency of blasting and the use of separate routes for product transport would assist management of cumulative noise impacts from these aspects.

For the purpose of impact assessment, and in accordance with the Basic Raw Materials Policy (DPUD, 1992), it may be assumed that noise within 2km of the site will be the most significant. This creates an overlap in the zone of noise influence for quarrying in the area, however land use within this overlap is predominantly stock grazing or State Forest. Indeed, the area of overlap which is not State Forest is owned predominantly by the proponent. Neither the Manjedal Scout Camp, the Whitby Falls Hostel, nor any residences fall within the zone of potential noise overlap.

Within the broader zone of influence defined by a nominal 2km zone from the proposed main quarry area, the following principal premises may be affected:-

1. Whitby Falls Hostel - located approximately 1.6km west of the property. Its location near to the 'mouth' of the Manjedal Brook Valley means that the hostel is not protected by topographic features which would offer a natural noise buffer. The hostel may therefore potentially receive higher noise levels in comparison to other premises within the 2km zone of influence. However, utilising modern quarry operation techniques and equipment, in conjunction with the proposed management strategies, it is anticipated that noise levels will be maintained at acceptable levels.

2. Manjedal Scout Camp - located approximately 1.3km north-east of the quarry. This recreation facility is separated from the proposed quarry by significant topographical and vegetative barriers, and additionally is mainly tenanted by transient occupants. The changing occupancy, together with natural sound attenuation barriers, should ensure acceptable noise levels at the camp.

3. Residence, Lot 9 Pruden Road - located approximately 2.2km south-west of the main quarry and partially screened by a valley 'spur', indicating that noise disturbance should not be an issue.

4. Whitby Falls Coach House Centre, South Western Highway - located approximately 2km west of the quarry. These premises are on the boundary of the potential zone of influence and on the western side of South Western Highway. These factors, together with the fact that traffic noise (5,500 vehicles per day) past the premises would be considerably louder than the operational noise from the quarry 2km distant, will ensure that the impact associated with quarry development would be essentially imperceptible (with the possible exception of infrequent blasting).

6.2.5 Management

Noise levels associated with the operation of the quarry will be minimised by the following factors and management techniques.

- The location of the quarry within a valley landscape will tend to reduce the lateral propagation of blasting and operational noise other than along the valley.
- All blasts conducted at the quarry will have millisecond delays between individual charges to produce sequential firing.
- Blasting will only be conducted during weekday afternoons.
- Monitoring of both airblast noise and ground vibration will be conducted, in accordance with the monitoring protocols to be determined in consultation with the EPA (via the Works Approval and Licensing avenues).
- Liaison will be maintained with Pioneer Concrete with respect to blasting plans, to avoid the unlikely event of simultaneous blasting.
- Whitby Falls Hostel will be provided with a schedule of blasting prior to commencement of quarrying and liaison maintained regarding the effects of blasting.
- Noise suppression devices will be maintained in good condition on all operational machinery.

- Workers will be issued with noise protection equipment and instructed as to noise reduction techniques in the workplace.

- Any complaints received regarding noise disturbance will be recorded and follow-up action instigated to minimise the cause of future, similar disturbance, to the greatest practicable extent.

6.3 Dust

Dust may potentially be generated at all stages of quarry operation, from blasting to transport. The highest potential for dust generation occurs over the summer period, when the moisture content of surface materials is low.

Dust may be generated during blasting, handling, crushing and screening, drilling, from stockpiles and while removing topsoil and overburden and during final product transportation. The following sections detail potential impacts associated with dust generation and management strategy options to reduce dust to within acceptable levels.

6.3.1 Potential Impacts

Excessive dust generation may have a detrimental impact on both the surrounding environment and workers within the quarry site. (Fine silica dust has the potential to cause lung disease e.g. silicosis, if workers breath air with unacceptably high levels of dust).

It should be noted that dust accumulation on surrounding vegetation is a seasonal rather than cumulative impact, as rain removes the dust layer.

Dust emissions could cause inconvenience to adjoining landholders if not adequately controlled, particularly during the strong morning easterlies characteristic of summer.

6.3.2 Management

The following management strategies will be utilised to prevent or minimise dust generation from the quarry operation.

- All reasonable and practicable measures will be taken to minimise dust emissions from the plant and associated equipment.

- Where possible, blasting will be conducted on days with westerly winds prevailing (winds from the westerly quadrant occur during 60% of the year) so that any dust produced will be carried to unpopulated areas. There will be a preference for small blasts to ensure minimal areal impact on foliage.

- Dust suppression water sprays will be incorporated into the crushing and screening plant. Conveyors will be sprayed or enclosed as necessary.

- In the event that wind-borne dust becomes a problem non-working faces of stockpiles will be sprayed with water from portable sprinklers and/or provided with a protective coating (e.g. hydro-mulch).

- All traffic areas will be sealed or treated and maintained in a manner which prevents or minimises generation of dust.

- The concentration of air borne dust from the premises shall not exceed those criteria stipulated in the EPA Works Approval, which shall be gauged by appropriate air sampling at critical times.

6.4 Water Quality and Quantity

The proponent considers the maintenance of the ecological integrity of Manjedal Brook to be of the utmost importance. The predominant concern is the control of water quality; more specifically the avoidance of siltation and turbidity generation within the brook, and contamination from wastes and fuel spillages etc.

6.4.1 Potential Impacts

Failure to control stormwater in the operational quarry site can generate the following impacts:

- erosion of exposed soil surfaces;
- stream pollution due to turbidity and/or hydrocarbons in surface water discharges;
- boggy areas within the site which impede safe work practices.

6.4.2 Management

The main management strategy employed to ensure the protection of Manjedal Brook will be the use of settling ponds to provide sufficient retention times to allow the settling of suspended solids before discharge, or to allow recycling for dust suppression. Retention basins will be designed by, and construction supervision by, a qualified engineer. Hydrological principles will be applied to calculate anticipated peak flows so that the structures can be sized to accommodate runoff volumes in accordance with Department of Mines (1991) guidelines.

The following management strategies will ensure that water pollution of Manjedal Brook is avoided:

- The summer throughflow in Manjedal Brook will not be altered by the proposed quarry operation (water for dust suppression etc. will be obtained from water storages constructed to trap winter runoff generated on site or within the minor tributaries to Manjedal Brook).
- The premises shall be drained such that all potentially contaminated water is retained on-site.
- Water run-off from the crushing area and mine development shall be contained within the vicinity of the working areas for sufficient time to allow settlement of suspended matter.

- A continuing program of rehabilitation of worked out areas will be instigated to stabilise slopes and minimise turbid run-off (see Section 6.9).

- The effectiveness of drainage structures (dams, drains) will be regularly checked and maintained.

- Silt removed from basins will be incorporated into the rehabilitation program as fill below topsoil.

- Where possible, all water used in the quarry will be recycled through the settling basins for re-use.

- Waste and fuel management will be handled in accordance with Sections 6.5 and 6.11 of this document respectively.

6.5 Waste Disposal

6.5.1 Potential Impacts

Solid and liquid wastes produced during quarry operations would be minimal, however the environment will be protected by the following management strategy.

6.5.2 Management

- No chemicals or liquids will be disposed of on-site. Oils and other lubricants from vehicle servicing will be disposed of in an approved manner (off-site) or recycled.

- Materials suitable for recycling, such as scrap steel, will be recycled.

- All other wastes will be taken weekly to an approved waste disposal site.

- A septic tank - leach drain system will be constructed and maintained on-site, with at least 100m horizontal separation from the nearest watercourse.

6.6 Flora

6.6.1 Potential Impacts

Approximately 20% of the site has previously been cleared for grazing activities at the northern end. Within this area it is proposed to construct a bench to locate the processing facilities, a temporary stockpile area, and water supply (to supplement existing dam if required). Therefore, there will be no requirements for the clearing of native vegetation in this area.

Approximately 10 years following project commencement, mining activity will transfer to the area south of Manjedal Creek (see Figures 5.2 and 5.3). The area will be sequentially cleared of vegetation, followed by progressive rehabilitation of quarry benches. The watercourse vegetation will not be affected as it will be protected within a buffer zone that is permanently excluded from quarrying activity.

No rare or endangered flora has been recorded from the site.

6.6.2 Management

The vegetation over the proposed quarry site has previously been described as belonging to the Dwellingup Complex and Myara Sub-Complex (Section 4.2.1). The representation of these vegetation complexes in reserves has recently been documented in CALM's Management Strategies for the South-West Forests of Western Australia (1992). From a regional perspective, the Dwellingup (M/H) Complex is classified as being "ample" (second highest category) in it's representation, with 14% in reserves. The Myara Sub-Complex is classified as having "minimal representation", with approximately 1.5% in reserves (second lowest category).

However, the limitation to the above approach is that determining representativeness using land units is derived mainly from the inherent assumption of vegetative homogeneity between similar mapped units throughout the region. Therefore, it is reasonable, and more practical, to compare the representation of complexes at a local level, where ground-truthing negates the limitation associated with broad regional analysis.

Both the Dwellingup Complex and Myara Sub-Complex are well represented in State Forest No. 22, adjacent to the site (Figure 4.3). The vested purpose of this forest is for water supply, recreation, sustainable timber production and for wildlife conservation.

CALM (1992) has emphasised the ecological significance and importance of riparian ecosystems and corridors in forest management and conservation, which in this case corresponds to the Myara Sub Complex parallel to Manjedal Brook. Indeed, the report has recommended that "All streams, permanent and ephemeral, including valley headwaters and seepage areas, be protected by riparian zones throughout all State forest and timber reserves in South Western Australia, and that timber harvesting be excluded from all riparian zones".

CALM's recommendation for the total width of riparian zones for streams varies from 60 to 400m, depending upon ecological boundaries. The integrity of the Myara land unit and vegetation represented in the State forest immediately adjacent to the site is, therefore, secure.

It should be noted that this proposal does not intend to mine or alter the riparian vegetation of Manjedal Brook, with the exception of an access point to the southern hard rock reserves on the site.

In addition to the above, the proponent proposes to implement the following management strategies:

- Clearing will be limited to the minimum necessary for safe and economic operation of the mine.

- No riparian vegetation will be cleared, with the exception of an access route to the hard rock resources south of Manjedal Brook.

- Indigenous species will be used during rehabilitation, with the exception of those particularly susceptible to Jarrah Dieback.

- Where possible, topsoil will be respread as soon as possible to maximise the chance of native seed germination and growth.

- Rehabilitation will be carried out progressively during the life of the quarry, subject to operational requirements.

- Weed species within rehabilitation areas will be controlled.

6.7 Fauna

The fauna survey of the proposed quarry site was undertaken by specialist consultants Dell and Turpin (1992). Their full report is available at the EPA library or on request.

The fauna report identifies the riparian zone (Habitat 3) as the most significant habitat on the site.

6.7.1 Potential Impacts

The vegetation over the site, and therefore much of the fauna habitat, has previously been modified through logging and clearing for grazing use, and cannot therefore be considered to be in pristine condition.

It is proposed to develop the quarry in stages, with clearing of vegetation only occurring in the southern sector of the site, and only after approximately 10 years. Consequently, mobile fauna will be displaced, gradually moving into similar adjacent habitat as the mine plan is steadily implemented. Much of the similar adjacent habitat is located in State Forest east of the site.

It is anticipated that in the long term, rehabilitated areas will provide suitable habitat for recolonisation, and that much of the fauna will return to the site as they have done following the cessation of logging and the regrowth of vegetation.

In terms of rare and restricted fauna, the species listed as potentially occurring (Section 4.2.2.6) would tend to preferentially utilise the stream zone. This includes the Schedule 2 Red-eared Firetail, which may occur on the site. The stream zone will not be mined or disturbed, except for a small access road to the hard rock reserves south of Manjedal Brook. Any fauna in other habitats where mining will occur will have ample opportunity to relocate, as the area of the site which will be mined will be cleared in consecutive sections.

Birds which may utilise the site, including Carnaby's Cockatoo and Baudins' Black Cockatoo, are not dependent on the habitat of the site, and are unlikely to be affected by the proposal.

6.7.2 Management

Whilst the destruction of some habitat areas is unavoidable due to the nature of the proposed activity, the following strategies are proposed to minimise impact on fauna:

- No clearing of the riparian zone adjacent to Manjedal Brook or other habitat areas which will not be mined.
- Staged clearing of the southern sector of the site (in 10 years time) to allow fauna to relocate to adjacent habitat.
- Rehabilitation of "worked" areas to allow recolonisation by fauna in the long term.
- State Forest No. 22, which is adjacent to the site, will enable the movement of fauna to an area with similar (if not superior) habitat value to those of the site.

6.8 Dieback Protection

6.8.1 Potential Impacts

No evidence of Jarrah Dieback disease was recorded from the site by examination of aerial photography and site inspection. The site is an example of marri regrowth following logging, and vegetation modification due to the pursuit of grazing activities. As such the site has been highly modified on a selective basis.

In terms of the spread of the dieback fungus through the stream environment, Manjedal Brook enters the site from State Forest before discharging west of the scarp to areas of cleared farmland where infection, if not already present, would be of little consequence. No management is therefore proposed in this respect.

6.9 Rehabilitation

6.9.1 End Use Considerations

The rehabilitation of a quarry is best conducted as a sequential process in accordance with the requirements of the designated end use. However, the identification of an end use is often difficult in the case of hard rock quarries, which by nature have effective production lives of many decades.

The anticipated working life of the proposed quarry is in excess of 60 years. During this time, the level of development surrounding the site can only be estimated. The urban expansion Policy for the south-east corridor identifies land west of the South Western Highway between Mundijong and Byford to be available for urban development in about 30 years (DPUD, 1990). Assuming that existing constraints to urban development can be overcome during this period, it is possible that the end use of the quarry following mining will be of a recreational nature.

Therefore, while the end use of the quarry remains uncertain, the planned rehabilitation program will aim to produce gradational landscape at the interface between quarried and non-disturbed areas, to minimise the contrast to the surrounding environment. Priority will be given to stabilisation of the area and concealment of the mined area from sensitive viewsheds, particularly from the west.

As detailed in Section 5, a fundamental objective of the excavation plan is to complete the eastern face of the quarry as early as possible to enable instigation of the rehabilitation program before the face is exposed. To achieve the above objectives, a sequential rehabilitation process will be completed as documented below, and in accordance with Environmental Management of Quarries: Development, Operation and Rehabilitation Guidelines published by the Department of Mines (1991).

The steps to slope rehabilitation will generally be as follows:

1. Clear, blast (when necessary) and trim the rock benches.

2. Deposit overburden from stockpiles in nominal 1m layers to form appropriate (30°) slopes.

3. Six month settling and stabilising period (if considered necessary).

4. Topdressing of slopes with a nominal 100mm of stockpiled topsoil.

5. Repair and correction of any erosion channels identified during the settling period.

6. Planting of seed and/or seedlings.

7. Monitoring of plant performance (growth and death) and maintenance as necessary.

8. Repeat procedure for all rehabilitation areas.

The primary components of rehabilitation are discussed in more detail below.

6.9.2 Surface Restoration

The quarry benches and mine floor will be rehabilitated with the use of overburden and topsoil stockpiled at the commencement of mining.

Quarry benches will be left in place in some locations, and simply covered by overburden. In the event that the resultant slopes would be to steep, these will be blasted to provide gentler slopes prior to overburden placement. In some places, the brow of the bench will be blasted to give the overall appearance of hill slopes. Rock faces may also be selectively blasted to create scree slopes on the lower part of the slope face.

During the initial 25 year period and beyond, when establishing the processing bench and the main quarry, it will not be necessary to rehabilitate the quarry floor, as works will be continuing. However when necessary, the quarry floor will be fractured and treated with overburden and topsoil to create a favourable revegetation microenvironment, depending of course on end-use proposals.

6.9.3 Revegetation

The principal initial objective of the revegetation program will be to ensure that the elevated areas of the quarry on the eastern edge of the property are screened from view once mining moves to the west. Landscaped bunds may also be established for temporary visual screening. This area has been identified in the visual resource analysis as the most visible part of the proposed mine area.

Revegetation may be achieved by three predominant methods:

1. Direct seeding with indigenous tree and understorey species.

2. Planting of seedlings only.

3. Planting of seedlings with seeding of indigenous or pasture understorey.

All three of the above methods have previously proved successful in the rehabilitation of quarries and other mined areas, however planting seedlings in addition to the provision of native understorey seed is usually the most effective rehabilitation method. This method will be employed with the proposed minesite in all revegetation areas. It is not proposed to detail the replanting methodology here, as the procedure is now common place, and will be in accordance with standard practices and Department of Mines Guidelines. A list of local native species is provided in Appendix E.

6.10 Fire Control

Fires are not synonymous with the proposed quarry activity, however care must be taken in any vegetated area of the scarp. For this reason, the following strategies are proposed to safe-guard against the threat of fire:

- The work area and quarry will effectively act as a firebreak.
- A firebreak will be maintained around the perimeter of the property, subject to the requirements of the Bush Fires Board and CALM.
- The water tanker used for dust suppression on roadways and tracks will have the dual purpose of providing a portable water source which can be used in the event of fire.

6.11 Fuel Management

Fuel spillage has the potential to contaminate soil in the immediate vicinity of the spill occurrence, but more importantly the stream environment if run-off of contaminated water occurs.

For these reasons, the following fuel management strategies are proposed.

- All hydrocarbon storage facilities will be bunded with an impervious material, having a capacity to accommodate the volume of fuel stored plus an allowance for rainfall and an additional safety allowance.

- All drains which collect surface run-off will be diverted to the settling basins. Therefore if a spill and run-off were to occur, the contaminants will be isolated from direct discharge to Manjedal Brook.

- Vehicle washdown and servicing areas will be equipped with fuel and oil traps to ensure contaminated waters are not discharged to the environment.

6.12 Safety

Safe practices must be employed to protect both the workers at the site, and the general public. To ensure general safety, the following practices will be implemented.

- Compliance with all relevant Acts and Regulations.

- The quarry area and access entrance will be fenced, including appropriate signage, and the gates locked when the quarry is not in use or unattended.

The proponent intends to consult with the Scout Association regarding the Manjedal Scout Camp, with the intention of facilitating guided tours of the quarry in recognition that this would satisfy the curiosities of camp users and provide an avenue to reinforce 'safety education'.

7.0 COMMITMENTS

The following section details commitments made by Ransburg Pty Ltd regarding the establishment, operation, and decommissioning of the proposed hard rock quarry on Lot 344 South Western Highway, Mundijong.

Aesthetics

1. Additional trees will be planted during the first 2-3 years of operations, adjacent to the stockpile and processing area, to supplement the screening function of existing trees (some of which are outside the property boundaries).

2. Quarry operations in the southern sector of the site will commence low in the profile and at the eastern side of the property. Quarrying will proceed in southerly then westerly directions, to enable the eastern benches to be rehabilitated before they become visible from distant view points.

3. Depending upon final end use, all buildings and equipment will be removed at the completion of the project, and all roads will be deep ripped and revegetated.

4. All buildings likely to be visible from outside the area owned by Ransburg Pty Ltd will be constructed and coloured to blend with the existing landscape to the greatest practicable extent.

Noise and Vibration

5. All blasts will be fitted with millisecond delays to produce sequential firing.

6. Monitoring of both ground vibration and air blast overpressure will be conducted at the most sensitive adjacent residence (most likely Whitby Falls Hostel).

7. Blasting will only be conducted during the afternoon on weekdays.

8. Efficient noise suppression devices will be maintained on all equipment and plant used at the site.

9. Selected residences, notably Whitby Falls Hostel, will be provided with a schedule of blasting to inform residents of likely future blasting times.

Dust Levels

10. All reasonable and practicable measures will be taken to minimise dust emissions from the plant and associated equipment.

11. When possible, blasting will be conducted on days when westerly winds are prevalent to minimise the potential for dust nuisance on dwellings west of the site.

12. Dust generated from the crushing and screening plants will be suppressed using water sprays. Equipment will be enclosed where practicable.

13. Stockpiles and unsealed roads will be sprayed with water when necessary to suppress dust.

14. Where possible, the stripping of overburden and topsoil will be conducted when soil moisture content is relatively high to reduce dust generation.

Water Quality

15. The existing water quality of Manjedal Brook will not be detrimentally affected due to the operation of the proposed quarry. Summer flows of the Brook will not be altered.

16. All water generated on the site will pass through a sediment settling dam or basin. Site run-off water will be stored in the settlement dams for use in dust suppression as far as is practicable. Water surplus to on-site requirements will be discharged to Manjedal Brook.

17. Silt traps will be cleaned at regular intervals to ensure effective operation. Fines will be utilised within the rehabilitation program where possible.

18. Small contour channels will be formed on re-constructed banks to reduce erosion potential and to increase water infiltration potential.

19. A septic tank and leach drain will be installed and maintained on-site with at least 100m horizontal separation to any open water body.

20. Oil and fuel handling areas will have impervious bunds with capacity to contain the volume of fuel stored, plus anticipated rainfall, plus a safety factor.

21. No chemicals or potential liquid contaminants will be disposed of on-site.

Waste Disposal

22. Materials suitable for recycling will be recycled.

23. All other wastes will be taken to an approved waste disposal site on a regular basis.

Flora

24. Clearing will be limited to the minimum necessary for safe and economic operation of the mine.

25. No riparian vegetation will be cleared, with the exception of an access route to the hard rock resources south of Manjedal Brook.

26. Indigenous plant species will be used during rehabilitation.

27. Where practicable and available, topsoil will be respread as soon as possible to maximise the possibility of native seed germination and growth.

28. Rehabilitation will be carried out progressively during the life of the quarry, subject to operational requirements.

29. Weed species within rehabilitation areas will be controlled.

Fauna

30. The clearing of vegetation will be carried out sequentially to allow mobile fauna to relocate.

Rehabilitation

31. The eastern sector of the resource area south of Manjedal Creek will be mined and rehabilitated or screened before subsequent mining exposes this area to viewsheds from the west.

32. The methodology outlined in Section 6.9 will be implemented to the satisfaction of the relevant authorities.

33. Rehabilitation will be monitored for success and modified when and if necessary.

Fire Control

34. Firebreaks will be maintained in accordance with the requirements of the Bush Fires Board and CALM.

35. The dust suppression water tanker will have a dual purpose by providing a portable fire-fighting water source.

Fuel Management

36. All hydrocarbon storage facilities will be bunded with an impervious material, having a capacity to accommodate the volume of fuel stored plus an allowance for rainfall and an additional safety allowance.

37. All drains which collect surface run-off from disturbed areas will be diverted to constructed settling basins or dams.

38. Vehicle washdown areas will be equipped with fuel and oil traps to ensure contaminated waters are not discharged to the environment.

Safety

39. All relevant Acts and Regulations covering occupational health and safety, and the safety of the general public, will be complied with.

40. The quarry area and access entrance will be fenced and the gates locked when the quarry is unattended.

Public Comment

41. All formal public comments to the proponent will be recorded. Where a complaint is valid, the proponent will take all practical measures to remedy the source of the complaint.

8.0 REFERENCES

DCE (1986). Darling Escarpment Environmental Study. Unpublished Report, Department of Conservation and Environment.

Dell, J. and Turpin, M. (1992). Vertebrate Fauna of the Proposed Granite Quarry at Cardup. Unpublished Report to Bowman Bishaw Gorham.

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DPUD (1990). Metroplan: A Planning Strategy for the Perth Metropolitan Region. Department of Planning and Urban Development, Western Australia.

DPUD (1992). Basic Raw Materials & Policy Statement for the Perth Metropolitan Region. A policy statement for the identification protection and conservation of raw materials. Department of Planning and Urban Development, Western Australia.

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Jordan, J.E. (1986). Serpentine Part Sheets 2033II and 2133III, Perth Metropolitan Region, Environmental Geology Series, Geological Survey of Western Australia.

MRPA (1984). Draft Statement of Planning Policy for Basic Raw Materials. Metropolitan Region Planning Authority.

Stephens, L. (1991). Byford Quarry Extension - Consultative Environment Review. Pioneer Concrete Pty Ltd.

WAWRC (1987). A Strategy for Water Allocation in the Perth-Bunbury Region. Discussion Paper. W.A. Water Resources Council.

APPENDIX A

EPA Guidelines

APPENDIX A CONSULTATIVE ENVIRONMENTAL REVIEW GUIDELINES

Proposed Development of Extractive Industry for Basic Raw Materials

Lot 344 South-West Highway Mundijong

Overview

In Western Australia all environmental reviews are about protecting the environment. The fundamental requirement is for the proponent to describe what they propose to do, to discuss the potential environmental impacts of the proposal, and then to describe how those environmental impacts are going to be managed so that the environment is protected.

If the proponent can demonstrate that the environment will be protected then the proposal will be found environmentally acceptable; if the proponent cannot show that the environment would be protected then the Environmental Protection Authority (EPA) would recommend against the proposal.

Throughout the process it is the aim of the EPA to advise and assist the proponent to improve or modify the proposal in such a way that the environment is protected. Nonetheless, the environmental review in Western Australia is proponent driven, and it is up to the proponent to identify the potential environmental impacts, and design and implement proposals which protect the environment.

These Guidelines identify issues that should be addressed within the Consultative Environmental Review (CER). They are not intended to be exhaustive and the proponent may consider that other issues should also be included in the document.

The CER is intended to be a brief document, its purpose should be explained, and the contents should be concise and accurate as well as being readily understood by interested members of the public. Specialist information and technical description should be

included where it assists in the understanding of the proposal. It may be appropriate to include ancillary or lengthy information in technical appendices.

Key Issues

The important issues for this proposal are likely to be associated with the location of the proposal on the Darling Scarp in an area proposed for the Darling Range Regional Park, and the rural nature of the residential development in the area.

The key issues for the project should be clearly identified and the content of succeeding sections determined by their relevance to these issues.

In this case the key issues should include:

- Regional conservation issues:
  - the need for another basic raw material quarry in the metropolitan area;
  - representation of affected habitats elsewhere in the region;
  - protection of similar habitats in secure reserves in the region;
  - representation and protection of rare/restricted/endangered flora and fauna;
- Landscape and recreation values:
  - visual impact;
  - impact on recreational users;
- Alternative options - explanation of other possible options for extraction and transport, and reasons for selecting the preferred option.
- Water management issues:
  - use of surface or groundwater;
  - protection of ground and surface water quantity and quality in particular Manjedal Brook;
- Operational management issues:
  - dust and noise control;
  - overburden and topsoil management, rehabilitation and final land use;
  - transport routes and nominal volumes to be transported;

plus any other key issues raised during the preparation of the report.

Public Participation and Consultation

A description should be provided of the public participation and consultation activities undertaken by the proponent in preparing the CER. This section should describe the activities undertaken, the dates, the groups and individuals involved and the objectives of the activities. This section should be cross referenced with the "environmental management" section which should clearly indicate how community concerns have been addressed. Where these concerns are dealt with via other departments or procedures, outside the Environmental Protection Authority process, these can be noted and referenced here.

Detailed List of Environmental Commitments

The commitments being made by the proponent to protect the environment should be clearly defined and separately listed. Where an environmental problem has the potential to occur, there should be a commitment to rectify it. They should be numbered and take the form of:

a) who will do the work;
b) what the work is;
c) when the work will be carried out; and
d) to whose satisfaction the work will be carried out.

All actionable and auditable commitments made in the body of the document should be numbered and summarised in this list.

APPENDIX B

Community Consultation Program

APPENDIX B COMMUNITY CONSULTATION PROGRAM

Consultations During Preparation of the CER - April/May 1992

(i) Letter recipients, followed by telephone discussion (copy of letter included in this Appendix):

- Bob Fawcett - Whitby Falls Hostel
- Noel Carlin - Director, Physical and Central Services, Health Department (letter also sent to Dr G.P. Smith, Mental Health Policy Unit).
- Kenneth Court - Nanwall Investments Pty Ltd
- Neil Kentish - Secretary, Serpentine-Jarrahdale Land Conservation District Committee.
- Jan Star - Councillor, Central West Ward, Shire of Serpentine-Jarrahdale.
- Fred McKenzie MLC - Chairman, Darling Range Regional Park Community Consultative Committee.
- Nettie Yoemans - President, The Ratepayers and Residents Association of the Shire of Serpentine-Jarrahdale.
- Jean Kirk, Women's Environment Group.

(ii) In addition, direct telephone contact was made with the following people:

- Christopher Harris - Manjedal Scout Camp.
- Brian Court - Scout Association.
- Warren Anderson - Planner, Shire of Serpentine-Jarrahdale.

- Terry Ashcroft - Jarrahdale District, CALM.
- Norm Caporn - Environment Protection, CALM.
- Denise Needham - Whitby Falls Coach House Centre.
- Helena Coles - Alcoa.

(iii) A formal presentation of the project was provided to the May 11th meeting of the Darling Range Regional Park Community Consultative Committee, at the invitation of the Chairman, Fred McKenzie.

The presentation was conducted by Mike Bishaw and Darryl Ferrara and Michael Della Bonna from W.A. Limestone Co.

The Committee comprised the following personnel:

CHAIRMAN:	Hon. F.E. McKenzie MLC	
MEMBERS/ DEPUTIES:	Mrs J. Mackintosh	(Mundaring Environmental Contact Group)
	Clr J. Star	(Shire of Serpentine-Jarrahdale)
	Clr J.E. Ellery	(Shire of Mundaring)
	Mr K. McMenemy	(WA Farmers Federation)
	Mr G. Rundle	(WA National Parks and Reserves Association)
	Mr J. Rogers	(Eastern Region Economic Development Committee)
	Mrs J. Payne	(Conservation Council of WA)
IN ATTENDANCE:	Mr G. Morris	(City of Gosnells)
	Mr S. Ramanathan	(Shire of Mundaring)
	Mr A. Moore	(DPUD)
SECRETARY:	Mr S. Hill	(DPUD)

22 April 1992

Dear

Lot 344 South West Highway, Mundijong

Ransburg Pty Ltd, a company owned in the majority by W.A. Limestone Co., has commissioned Bowman Bishaw Gorham to prepare a Consultative Environmental Review (CER) for a proposed basic raw materials quarry at the abovementioned location (please see plan attached).

This property has been the subject of previous application for development in which approvals to commence have been granted and subsequently lapsed. The current proposal will be formally assessed by the Environmental Protection Authority and considered for approval by the Minister for the Environment.

Whilst the CER document will be released for your comment in May or June of this year, it is recognised that you may have information and/or opinions which could be of value during our preparation of the document.

I would like to contact you by telephone in the next few days to provide further information and discuss how we may respond to any concerns that you have with the proposed development.

Thanking you in anticipation of your co-operation.

Yours faithfully
BOWMAN BISHAW GORHAM

MICHAEL BISHAW

APPENDIX C

CALM's Declared Rare Flora Information

DEPARTMENT OF CONSERVATION AND LAND MANAGEMENT

HEAD OFFICE
HACKETT DRIVE CRAWLEY
WESTERN AUSTRALIA
Phone (09) 386 8811
Telex AA 94585
Facsimile (09) 386 1578

STATE OPERATIONS HEADQUARTERS
50 HAYMAN ROAD COMO
WESTERN AUSTRALIA
Phone (09) 367 0333
Telex AA 94616
Facsimile (09) 367 0466

Please address all correspondence to Executive Director, P.O. Box 104, COMO W.A. 6152

Your Ref:
Our Ref: 031677F0216
Enquiries: Dr Atkins
Phone: 09 3670425

Ms Bev Walker
Bowman Bishaw Gorham
PO Box 404
SUBIACO WA 6008

Dear Ms Walker

REQUEST FOR RARE FLORA INFORMATION

I refer to your request of 30 April, 1992 for information on rare flora in the Byford/Mundijong area (Job MI2128).

Attached is a printout from the Department's Declared Rare Flora and Priority Species List (species that are declared rare [R, or X for those presumed to be extinct], poorly known [1 - 3], or require monitoring [4]). No specific DRF populations are known from this area.

Attached also are the conditions under which this information has been supplied. Your attention is specifically drawn to the sixth point which refers to the requirement to undertake field investigations for the accurate determination of rare flora occurrence at a site. The information supplied should be regarded as an indication only of the rare flora that may be present.

An invoice for $90, being the set charge for the supply of this information, will be forwarded.

It would be appreciated if any populations of rare flora encountered by you in the area could be reported to this Department to ensure their ongoing management.

If you require any further details, or wish to discuss rare flora management, please contact my Senior Botanist, Dr Ken Atkins on 09 3670425.

Yours faithfully

.....
for Syd Shea
EXECUTIVE DIRECTOR

4 May, 1992

DECLARED RARE AND PRIORITY FLORA LIST
DEPARTMENT OF CONSERVATION AND LAND MANAGEMENT

SPECIES	PRI CODE	CALM REGION	DISTRIBUTION	FLOWERING PERIOD
Aotus cordifolia	3	CF,SW	Red Hill, Byford, Witchcliffe	Aug-Dec
Calytrix simplex subsp. simplex	1	SW	Armadale, Mt Saddleback	Jan
Centrolepis caespitosa	X	SW	Byford	Nov
Nemcia acuta	2	GRE,SW	Armadale, Darlington, Bindoon, Regans Ford	Aug-Sep
Tripterococcus sp. (Cannington) AS George 16201 [aff. 'paniculatus']	1	SW	Cannington, Armadale, Leeming, Forrestfield	Nov
Verticordia plumosa var. pleiobotrya	1	SW	Mundijong West Road	Nov

APPENDIX D

Viewshed Analysis

APPENDIX D VIEWSHED ANALYSIS

(i) Introduction

Given the location of the site within a valley on the Darling Scarp, a systematic visual resources assessment was conducted to ascertain the visual sensitivities of the proposed quarry operation. The visual resource assessment was based on the following elements of work:

- Review of 'computer-generated' perspective views of the site and surrounding terrain to ascertain the most sensitive viewshed;
- Site inspection to assess the screening potential of existing trees within the property;
- Reconnaissance surveys along South Western Highway and in the Mundijong locality to gauge the visibility of the site;
- Analysis of detailed cross-sections to define sectors of the site where quarrying would not be exposed to views from the west.

Each of these elements are briefly discussed below to enable assessment of the viewshed issue and to confirm that quarrying could be conducted in a visually sensitive manner.

(ii) Perspective View

The perspective view shown on Figure D1 was selected because it illustrates two important features in relation to the southern sector of the site where the main granite quarry will eventually be established:

- the deviation of the valley offers natural protection to the initial quarry area, which will be located on the 'north-facing' slope;

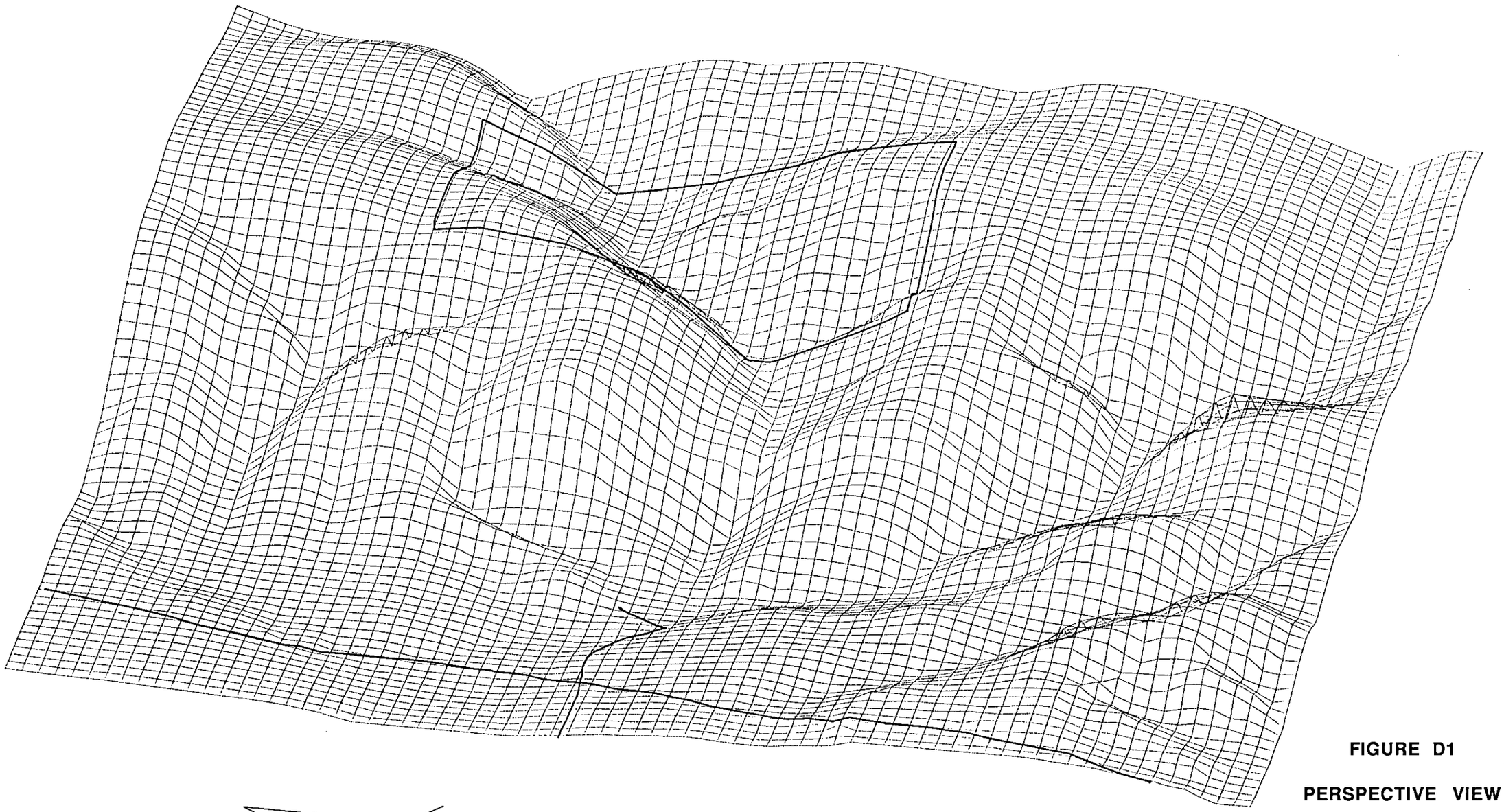


FIGURE D1

PERSPECTIVE VIEW

GEMELL MINING ENGINEERS		
PERSPECTIVE VIEW LOOKING EAST x3 Vertical Exaggeration		
Scale: 1: 10000	Dwg:	Date: 21-JUL-92

PERSPB.PF

- the alignment of the valley (opening) across Whitby Falls to the coastal plain means that the south-western sector of the site is exposed to views from the west, albeit a narrow viewshed because of the confining nature of the valley walls.

This perspective view presents the worst case viewshed and needs to be recognised as an exaggeration of the true situation. It is an oblique aerial view and therefore does not simulate the viewshed at groundlevel. (The reader needs to imagine oneself located at about 500-800 metres above Mundijong to experience the same view).

(iii) Screening Effects of Existing Vegetation

The southern sector of the site has a good vegetation cover in terms of facilitating the screening of portions of the quarry. Careful planning of the quarry layout, in combination with the minimisation of disturbance to adjoining land with tree cover, will ensure that a significant portion of the site could be quarried without being visually intrusive.

Obviously, the screening effect of trees will be of little benefit on the steep, 'west-facing' slopes which are the most visually sensitive areas on the site.

(iv) Reconnaissance Survey of Westerly Viewshed

A reconnaissance survey of the locality to the west of Lot 344 was conducted to assess the visibility of the site. This survey involved traversing the majority of roads in the localities of Mundijong and Whitby Falls to ascertain the viewshed of the site i.e. the 'window' of land on the coastal plain where views of some parts of the site may be obtained.

Difficulty was experienced with precise definition of the site when viewed from the west, because the Darling Scarp at this location appears as a vegetated continuum from such a low angle of view. Therefore the boundaries of the site could only be approximated and the degree to which the valley spurs obscure the site could only be estimated in broad terms.

Notwithstanding the above, the viewshed reconnaissance provided useful feedback to assessment of the potential visual sensitivities of the proposed quarry. The following pertinent points were noted:

- The site is not readily visible from the South Western Highway, with only a small portion of the most elevated southern sector 'west-facing' slopes that are potentially exposed to view. This is because of the location of the highway relatively close to the foothills of the scarp and the fact that the highway is low in the profile as it traverses the Manjedal Brook valley;

- As one moves further to the west, more of the site becomes visible, but only the west-facing slopes of the southern sector of the site. The northern sector of the site is not visible from the coastal plain;

- Local residents in the Keirnan Street Special Rural area, at Mundijong and in the residential area on the southern side of Watkins Road may potentially have views of a proportion of the southern sector of the site;

- However, views of the scarp are often severely limited from residential allotments because of the extensive tree and shrub cover within and adjacent to the residential areas. This is particularly the case at Mundijong.

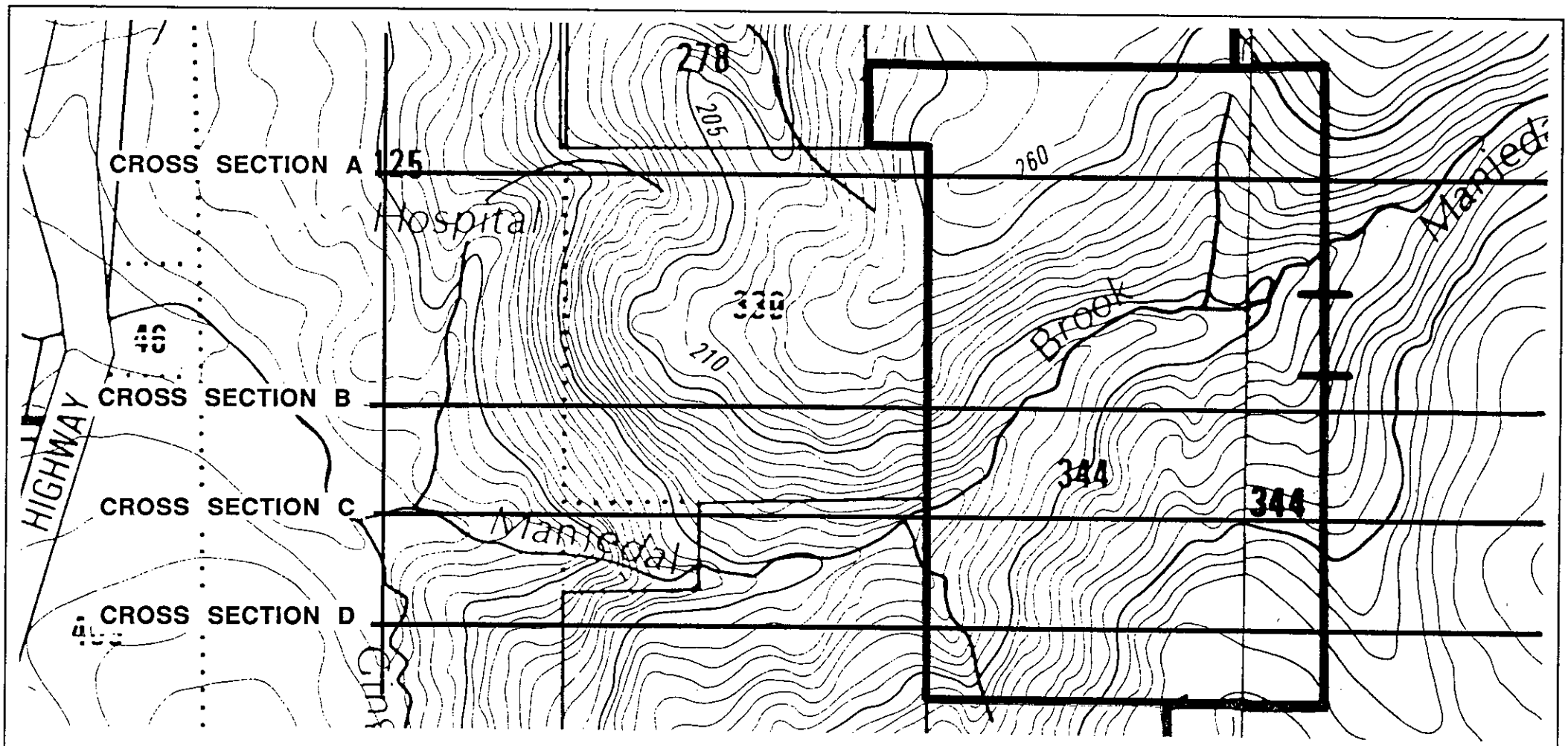
Despite the limitations of the reconnaissance survey, it was able to confirm that the southern sector of the site is not unduly exposed to views from the South Western Highway, but the west-facing slopes are visually sensitive to views from some residences in the range of 2-5 kilometres from the site, and some sections of local roads. It is this visual sensitivity which has prompted the quarry plan described in Section 5.0 of the main text.

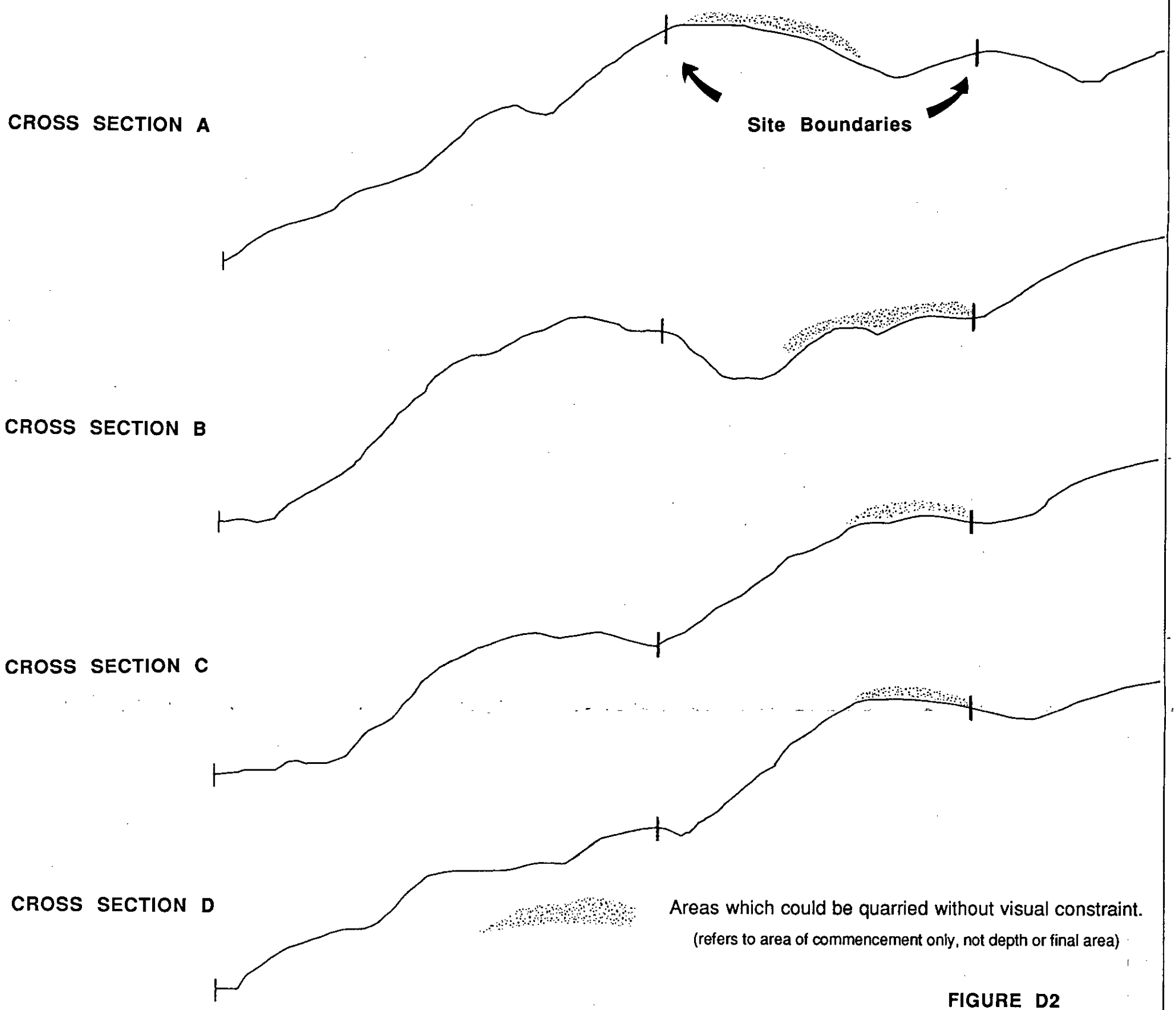
(v) Detailed Cross-Sections

Several cross-sections of the site are presented on Figure D2. They extend from State Forest through the site, in an east-west direction, to approximately the base of the scarp.

The cross-sections show the worst case situation for consideration of viewsheds because the screening effects of vegetation are ignored.

Two important points emerge from the cross-sections shown on Figure D2. These are:





Areas which could be quarried without visual constraint.

(refers to area of commencement only, not depth or final area)

FIGURE D2

CROSS SECTIONS

Horizontal Scale 1:10,000
3x Vertical Scale Exageration

BOWMAN BISHAW GORHAM
ENVIRONMENTAL MANAGEMENT CONSULTANTS

- The bench area proposed for the northern sector of the site will be totally obscured to views from the west;

- In the southern sector of the site, quarrying could be readily conducted on the eastern side of the property without being visible from the west. This is mainly due to the characteristics of the valley terrain, in which the eastern side of the property has north-facing slopes that could be quarried without constraint.

Again, it is this detailed consideration of the site's topographical features which has enabled derivation of the visually acceptable quarry management plan.

APPENDIX E

Indigenous Plant Species for Rehabilitation Use

APPENDIX E INDIGENOUS PLANT SPECIES SUITABLE FOR REHABILITATION USE

Tree species
(* species more suitable to moister sites)

Allocasuarina fraseriana
Eucalyptus laeliae
Eucalyptus lane-poolei
Eucalyptus wandoo
Agonis linearifolia*

Shrubs/Ground Covers
Acacia aphylla
Acacia extensa*
Acacia pulchella
Acacia urophylla*
Adenanthos barbigeris
Allocasuarina huegeliana
Calothamnus quadrifidus
Calothamnus sanguinus
Grevillea bipinnatifida
Hakea lissocarpha
Hakea trifurcata
Hardenbergia comptoniana (creeper)
Kennedia coccinea
Kennedia prostrata (creeper)
Kennedia nigricans
Leptospermum erubescens
Viminaria juncea*