EIS 927

AB019678

Environmental impact statement for proposed extension to hard rock quarry - Lot 2 DP 537292, and part Portion 102, Parish of Sutton Forest, Exeter, NSW

RESOURCE PLANNING PTY LIMITED

SOUTHERN HIGHLANDS QUARRIES
PTY LIMITED

ENVIRONMENTAL IMPACT STATEMENT FOR PROPOSED EXTENSION TO HARD ROCK QUARRY - LOT 2 DP 537292, AND PART PORTION 102 PARISH OF SUTTON FOREST, EXETER, NSW.

PREPARED BY:

RESOURCE PLANNING
PTY LIMITED

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DECEMBER, 1992.

Form 4.

ENVIRONMENTAL PLANNING AND ASSESSMENT ACT, 1979 (SECTION 77 (3) (d)).

ENVIRONMENTAL IMPACT STATEMENT.

This Statement has been prepared by or on behalf of . Southern Highlands Quarries Pty Limited ..... being the applicant making the development application referred to below.

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

Extension and modification of quarrying activities.

The development application relates to the land described as follows:—

No. ..... Street . Rockleigh Road .....

Locality/suburb . Exeter .....

Real property description . Lot 2, DP 537292 and Part Portion 102 ..

Parish of Sutton Forest .....

(e.g. Lot, D.P./M.P.S., vol./fol., Parish, Portion)

The contents of this statement, as required by clause 34 of the Environmental Planning and Assessment Regulation, 1980, are set forth in the accompanying pages.

Name, Qualifications and Address of person who prepared Environmental Impact Statement

Valerie Smith, B.Sc., M.Sc., Hort.Cert.
PO Box 388
EAST MAITLAND NSW 2323

Certificate.

I, Valerie Smith , of Resource Planning Pty Limited hereby certify that I have prepared the contents of this Statement in accordance with clauses 34 and 35 of the Environmental Planning and Assessment Regulation, 1980.

.....
Signature

15th December 1992
Date

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SUMMARY

1.0 SUMMARY

To ensure a continued supply of hard rock, Southern Highlands Quarries Pty Limited seeks to extend its existing quarry on Part Portion 102, Parish of Sutton Forest to Lot 2, DP 537292 which adjoins the western boundary of the existing operation. Geological assessment of the site has indicated that the proposed extension contains approximately 2.3 million tonnes of hard rock resource which at current levels of production would have an expected operation life of 8 to 9 years.

Southern Highlands Quarries Pty Limited is firmly established as a major supplier of quarry products to the Southern Highlands and surrounding areas and has a diverse client base with product supplied to the Roads and Traffic Authority, Councils, civil engineering contractors, concrete plants, local contractors, landscapers, etc.

Product from the existing quarry mostly services the Southern Highlands, outer Sydney and Goulburn regions with material on a less frequent basis being supplied to the Blue Mountains, Sydney and Southern slopes regions. In the order of 270,000 tonnes of product per year is supplied to these markets and the quarry extension is expected to continue to provide supply for this market.

Overburden within the proposed extension will initially be removed using scrapers. The remainder of the overburden and the hard rock resource will be removed using hydraulic excavators and off road rear dump trucks. Apart from the short period required to construct the proposed bund wall (approximately 1 month) and intermittent periods of surface overburden/topsoil removal, all quarry activities within the proposed extension will be carried out below ground level. Transport of hard rock and overburden material in dump trucks within the quarry area will be below existing ground level and will not be visible from surrounding residences.

Raw feed extraction rates will be similar to those of the current extraction operations. Raw feed will be transported from the proposed quarry extension, across Rockleigh Road to the existing processing plant. Both the haul road and the section of Rockleigh Road utilised to transport raw feed will be fully maintained by Southern Highlands Quarries Pty Limited.

There are no proposals to alter the existing processing plant, production or haulage of product which are subject to separate consents from that of the proposed development. This development application seeks consent for the extension of quarrying operations and variations to the proposed rehabilitatin of the existing quarry.

All surface runoff from the proposed extension will be collected and diverted to a sedimentation dam located in the floor of the existing quarry. Existing runoff controls for the site will be incorporated into the overall water management plan.

The limit of the proposed quarry will be approximately 450m from the nearest residence not associated with the development. Noise and visual impacts associated with the development will be ameliorated by the provision of a 3m

high vegetated bund along the northern and western perimeter. Additional vegetative screening will be provided along the southern perimeter of the extension area.

Predicted increases in dust deposition levels for the proposed quarry extension have been estimated to be less than 1g/m^2/month annual average at the nearest residence. This level is significantly less than levels considered by the Environment Protection Authority to be unacceptable. Predicted noise levels are not expected to cause annoyance to residents in the vicinity of the quarry.

No rare or endangered species of flora and fauna have been identified on the proposed extension area and no archaeological sites will be affected by quarry operations.

The site will be rehabilitated to provide a rural environment compatible with the surrounding landform. The final landform has been designed to incorporate the proposed extension and existing quarry into a gently sloping valley that drains to a tributary of Indigo Creek on the eastern side of the existing quarry. The entire quarry area will be revegetated with groves of native trees and pasture species with emphasis being placed on maintaining or enhancing the value, in monetary and environmental terms, of the proposed development site.

INTRODUCTION

2.0 INTRODUCTION

2.1 OBJECTIVES AND OUTLINE OF THE PROPOSED DEVELOPMENT

Southern Highlands Quarries Pty Limited seeks Development Consent from Wingecarribee Shire Council to extend the existing quarrying operations on Part Portion 102, Parish of Sutton Forest onto an adjoining property to the west of the existing quarry, described as Lot 2, DP 537292. **Figures 1** and **2** show the location of the proposed development.

As the proposal is "designated development" within the meaning of the Environmental Planning and Assessment Act 1979 and Regulation 1980, the development application must be accompanied by an Environmental Impact Statement. Resource Planning Pty Limited has been commissioned by Southern Highlands Quarries Pty Limited to prepare this statement on its behalf.

The extension area will be quarried using similar techniques to those used in the existing quarry. Topsoil and overburden will be stripped and used to construct bund walls around the site and in rehabilitation of worked out parts of the quarry. The underlying basalt hard rock will be quarried by excavator and hauled by dump truck to the existing approved processing plant located on Lot 1, DP 611935, north of Rockleigh Road.

There are no proposals to alter existing processing plant, production or haulage of product, which are subject to separate consents (see **Section 2.2**). This development application seeks consent for the extension of quarrying operations and variation to the planned rehabilitation of the existing quarry.

The existing processing plant produces between 250,000 and 300,000 tonnes per year of quarry products. Product is supplied to local Shires, Roads and Traffic Authority, State Rail Authority and a range of private markets including concrete plants, construction industries and landscapers. The Southern Highlands operation at Exeter has been a long term valuable source of construction materials used throughout the local and Sydney Regions.

The objective of the proposed development is to ensure an ongoing supply of extractive material to the Company's processing plant enabling Southern Highlands Quarries Pty Limited to maintain a continued supply of competitively priced quarry products to its client base, and employment for existing employees.

2.2 EXISTING AND PAST DEVELOPMENT APPLICATIONS AND APPROVALS

Quarrying and processing activities have been undertaken in the Exeter area for a period of some 17 years since consent was granted by Wingecarribee Shire Council to Belfast Holdings Pty Limited on 24th April 1975 for the establishment of a quarry on Lot 1, DP 611935 (previously described as Lots B and D in M.P.S.

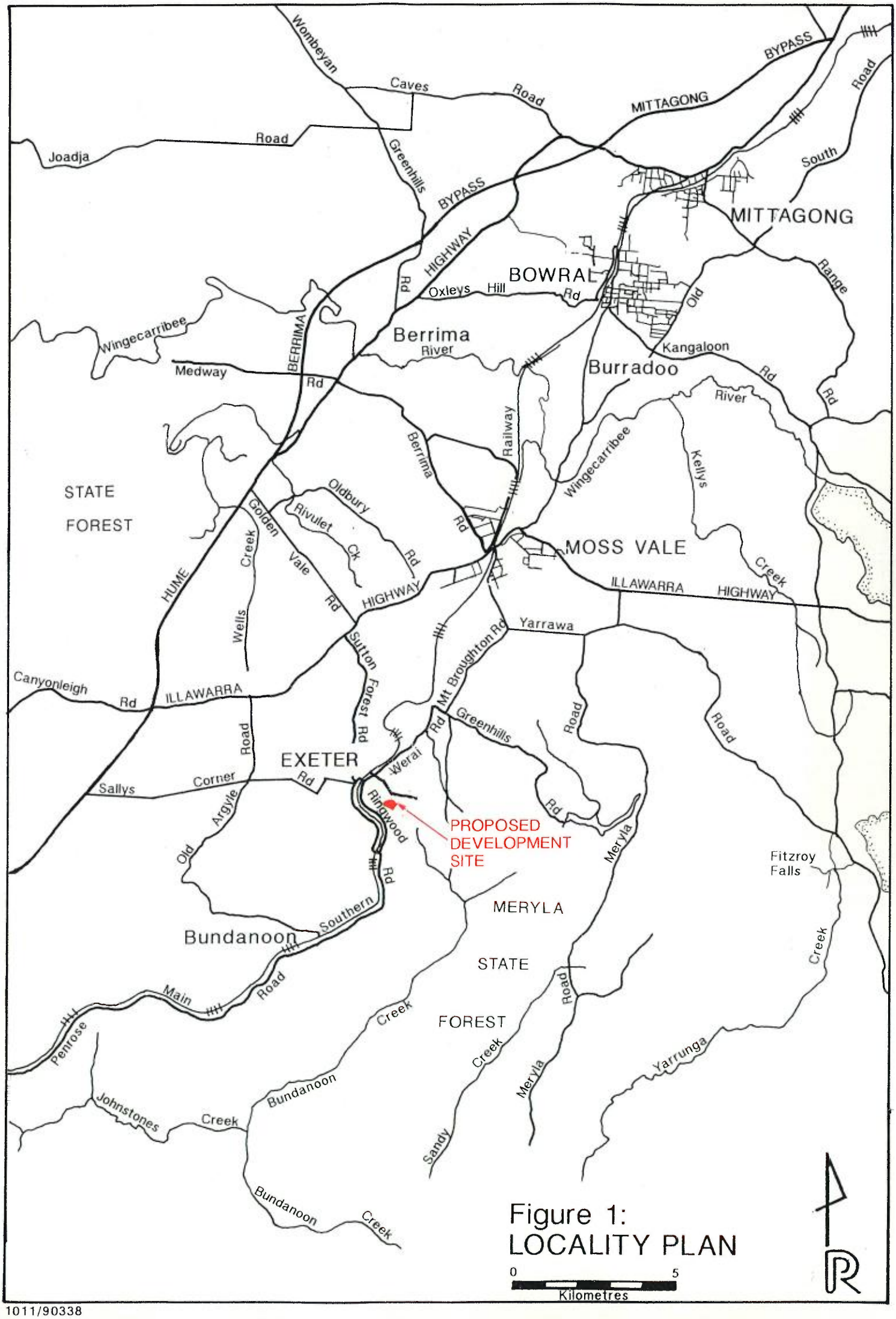


Figure 1: LOCALITY PLAN

0 5
Kilometres

1011/90338

KEY
Exeter Village Zone
Proposed Quarry Extension (includes bund walls)

RAILWAY
ROAD
WERAI
ROCKLEIGH
ROAD
11KV
Indigo
ROAD
FOREST
SUTTON
MIDDLE
ROAD
SOUTHERN
EXETER
EXETER
730
740
700
650
630
700
650
700
Transmission
Easement
Creek
ROAD
Stonequarry
STONEQUARRY
Stonequarry
640
700
132KV
Lot 1
DP 611935
Quarry Approved 24/4/75
Existing Processing Plant
Site Approved 16/1/76
Easement
Transmission
Lot 2 DP 537292
PROPOSED QUARRY EXTENSION
Existing Quarry
Approved 3/4/85
700
700
Creek
RINGWOOD
ROAD
Creek
650
Part Portion 102
Land Controlled by
Southern Highlands Quarries
Indigo
Creek
Creek
Reedy
Transmission
132KV
700
700
MAIN
ROAD
To Bundanoon
Quarry Approved 29/11/79
(Now Rehabilitated)
680
600

SOURCE: CMA 1:25000 Topo Moss Vale and Bundanoon

1011/90338

Figure 2: EXISTING AND PAST DEVELOPMENT CONSENTS

0 100 200 300 400 500
metres

(R.P.) and Part Land in C.T. 41725 Vd. 6305); the site of the present processing plant. On 16th January 1976, consent was granted to permit the establishment of the processing plant on the site. Product truck haulage from the plant site forms part of the 1976 consent.

On the 3rd July 1979, Exeter Quarries Pty Limited was granted consent to establish a quarry on 'Lantern Hill', north of the existing processing plant. Quarrying commenced on the site but ceased later in 1979.

On 29th November 1979, Council granted consent to Exeter Quarries Pty Limited to establish quarry operations on a 5.2 hectare parcel of land in the southern part of Part Portion 102, Parish of Sutton Forest. This area was the Company's principal source of quarry materials until reserves were depleted in 1986. Consent was sought and granted on 3rd April 1985 to establish quarry operations on the present site at the northern end of Part Portion 102.

Quarrying has been undertaken in this area since granting of consent with all materials hauled to the existing processing plant. **Figure 2** shows the location of existing and past development consents.

In May 1981, Southern Higlands Quarries' parent company, XQ Holdings Pty Limited acquired the present operations.

There are no proposals to alter existing processing plant, production, or product haulage and consequently these components do not form part of the present Development Application.

The Environmental Impact Statement addresses the proposed extension and any modifications to existing extractive operations. Modifications principally involve variations to the planned rehabilitation of the existing quarry that a required to complement the proposed extension.

2.3 LAYOUT OF THE IMPACT STATEMENT

The Environmental Impact Statement has been prepared in accordance with Clauses 34 and 35 of the Environmental Planning and Assessment Regulation 1980. The Director of the New South Wales Department of Planning was consulted as to the required form and content, and these requirements taken into account in preparation of the statement. **Appendix 1** presents the requirements of the Department with respect to the proposed development.

The impact statement has been divided into a number of sections to facilitate reading of the document. The sections are inter-related and basic data to support statements or conclusions made in one section of the statement may be found in other parts of the document. The reader is advised to read the Table of Contents carefully to locate all information of interest. As a further aid to locating information in the statement, the following notes outline for the reader the layout adopted for the impact statement.

SECTION 1.0 SUMMARY

Section 1.0 summarises the proposal and the findings of the environmental investigations.

SECTION 2.0 INTRODUCTION

The introduction presents the objectives and brief outline of the proposed development as required by **Clause 34(b)** of the Regulations. The layout of the statement and authorities consulted are presented.

SECTION 3.0 JUSTIFICATION FOR THE PROPOSED DEVELOPMENT AND REVIEW OF ALTERNATIVES

This section outlines uses and demand for the Company's quarry products and the justification for the development in terms of environmental, economic and social considerations as required by **Clause 34(f)** of the Regulations.

It also describes the alternatives to the proposed development as required under **Clauses 34(h)** and **34(i)** of the Regulations. Alternatives considered are alternative sources, alternative extraction methods and the alternative of not proceeding with the proposed development.

SECTION 4.0 DESCRIPTION OF THE EXISTING ENVIRONMENT

Base-line investigations were carried out to establish the characteristics of the existing environment of the extension and its surrounds. This information was used in the design and layout of the extractive operations and in the design of the environmental management procedures. This information is essential in assessing the impacts of the proposal.

The section presents a description of the natural, physical and man-made features of the site together with social and economic factors (**Clause 34(c)** of the Regulations).

Detailed supporting information are attached as appendices to the document.

SECTION 5.0 DESCRIPTION OF THE PROPOSED DEVELOPMENT

This section provides full details of the proposed development including methods and plans of the extractive operations, extraction rates, machinery, facilities, working hours, raw material haulage, and workforce as required by **Clause 34(a)** of the Regulations.

SECTION 6.0 ENVIRONMENTAL MANAGEMENT PROCEDURES

This section describes the environmental management procedures to be incorporated into the project to protect the environment or mitigate adverse impacts on the environment of the site (**Clause 34(g)** of the Regulations). These include measures for the control of dust, noise, water quality, visual amenity, and energy (**Clause 34g1** of the Regulations).

SECTION 7.0 ASSESSMENT OF ENVIRONMENTAL IMPACTS

This section examines the effectiveness of the measures outlined in **Section 6.0** to protect the environment and provides an assessment of the residual environmental effects. Both adverse and beneficial effects are described in accordance with **Clauses 34(d)** and **34(e)** of the Regulations.

The reader should note that **Sections 2.0** to **6.0** and appendices provide the basic data to be considered in the assessment of impacts.

2.4 AUTHORITY AND COMMUNITY CONSULTATIONS

During preparation of the impact statement a number of State and Local Authorities were contacted either by phone, letter, or by way of a meeting. Listed below are authorities and organisations consulted and/or from whom information was obtained.

* Department of Planning
* Wingecarribee Shire Council
* Department of Minerals (and Energy)
* Soil Conservation Service (now CALM)
* State Pollution Control Commission (now EPA)
* Department of Lands (now CALM)
* NSW Agriculture and Fisheries
* Illawarra Electricity
* Roads and Traffic Authority
* Department of Water Resources
* National Parks and Wildlife Service
* Moss Vale Rural Lands Protection Board
* Exeter Village Association

The requirements of each of those authorities who responsed are outlined below with reference to those sections in the impact statement where the requirement is addressed.

Department of Planning

The Director required the following matters to be specifically addressed in the Environmental Impact Statement.

* Noise impact assessment on nearest residences (**Section 7.7** and **Appendix 4**).

* Proposals to minimise dust emissions from excavation and trafficking operations (**Section 6.4**).

* Assessment of any additional traffic generated by the proposed extension of the quarry (**Section 5.4.3**).

* Take into account any comments Wingecarribee Shire Council considers may apply to its determination of the proposal.

* Made reference to standard Attachments 1 and 2 (**Appendix 1**).

In subsequent correspondence, the Department advised that at present there is no mandatory "buffer" distance for extractive sites and consideration should be given to the concept of "operational buffers" and "planning buffers" (**Section 6.6**).

Wingecarribee Shire Council

Council requested the following issues be addressed in the Environmental Impact Statement.

* Means of providing an effective buffer between quarry extremities and adjoining private properties. Council suggested a 1km buffer between quarry operations and existing dwellings (**Section 6.6**).

* Likely impact on the local road system of the prolonged quarry operation (**Section 5.4.3**).

* Means by which local water courses, particularly Indigo Creek will be protected from sedimentation and the inclusion of a comprehensive hydraulics and water management assessment (**Sections 6.1** and **6.2**).

* Total site rehabilitation of worked areas (**Section 6.10**).

Department of Minerals and Energy (Now Department of Mineral Resources).

As the proposed quarry extension is identified in the Illawarra Regional Environmental Plan No. 1 as a regionally significant extractive resource, the Department requested that the following aspects be addressed in the Environmental Impact Statement.

* Resource evaluation, assessment and method of determination (**Section 4.4**).

* Production and life of operation (**Section 5.3.4**).

* Characteristics and quality of material to be extracted (**Sections 3.1.1** and **4.4**).

* Details of extraction and processing methods (**Sections 5.3** and **5.4**).

* Uses and markets for aggregate (**Section 3.1**).

Soil Conservation Service (Now Department of Conservation and Land Management)

Advised the following matters should be addressed in the Environmental Impact Statement.

* Protected lands should be identified and management proposals addressed (**Section 4.3**).

* Erosion and sediment control plan should be developed at the detailed design stage to the satisfaction of the Soil Conservation Service (**Section 6.2**).

* Broad details of the various components of the Erosion and Sediment Control Plan should be addressed in the impact statement (**Section 6.2**).

* Site environmental management officer should be identified (**Section 5.10**).

* If possible a site meeting between the proponent, Council and Statutory Authorities should be organised before final production of the Environmental Impact Statement (Held 17th December, 1992).

State Pollution Control Commission (now Environment Protection Authority)

Advised that as the extension area is greater than 2 hectares in area, formal approval will be required under the State Pollution Control Commission Act subsequent to development consent being granted. In addition, the Commission requested the following matters be addressed.

* Control of runoff from disturbed areas. Sedimentation dams are to be of sufficient capacity to collect runoff from a one in ten year 24 hour storm (**Sections 6.1** and **6.2**).

* Control of dust from the extraction area, stockpiles and access roads (**Section 6.4**).

* Noise impacts on closest affected residence and inclusion of a noise impact statement (**Sections 7.7** and **Appendix 4**).

* Advise to be sought from Soil Conservation Service in regard to rehabilitation of the site (**Appendix 1**).

Department of Lands (now Department of Conservation and Land Management)

Requested that any adverse impact on Exeter Park be addressed (**Section 7.10**).

NSW Agriculture and Fisheries (now NSW Agriculture, NSW Fisheries)

Requested attention be given to the following aspects.

* Surface runoff (**Section 6.1**).

* Sediment control to prevent siltation of Indigo Creek (**Section 6.2**).

* Erosion control system (**Section 6.2**).

* Control of noxious weeds such as Serrated Tussock and Blackberries (**Section 6.10**).

* Rehabilitation of any destroyed pasture land to at least the standard of the existing pasture (**Section 6.10**).

* Revegetation of disturbed areas (**Section 6.10**).

* Fencing for stock protection (**Section 7.13**).

Illawarra Electricity

Expressed concern in regard to possible damage to the 132kV transmission line that crosses the proposed extension and indicated that if the proposal was to proceed, the line would need to be relocated and subsequent environmental impacts would need to be addressed (**Section 7.11**).

Roads and Traffic Authority

The Roads and Traffic Authority requested the following traffic issues be addressed as required for extractive industry under State Environmental Planning Policy 11.

* Point of access to classified road system (**Section 5.4**).

* Number and type of vehicle movements per day (**Section 5.4**).

* Effect on the local and classified road systems (**Section 5.4**).

* Provision of roadworks necessitated by increased vehicles (**Section 5.4.3**).

Department of Water Resources

Drew attention to the following reference documents to assist in the preparation of the Environmental Impact Statement.

* "A Guide to Stream Channel Management".

* "The Seven Step Method of Controlling Bank Erosion and Sediment Buildup".

* "General Requirements for Environmental Impact Statements".

No site specific issues were identified.

NSW National Parks and Wildlife Service

Advised that an Aboriginal archaeological site had been previously identified near the site and requested additional information be provided in this regard. The Service advised that they had no specific concerns regarding nature conservation values.

Issues to be addressed include:

1. Establishing the existence of the previously recorded site and whether it will be affected by the development (**Section 4.12** and **Appendix 5**).

2. Identification of areas of high archaeological potential in the extension area (**Section 4.12** and **Appendix 5**).

3. Whether there are areas which are likely to contain sites which were not visible at the time of the original survey (**Section 4.12** and **Appendix 5**).

4. Consultation with the Illawarra Local Aboriginal Land Council (**Section 4.12** and **Appendix 5**).

5. Significance of any sites found in a local and regional context in terms of the nature of the artefact assemblages (**Section 4.12** and **Appendix 5**).

Moss Vale Rural Lands Protection Board

Advised that the Board had no specific issues to be addressed.

Exeter Village Association

Southern Highlands Quarries Pty Limited has consulted with adjoining neighbours to identify their concerns.

2.5 PROJECT TEAM

The Environmental Impact Statement was prepared by Resource Planning Pty Limited, Geological and Environmental Consultants, Maitland, New South Wales. The statement was prepared in conjunction with air quality sub-consultants Nigel Holmes and Associates, and acoustic sub-consultants Wilkinson Murray Pty Limited.

Valerie Smith **B.Sc.(Hons), M.Sc.** **Hort.Cert.**	– Project Management – Liaison with Company and Authorities.
Peter Jamieson **B.E. (Civil)**	– Liaison with Company and Authorities – Hydrological Studies – Erosion and Sedimentation Controls – Report Writing

Barbara Crossley **B.Nat.Res.(Hons)**	– Soil Investigations – Report Writing
Matthew Barber **B.A.(Hons)**	– Archaeological Investigations
Megan Dewsnap **B.Land.Arch.**	– Visual Assessment – Landscape Design
Chris Herbert **B.Sc.(Hons)**	– Geological Investigations
Naomi Buchhorn **B.Sc.(Hons)**	– Flora and Fauna Study

JUSTIFICATION AND ALTERNATIVES

3.0 JUSTIFICATION FOR THE PROPOSED DEVELOPMENT AND REVIEW OF ALTERNATIVES

3.1 JUSTIFICATION FOR THE DEVELOPMENT

3.1.1 Economic Considerations

Southern Highlands Quarries Pty Limited is the operating subsidiary of XQ Holdings Pty Limited who in turn, is associated with the Concrite Group of Companies through a holding company, Form Readymixed Concrete Pty Limited.

The Concrite Group is a major independent supplier of concrete to the southwestern Sydney Region and Southern Tablelands with concrete plants located at Yass, Goulburn, Smeaton Grange, Liverpool, Menai, Kirrawee, and Alexandria. Over 100 employees and full-time subcontractors are employed by the Concrite Group.

In the local region, Concrite-Southern Highlands operates two concrete plants at Moss Vale and Mittagong with a third approved for construction in Picton. Approximately 8 people are employed in these local operations.

The Exeter quarry of Southern Highlands Quarries Pty Limited is a major supplier of concrete aggregates to these concrete plants. It is a strategic Company resource and its continuing operation is of considerable importance to the Concrite group, its employees, and other users of the product.

Use of Quarry Products

Hard rock quarried from the existing quarry is of high quality and used to produce a wide range of quarry products. Products include sealing aggregate, concrete aggregate, rail ballast, roadbase (DGB 20 and DGB 40) and stabilised road base.

Crushed stone aggregate produced from the Exeter quarry is principally used in the group's own concrete plants. The material complies with Australian Standard AS 2758.1-1985 "Aggregates and Rock for Engineering Purposes". Part 1- Concrete Aggregates, with regard to soundness, density, water absorption, shape, grading, strength and other parameters defined in the Standard. Not all rock sources can comply with these requirements. Detailed drilling and testing of basalt from the proposed extension has shown this material to be of similar high quality suitable for these uses.

The material is particularly suitable for producing concrete with low shrinkage characteristics; a feature not common to many hard rock sources supplying the Sydney Region.

Hard rock from the Exeter quarry is also utilised to produce prepared roadbase and sealing aggregates and complies with Australian Standard AS 2758.2-1985. "Aggregates and Rock for Engineering Purposes. Part 2 - Aggregate for

Sprayed Bituminous Surfacing". It is used by the Roads and Traffic Authority, contractors and local Councils.

The resource has been identified as a significant extractive material and is protected under Local Environmental Plan 1989. The extension of an existing quarry onto an adjoining parcel of land that is underlain by a proven significant resource of hard rock is more desirable economically and environmentally than the alternative of establishing a new quarry elsewhere.

Markets

Southern Highlands Quarries Pty Limited has established a strong client base with an ongoing demand for quarry products. Exeter quarry products are currently sold throughout the Southern Tablelands, southwestern Sydney Region, Blue Mountains and the Goulburn–Yass area and the quarry is the only operating quarry in the Tablelands area.

The Company has stable commercial trading arrangements with these clients and expects to continue to provide high quality aggregate materials at a competitive price to its established clientele.

A three month survey was carried out between July and September 1991 to record product distribution. During this period, 74,262 tonnes of product were sold from the Exeter quarry and distributed as shown in **Table 3.1**.

TABLE 3.1
PRODUCT DISTRIBUTION
EXETER QUARRY

JULY–SEPTEMBER 1991

Customer	% of Total
Concrite Group	31
Wingecarribee Shire Council	15
Astec Pty Limited	13
Roads and Traffic Authority	10
Other Councils	5
Other Contractors	5
Cash Sales	5
Leighton Contractors	3
Other Government Departments	1
Other	12

Source: **Southern Highlands Quarries Pty Limited**

Note: **Others include landscapers, builders, other quarry operators, plumbers, hauliers, retailers.**

There are no plans to increase production levels nor to seek additional markets. The Development Application seeks to provide an ongoing supply of raw material to existing processing operations which supply a well-established client base.

3.1.2 Social Considerations

Southern Highlands Quarries Pty Limited is a major employer in the Exeter area. The extension of the existing quarry will provide on-site continued direct employment for operators employed in the quarry and indirectly for plant personnel. In the order of 20 people are employed in these activities and an additional 20 engaged in the provision of services such as maintenance contractors, road haulage contractors and contract equipment operators. The Company purchases most of its spares, tyres, and fuel in the local community and uses local servicing firms for maintenance operations. In this regard, the quarry extension will provide a positive and beneficial impact on the local community and economic base.

It is estimated that the existing Exeter operations generate in excess of $1.5 million in local revenue annually through salaries, maintenance and operation of plant, and purchase of consumables. On a regional basis, it is estimated that in the order of $5 million is generated by Southern Highlands Quarries Pty Limited and the Concrite Group. The proposed extension will ensure that the local economy will continue to benefit from the operation and this will provide a positive and beneficial impact on the local community and economic base.

3.1.3 Environmental Considerations

The environmental issues raised by the Department of Planning, other Government agencies, and those required to be addressed under the Environmental Planning and Assessment Act 1979 and Regulations 1980 have been addressed in this document.

Potential adverse environmental impacts from the quarry on the natural and man-made environments surrounding the proposed extension have been mitigated by the planning proposals, design and management procedures, and environmental controls to be implemented and described in the environmental impact statement.

3.2 ALTERNATIVES

3.2.1 Alternative Sources

In considering alternative sources to the proposed extension, a major factor to be considered is the distance involved in hauling raw quarry materials to the existing approved processing plant.

The haulage of raw quarry materials long distances on public roads is undesirable economically and environmentally. Consequently, the optimum quarry location is as close as possible to the processing plant.

The Exeter and Southern Highlands area is underlain by extensive flows of basalt similar to the proposed extension. These deposits have been the subject of a detailed survey by the Geological Survey of New South Wales of sources of "blue metal" in the Mittagong–Moss Vale area with the potential to support quarrying operations (Smith, 1974).

The study identified 18 potential sites of varying potential. Of these, only 5 sites were considered potentially suitable for supporting economic and environmentally acceptable quarrying operations. These included Oxley Hill, Mt Misery/Hurdle Ridge, Mt Flora, Cotswald Farm, and Mt Gingenbullen.

In March 1982, a Tablelands Technical Committee comprising representatives of the Department of Mineral Resources and Environment and Planning (now Planning), and Wingecarribee Shire Council produced a report "Planning for Blue Metal Quarrying in the Municipalities of Shellharbour and Kiama and Tablelands Sub–Region". The objectives of this report were to formulate management plans to ensure that sufficient hard rock resources were protected from sterilisation and that any future quarrying was carried out in an environmentally acceptable manner and not unduly affected by urban encroachment.

The report recognised the existing quarries at Oxley Hill near Bowral and Exeter, and the alternative potential sources at Mount Misery/Hurdle Ridge, Mount Flora, Cotswald Farm and Mount Gingenbullen. The location of these sites is shown on **Figure 3**. A subsequent Commission of Inquiry into Hard Rock Deposits in the Shire of Wingecarribee in 1985, also recognised the above existing operations and potential deposits.

Since these studies, quarrying operations at Oxley Hill have ceased. Mount Misery and Mount Flora are approved for quarry development but have not proceeding at this stage and Mount Gingenbullen has been subdivided into small landholdings. Of the remaining proven deposits only Cotswald Farm could be considered a potential alternative site to the proposed extension on the basis of quantity and quality. Cotswald Farm is a small syenite intrusion 4km east of Bowral. The site has been previously drilled by Hi–Quality Quarries Pty Limited and samples submitted for preliminary testing. Reserves are estimated in the order of 7.5 million tonnes.

However, its distance from the Exeter processing plant renders it an unacceptable alternative on economic and environmental grounds.

3.2.2 Importance and Significance of the Proposed Extension

A review of known potential alternative sources has shown that extending the existing quarry into the adjoining basalt deposit represents the optimum alternative to Southern Highlands Quarries Pty Limited to ensure the continued availability of hard rock to the Company's processing plant.

Drilling and testing has confirmed the presence of a significant reserve of high quality stone in the quarry extension which can be worked economically and is suitable for the Company's purposes.

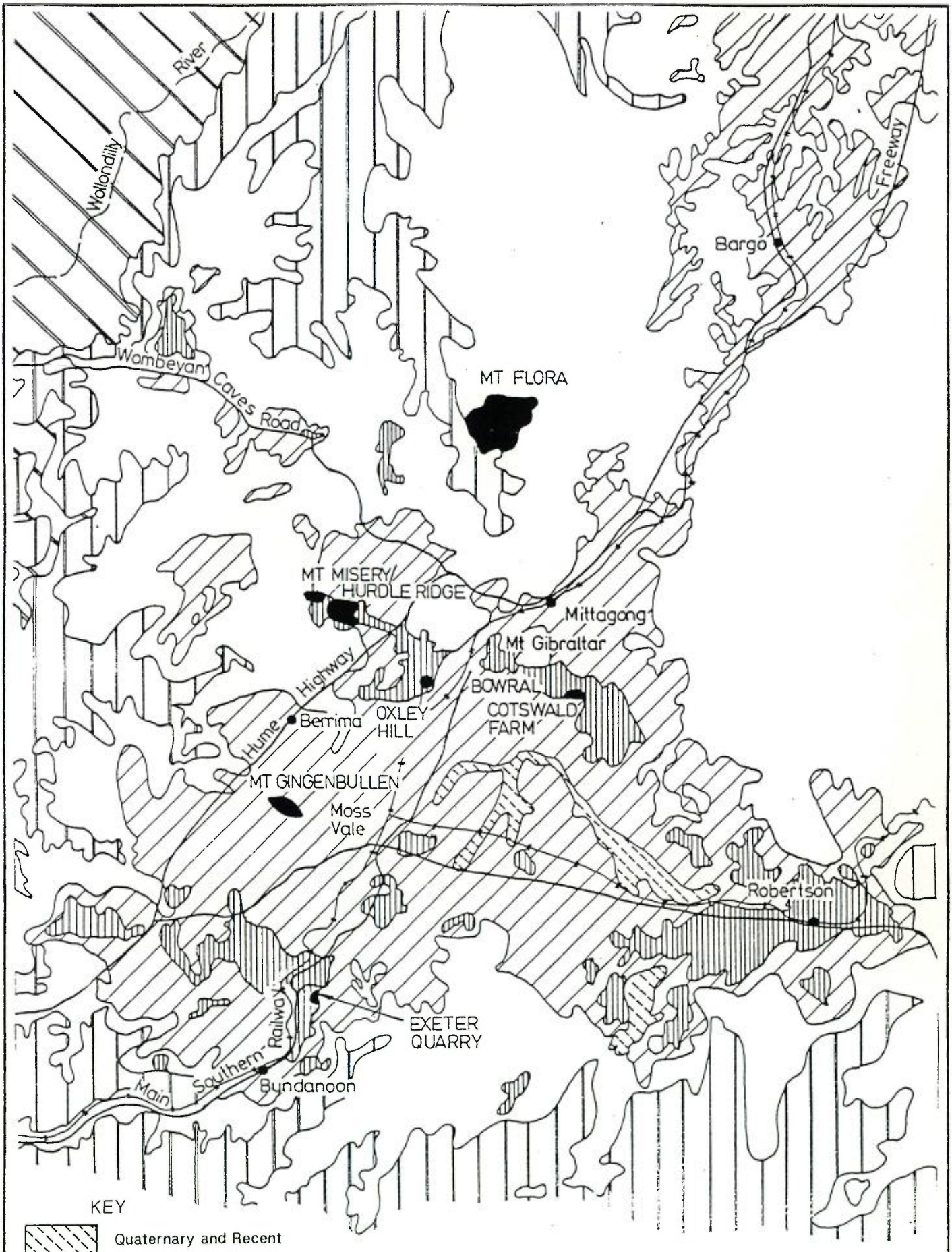


Figure 3:
REGIONAL GEOLOGY AND ALTERNATIVE SITES

SOURCE: Wollongong 1:250000 Geology (Simplified)

Wingecarribee Local Environmental Plan 1989 provides protection to the Exeter hard rock deposit under the planning provisions of the LEP. An objective of this plan is to *"recognise the necessity to ensure identified extractive resources and mineral deposits are not rendered sterile by future development but at the same time to ensure that their subsequent extraction and transportation to market is undertaken in an environmentally acceptable manner".* (Clause 2(l)).

3.2.3 Alternative of Not Proceeding

The proposed extension is considered by Southern Highlands Quarries Pty Limited as an important resource of high quality basalt materials. It represents the optimum alternative for the Company to ensure a continuous supply of high quality raw feed to its plant and ultimately to its dependent customers. The deposit has been recognised as a significant regional and local hard rock resource for development prior to sterilisation from competing land uses.

Should the proposed extension not proceed the Company will need to seek alternative sources of hard rock to supply its existing processing plant. Up to 20 people are directly employed in the Exeter operations and another 20 indirectly employed in subcontract positions. If the development does not proceed the opportunity to provide continued employment for local quarry personnel may be jeopardised.

The extension represents the optimum deposit of high quality aggregate materials that can be worked with minimal impact on the environment. To haul aggregate from more distant sources results in higher transport costs. The longer the haul distance the higher the impacts on public roads and roads users.

To minimise economic and environment costs, the Company has sought access to the extension. The environmental investigations outlined in this document have shown that extraction operations on this site can be conducted with minimal impact on the environment.

DESCRIPTION OF THE EXISTING ENVIRONMENT

4.0 DESCRIPTION OF THE EXISTING ENVIRONMENT

4.1 LOCATION AND LAND OWNERSHIP

The present quarry and proposed extension area are located off Rockleigh Road, approximately 2km by road east of the village of Exeter. Exeter lies between the towns of Bundadoon and Moss Vale in the Shire of Wingecarribee. **Figure 2** shows the location of the proposed extension.

The extension is located on Lot 2, DP 537292, Parish of Sutton Forest which has a total area of 23.4 hectares and is owned by Southern Highlands Quarries Pty Limited. Approximately 6 hectares (25% of the total area) will be disturbed by the proposed development.

The existing quarry is on an adjacent parcel of land, described as Part Portion 102, which is under long term lease to XQ Holdings Pty Limited, Southern Highlands Quarries Pty Limited's parent Company. Processing facilities are located on a 13.9 hectare property on the northern side of Rockleigh Road described as Lot 1, DP 611935, and owned by XQ Holdings Pty Limited.

Land ownership immediately surrounding the proposed extension has been researched by inspection of the records of Wingecarribee Shire Council and is documented in **Table 4.1** and shown on **Figure 4**.

TABLE 4.1
LAND OWNERSHIP

No.	Description Property Title	Owner
1	Lot 2, DP 537292	Southern Highlands Quarries
2	Lot 1, DP 611935	XQ Holdings Pty Ltd
3	Part Lot 102, Sec. 2 751289 "Rockley"	Adoxa Pty Ltd, C.J. Lawson
4	Part Lot A, "Rockleigh"	Nibico Pty Ltd
5	Part Lot 19, "Lantern Hill"	Nibico Pty Ltd
6	Part Lot 4/5, Sec. 1, "Lylen"	R.H. & I.E. Fryer
7	Part Lot 4/5, Sec. 1, "Lylen"	R.H. & I.E. Fryer
8	Pt. 6. Sec. 1, DP 978852	R.H. & I.E. Fryer
9	Pt. 7. Sec. 1, DP 978842	R.H. & I.E. Fryer
10	Lot 1, DP 732123, "Willowbank"	R. & G.H. Kingsford-Smith
11	Lot 1, DP 537292	R. and G.H. Kingsford-Smith
12	Lot 7, Sec. 2, DP 3373 "Merry Hill"	G.A. Beaumont Durnford & J.L. Durnford.
13	Lot 16, DP 239341	J.S. Jefferson

KEY

Exeter Village Zone

Proposed Quarry Extension (includes bund walls)

Residence (owners)

Residence under construction

RAILWAY

FOREST

MIDDLE ROAD

SOUTHERN HIGHLANDS

EXETER

RD ROCKLEIGH

11KV

WERAI

'Lylen' (Fryer)

RD

6

7

8

9

10

33

'Willowbank' (Kingsford-Smith)

Indigo

12

11

ROAD

Transmission

School

'Merry Hill' (Beaumont & Durnford)

(Holmes)

(Jefferson)

13

14

15 (O'Keefe)

30

29

28 (Wailes)

'Ringwod Farm' (Hopkins)

'Romsey Cottage' (Smythe)

Creek

'Good N Windy' (Balding)

16

17

RINGWOOD ROAD

'Misty Lodge' (Seaman)

'Boeing Park' (Marshall)

18

(Marshall)

Reedy

Transmission

132KV

'Uig Lodge' (Becher)

19

'Indigo' (Green Park Pastoral Pty Ltd)

20

MAIN

To Bundanoon

'Rockleigh' (Nibico Pty Ltd)

'Rockley' (Adoxa Pty Ltd)

(Southern Highlands Quarries P/L)

1

Easement

2

3

4

5

Transmission

Easement

Creek

ROAD

Stonequarry

STONEQUARRY

27

Gumtree Gully

26

25

24

23

'Bundalink' (Maidenstone Pty Ltd)

21

Tarah

22

32

31

700

650

630

740

660

640

600

680

SOURCE: CMA 1:25000 Topo Moss Vale and Bundanoon

1011/90338

Figure 4:
LAND OWNERSHIP

0 100 200 300 400 500
metres

TABLE 4.1
LAND OWNERSHIP (CONT'D)

No.	Description Property Title	Owner
14	Lot 17, DP 239341	J.S. Jefferson
15	Lot 132, DP 790655	M.P. & C.D. O'Keefe
16	Lot 23, DP 531784 "Good-N-Windy"	A.M. & P.A. Balding
17	Port. 24, DP 580989, "Misty Lodge"	R.T. & C.Y. Seaman
18	Lot 25, DP 580989, "Boeing Park"	K.H. & S.L. Marshall
19	Part Lot A, "Uig Lodge"	G.F. & E.R. Becher
20	Lot 1/4, DP 740341, "Indigo"	Green Park Pastoral Pty Ltd
21	Lot 1, DP 580958, "Bundalink"	Maidenstone Pty Ltd
22	Lot 2, DP 580958, "Tarah"	M. Hamill
23	Portion 61	B. Woodford
24	Portion 44	B. Woodford
25	Portion 43	B. Woodford
26	Portion 42	C.R. & E.M. Lucas and J.S. & J.I. Powell
27	Lot 2, DP 21182, "Gumtree Gully"	C.R. & E.M. Lucas and J.S., and J.I. Powell.
28	Lot 15, DP 239341	R.J., and R.A., Wailes
29	Lot 131, DP "Romsey Cottage"	L.E. & A Smythe
30	Lot 12, DP 530641, "Ringwood Farm"	J.A. & A.M. Hopkins
31	Portion 45	H. Buchann
32	Portion 63	Maidenstone Pty Ltd
33	Lot B, DP 395847	R.H. & I.E. Fryer

4.2 EXISTING OPERATIONS

4.2.1 Existing Quarry

Southern Highlands Quarries Pty Limited obtained development consent for the existing quarry on Part Portion 102 in April 1985 and has operated this site as follows.

Prior to extraction of basalt, 4m to 6m of overburden comprising clay, soil and loose rock, is stripped on a campaign basis using either scrapers or an hydraulic excavator/rear dump truck combination. Overburden is used in rehabilitation of previously quarried areas. Once emplaced, the overburden is shaped, topsoiled and vegetated, initially with Japanese Millet to provide a quick groundcover, and subsequently with improved pasture species.

Basalt raw feed is extracted using an hydraulic excavator and two 35 tonne off-road rear dump trucks. Due to the fractured nature of the material no drilling or blasting is required at the site with raw feed being readily won using an hydraulic excavator.

The current quarry is mostly screened from the east, south and west by natural topography and to the north by a low bund wall adjacent to Rockleigh Road.

Runoff from existing disturbed areas is conveyed along the quarry floor via a drain cut through the eastern quarry wall to two sedimentation dams located adjacent to an unnamed tributary of Indigo Creek. Clean overflow from the dams discharges to the unnamed tributary which enters Indigo Creek some 600m downstream of the quarry site. A third sedimentation dam is located on the unnamed tributary approximately 300m upstream of its confluence with Indigo Creek.

A series of diversion drains around the perimeter of the quarry convey runoff from disturbed areas to the sedimentation dams.

Material extracted from the quarry is transported along a private haul road, over Rockleigh Road to the existing crushing and processing plant on Lot 1, DP 611935 immediately to the north of Rockleigh Road.

On-site equipment utilised in the quarry is presented in **Table 4.2.**

TABLE 4.2
ON-SITE EQUIPMENT

2 x 35 tonne Volvo rear dump trucks
1 x 2.5m^3 Liebherr hydraulic excavator
1 x 8 tonne diesel water cart
2 x contract Cat 631E Scraper (for overburden material)
1 x contract D7 Bulldozer (overburden shaping)

Extractive operations currently provide direct full-time employment for 4 people. Additional contractors are employed on a casual basis for overburden removal. An environmental officer is also employed full-time to undertake rehabilitation work at the site, maintain the surrounds of the processing plant and tend the Company's native tree nursery.

4.2.2 Existing Processing Plant

Southern Highlands Quarries Pty Limited's processing plant is located on a 13.9 hectare parcel of land on the northern side of Rockleigh Road. Consent for this facility was granted in 1976.

A comprehensive range of quarry products are produced at the processing plant, products including roadbase, stabilised roadbase, concrete aggregate, sealing aggregate and larger diameter rock for railway ballast and rip rap. The processing plant currently operates between the hours of 7:00am and 6:00pm Monday to Friday with plant maintenance being carried out between 6:00am and 6:00pm on Saturdays. No work is permitted on Public Holidays or Sundays.

At present 17 people are permanently employed at the processing plant and administration centre. An environmental officer is also employed at the site to maintain the surrounding landscape and tend to Southern Highlands Quarries Pty Limited nursery which is shared with the existing quarry operation. Native trees and shrubs are propagated at the nursery as part of the ongoing rehabilitation of quarry areas where extraction is completed.

Current production is between 250,000 tonnes and 300,000 tonnes of quarry product per annum. Peak daily sales from the site is approximately 3,000 tonnes with an average daily production from the plant of approximately 1,200 tonnes. Quarry product is sold principally in the Southern Highlands, and outer Sydney and Goulburn regions, with material on a less frequent basis being supplied to the Blue Mountains, Sydney and Southern slopes regions.

Product is supplied to a diverse client base including local Councils, Roads and Traffic Authority, State Rail Authority, civil engineering contractors, concrete plants, local contractors, and landscapers.

4.2.3 Existing Product Haulage

A market destination and haulage route survey for quarry product was undertaken by Southern Highlands Quarries Pty Limited in conjunction with Stapleton and Hallam (traffic consultants) for the period 11/11/91 to 4/2/92. Over this period a total of 2513 loads of quarry product were transported at an average of 52 loads per day. Production rate for this period was equivalent to a yearly production of approximately 271,000 tonnes. A summation of product haulage for the study period is presented in **Table 4.3** and routes shown on **Figure 5**.

As shown in **Table 4.3**, during the survey period approximately 80% of quarry product was transported along Sutton Forest Road with 16% transported along Werai Road and 4% along Ringwood Road. Production levels and haul routes utilised in the above survey period are considered typical for the Exeter quarry. There are no proposals to alter production, product haulage or transport routes.

Southern Highlands Quarries Pty Limited currently makes a road maintenance contribution of 29.3 cents per tonne (indexed) to Wingecarribee Shire Council for the maintenance of these roads. At current production levels a contribution of approximately $80,000 is made annually.

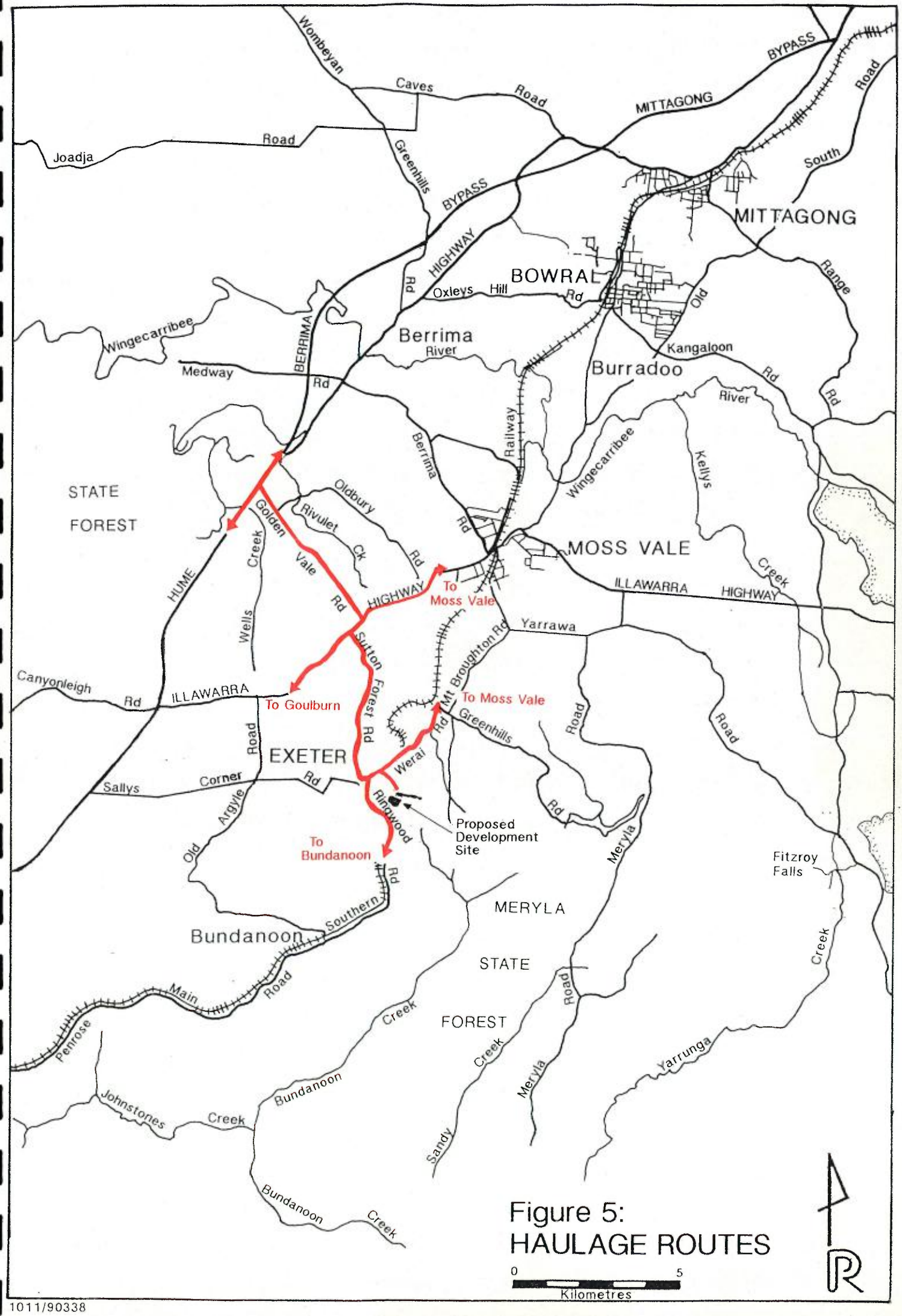


Figure 5: HAULAGE ROUTES

1011/90338

TABLE 4.3
PRODUCT HAULAGE

Route	Loads	Percent
Sutton Forest Road/Golden Vale Road/Hume Highway	1628	65
Werai Road towards Moss Vale	407	16
Sutton Forest Road/Illawarra Hwy to Moss Vale	194	8
Sutton Forest Road/Illawarra Hwy to Goulburn	181	7
Ringwood Road to Bundanoon	103	4
Total	**2513**	**100**

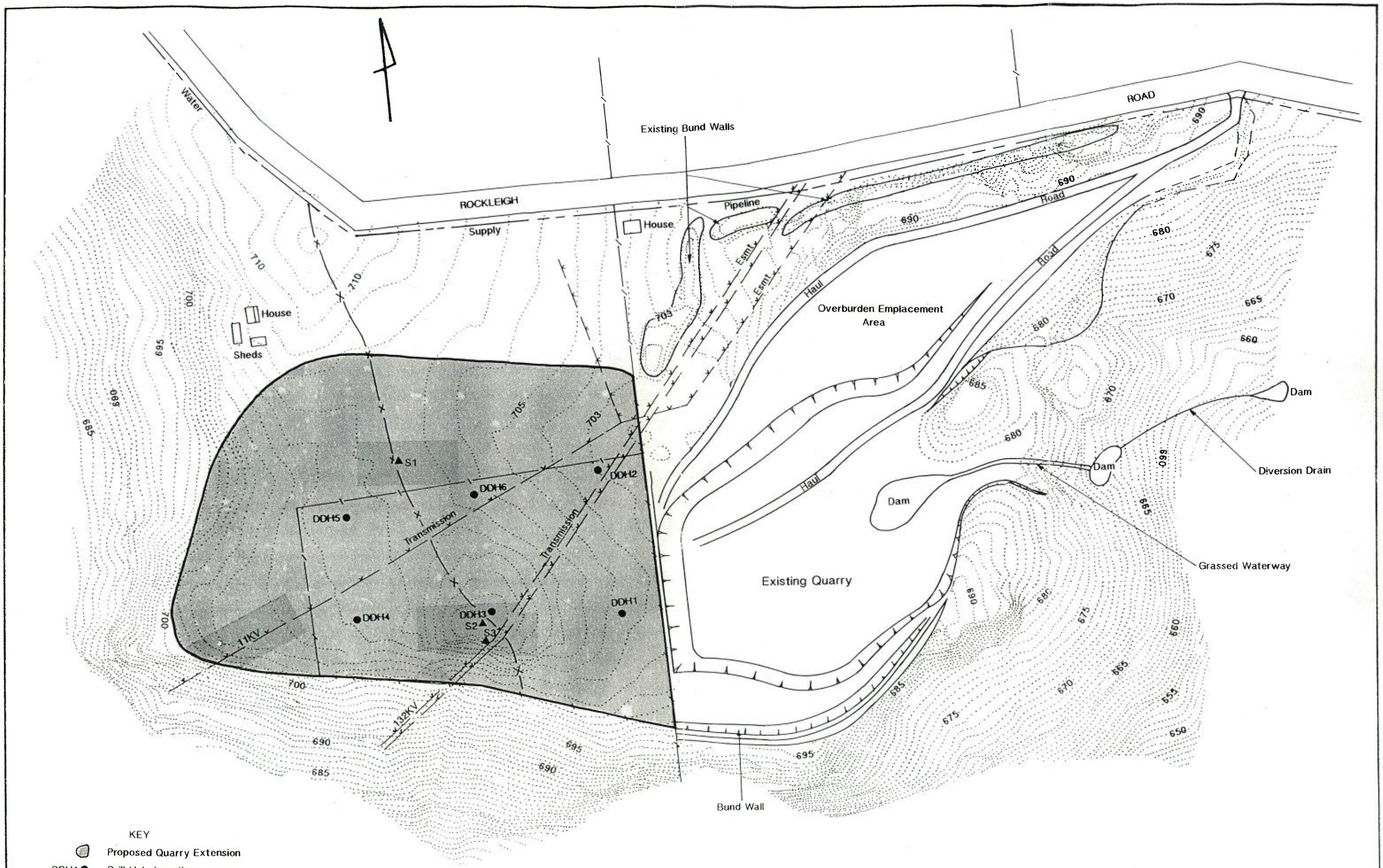
4.3 TOPOGRAPHY AND SLOPES

The topography of the site is shown on **Figure 6**.

The proposed quarry extension is located on a plateau area with elevations ranging from 701m AHD along the southern extraction area boundary to 711m AHD on the crest of a small knoll located in the southern portion of the proposed extraction area.

Most of the proposed extension has gradients ranging from 1.5% to 5%. Average gradients of the knoll sideslopes are in the order of 10% and the southern sideslopes of this area have an average gradient of 30%. The proposed development area is not on Protected Lands as defined by the Department of Conservation and Land Management as having a slope generally greater than 18°.

Indigo Creek is incised within a steep valley area to the south and east of the proposed extension and flows in a general southeasterly direction as shown on **Figure 2**.



KEY

- Proposed Quarry Extension
- DDH1 ● Drill Hole Location
- S1 ▲ Soil Sampling Site
- Localised Catchment Boundary

NOTE: Property Boundaries Shown on Figure 4:

SOURCE: Campbell and Anderson Pty Limited, Bowral

Figure 6: TOPOGRAPHY

0 25 50 75 100
metres

101/90538

4.4 SITE GEOLOGY

In the Exeter area Tertiary basalt lava flows of probable Oligocene age (about 20 million years old) have infilled valleys eroded into older Triassic sedimentary rocks of the Wianamatta Group (about 220 million years old). Subsequent erosion has left remnants of the formerly more extensive basalt flows which now crop out at the edge of plateaux and as isolated hill cappings.

The basalt in the Rockleigh Road area appears to have infilled a former valley but now only the northern side of the valley-infilling basalt is preserved.

Shale and lithic sandstone belonging to the Bringelly Shale of the Wianamatta Group occurs in the valley of Indigo Creek. This unit has been eroded and weathered before Tertiary sediments and basalt flows were subsequently deposited on top.

A thickness of up to 9m of Tertiary sand, clayey sand and clay overlies the Bringelly Shale. Tertiary Basalt up to 37.8m thick, in turn, overlies sediments and the Bringelly Shale and forms the topmost geological unit at the site. The basalt is erosionally truncated to the south and west by the valley of Indigo Creek.

Although a maximum thickness of basalt of 37.8m has been recorded, the top and bottom of the sequence have been extremely weathered and altered. The topmost weathered zone extends to a depth of up to 10m while the lowermost altered zone varies from 1m to 20m thick. The altered zone is usually a black, vesicular, friable material with the white zeolite (chabazite), infilling vesicles. As a result of weathering and alteration only the central core of the basalt is suitable for use as aggregate.

When fresh, the basalt is dark grey to black, fine-grained and dense, with a specific gravity of 2.8kg/m^3. Strong pervasive, closely-spaced jointing effectively fragments the basalt and allows it to be quarried by excavator without the use of explosives. Joint planes are strongly coated with yellow and orange iron oxide and clay produced from the weathered breakdown of the basalt. Weathering rims on quarried boulders, however, extend only a few millimetres into the otherwise fresh basalt.

4.4.1 Extent of Basalt Resource

The basalt has an assymetrical, lensoidal cross-section in a north-south direction. From its maximum thickness of 37.8m near the centre, the basalt thins to zero to the south in the valley of Indigo Creek. This cross-sectional shape continues in an east-west direction forming a lensoidal prism about 750m long until the ridge dies out in both directions. **Figure 7** shows a typical cross section of the basalt in the extension area.

4.4.2 Material Characteristics Related to Quarrying

In most hard rock quarries drilling and blasting is required to economically win hard rock for the manufacture of aggregate. However, in the case of the Exeter basalt this is unnecessary. The presence of closely-spaced, columnar, prismatic

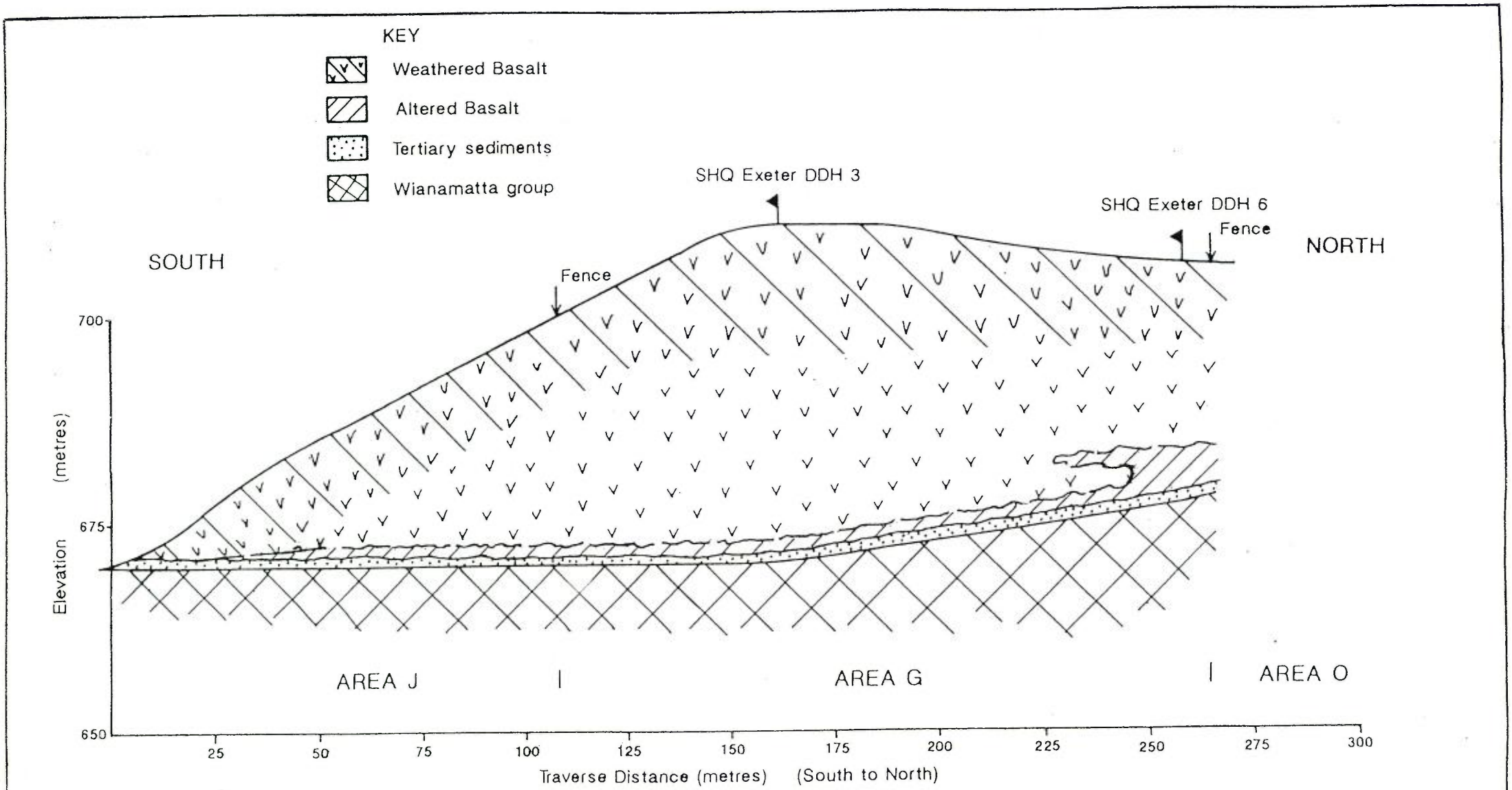


Figure 7:
TYPICAL CROSS SECTION

0 25 50 75
metres

1011/89233

and radial jointing which pervades the entire rock mass, naturally fragments the basalt into easily handled particle sizes negating the need for blasting.

About 97% of the naturally fragmented boulders in the deposit are 30cm diameter or below. An excavator can easily quarry the basalt and load direct into trucks for immediate transportation to the processing plant. Rare boulders up to a metre or more in diameter are not utilised for aggregate production, instead they are rejected and utilised later in rehabilitation.

4.4.3 Resource Use

When crushed the basalt produces a high quality aggregate suitable for surfacing bitumen roads and for the manufacture of concrete. Crushed fines incorporated with the aggregate produce a comprehensive range of prepared road base materials as discussed in **Section 3.1.1**.

A particular characteristic of the aggregate produced from Exeter is its ability to be used to produce concrete with low shrinkage characteristics, a feature not common in most hard rock. In un-reinforced concrete pavements, concrete with low shrinkage characteristics is of particular importance.

4.4.4 Drilling Programme

During November, 1989, six diamond drill holes were drilled in the proposed extension area to determine the extent of the basalt (**Figure 6**). A total of 317.1m was cored, logged and selective horizons sampled for testing. Testing showed the material to be highly suitable for aggregate purposes.

4.5 SOILS

4.5.1 Soil Survey

A soil survey was undertaken within the proposed extension on the 21st January 1991 and detailed soil profile descriptions undertaken on a single toposequence transect (refer to **Figure 6** for sampling site locations).

Soils have been classified into Principal Profile Forms according to Northcote (1979) and an approximate correlation between these classifications and Great Soil Groups has also been noted. Full descriptions of each identified Principal Profile Form is given in **Appendix 2**.

Chocolate Soils (Principal Profile Forms Dr 4.12 and Dr 4.11) occur on the flat plateau area and upper sideslopes of the proposed extension. These soils are characterised by silt loam to light sandy clay loam topsoil material with a depth of 10cm to 30cm. Topsoil material has weak consistence and structure and generally low stone content.

Subsoil material is a dark reddish brown colour and has a clay loam to light clay texture. The subsoil generally has strong consistence and moderate pedality.

4.5.2 Suitability of Soils for Stripping, Stockpiling and Site Rehabilitation

Suitability of soils for stripping, stockpiling and site rehabilitation depend primarily on the textural and structural characteristics of the soil. This determines the soils ability to maintain structure, grade and a friable surface after handling by heavy machinery. In general, soils which are not suitable for stripping and stockpiling are weakly structured, poorly drained or have high sand and/or gravel contents. Pedal soils which have strong consistency are also not suitable because the peds set hard and resist root penetration during revegetation.

Topsoil materials in the proposed quarry extension have few of these negative characteristics and are considered suitable for stripping, stockpiling and use for site rehabilitation.

Subsoil material has strong consistence but the relatively light texture of this material will assist in providing an appropriate plant growth medium for revegetation purposes.

4.6 EXISTING EROSION AND SOIL ERODIBILITY

The proposed quarry extension has a high proportion of groundcover and minimal existing erosion. The low gradient plateau area is well grassed and is not considered to be currently susceptible to rill erosion or to mass movement. There is evidence of minor sheet erosion in the higher knoll area. The steep southern sideslope area is generally well vegetated and stable although an area of active minor erosion and slumping was noted at soil profile 3. Removal of groundcover would result in high erosion hazard in this steep sideslope area and measures to minimise erosion are discussed in **Section 6.2**.

Soil erodibility is determined by a combination of inherent structural, textural and chemical characteristics. The erosion hazard of particular soils varies depending on factors such as soil erodibility, topographic position, rainfall intensity and land management.

In general, soils which are susceptible to sheet erosion, have light texture, weak structure and hardsetting topsoils. The soils within the proposed extension have a friable surface condition, clay loam textures and crumbly shear characteristics. Due to these combined factors it is considered that these soils are not highly susceptible to sheet or rill erosion.

4.7 HYDROLOGY

4.7.1 Surface Drainage

The existing quarry and proposed extension area are bounded to the north by Rockleigh Road to the west and south by Indigo Creek, and to the east by a tributary of Indigo Creek (see **Figure 2**). Rockleigh Road forms the catchment divide between Indigo Creek and an unnamed tributary of Stonequarry Creek.

The tributary of Indigo Creek to the east of the current quarry conveys runoff from the quarry to Indigo Creek via sediment dams.

The proposed quarry extension occupies a plateau which is approximately 30m to 50m above Indigo Creek. Indigo Creek at its confluence with the eastern tributary that drains the existing quarry has a catchment area of approximately 180 hectares which includes a portion of Exeter and adjoining rural residential land.

Within the proposed extension area a knoll with a relief 4m higher than the plateau exists towards the central section of the southern boundary. The knoll connects with a low ridge to form a shallow saddle between the knoll and Rockleigh Road to the north-northwest (see **Figure 6**). The saddle forms a drainage divide separating the proposed extension area into westerly draining and easterly draining sub-catchments.

4.7.2 Groundwater

Groundwater resources in the area are associated with the basalt deposit that forms a fractured rock aquifer. Groundwater within the basalt is principally contained within the more porous and fractured zones of the basalt with groundwater seepage being observed at the interface of the basalt flow and less pervious underlying Wianamatta Group shales within the existing quarry.

Indigo Creek drainage system bounds the proposed extension to the south, west and east with groundwater from the site contributing to flows within the creek system.

The aquifer would have a localised recharge area, bounded to the north by the extent of the basalt flow and a tributary of Stonequarry Creek and to the west, south and east by the Indigo Creek drainage system.

No groundwater bores are known within the immediate vicinity of the proposed extension.

4.7.3 Water Quality

Three water samples were collected from the locations shown on **Figure 8**. These included one surface water sample from Indigo Creek (W1) downstream of the eastern tributary; one from Indigo Creek upstream of the confluence of the tributary (W2); and a sample of surface runoff discharging from the existing quarry (W3) that was taken during wet conditions.

Analysis of water samples was undertaken by Metford Laboratories Pty Limited and results presented in **Table 4.4**.

KEY
Exeter Village Zone
Proposed Quarry Extension (includes bund walls)

RAILWAY
ROAD
WERAI
ROCKLEIGH
FOREST
SUTTON
MIDDLE
ROAD
SOUTHERN
EXETER
EXETER
11KV
Indigo
Transmission
ROAD
Creek
Easement
Stonequarry
STONEQUARRY
ROAD
Transmission
132KV
Easement
Creek
Indigo
Reedy
Transmission
132KV
RINGWOOD
ROAD
MAIN
To Bundanoon

L6 'Lylen' (Fryer)
'Rockleigh' (Nibico Pty Ltd) D2 L5
'Willowbank' (Kingsford-Smith)
School
'Merry Hill' (Beaumont & Durnford)
(Holmes) L4
(Jefferson)
(O'Keefe)
'Ringwood Farm' (Hopkins)
'Romsey Cottage' (Smythe)
(Wailes)
'Good N Windy' (Balding)
'Misty Lodge' (Seaman)
D1
'Boeing Park' (Marshall)
L3
'Boeing Park' (Marshall)
L2
'Uig Lodge' (Becher)
'Indigo' (Green Park Pastoral Pty Ltd)
(Southern Highlands Quarries P/L)
Rockley (Adoxa Pty Ltd)
D3
W3
W2
W1
'Bundalink' (Maidenstone Pty Ltd) L1

740 700 650 630 700 660 700 640 700 650 700 600 680

KEY
L1 Noise Monitoring and Modelling Site
L2 Noise Modelling Site
W1 Water Monitoring Site
D1 Dust Monitoring Site
Residence (owners)
Residence under construction

SOURCE: CMA 1:25000 Topo Moss Vale and Bundanoon

Figure 8: MONITORING SITES

0 100 200 300 400 500 metres

1011/90338

TABLE 4.4
WATER QUALITY

Location	pH	Conduct. µs/cm	TSS mg/L	Ca+ mg/L	Cl⁻ mg/L	Fe mg/L (Total)
11/6/91						
W1	7.1	140	16	16.2	17.5	1.89
W2	7.1	140	16	16.2	17.5	2.39
10/7/91						
W1	7.1	292	33.6	-	28	2.6
W2	7.0	250	34.5	-	47	2.38
W3	7.6	268	27.0	-	74	2.13

The results of analysis on water from the tributary to, and Indigo Creek (W1 and W2) with the exception of iron, compare favourably with Australian drinking water quality criteria.

Swamp W3 from the quarry floor with the exception of iron, is within the requirements of the Australian drinking water quality criteria.

Based on the analysis performed, both the groundwater and Indigo Creek water would be suitable for stock, irrigation, and with minor treatment, human consumption.

4.8 METEOROLOGY

4.8.1 Rainfall

The Exeter area experiences a mild climate typical of the Southern Tablelands. There is a spring to summer dominance in the rainfall pattern with greater storm activity in the summer months and protracted rainfall throughout winter.

Rainfall data for the nearest official meteorological station at Bowral approximately 25km to the north of Exeter, is shown in **Table 4.5**.

TABLE 4.5
RAINFALL
(mm)

	J	F	M	A	M	J	J	A	S	O	N	D
Average	89	84	112	78	75	91	42	63	58	85	94	71
No. of Raindays	14	13	13	11	12	11	10	10	11	13	13	12

The mean rainfall for the year is 942mm which falls on a mean of 143 days per year.

4.8.2 Temperature and Humidity

Mean daily maximum and minimum temperatures are available for Burradoo which is 15km north of Exeter and are shown in **Table 4.6.** Temperatures are cold during the winter months with frosts likely to occur between April and October. Summer temperatures are warm; the mean daily maximum and minimum in January, the hottest month, being 24.9°C and 12.9°C, respectively.

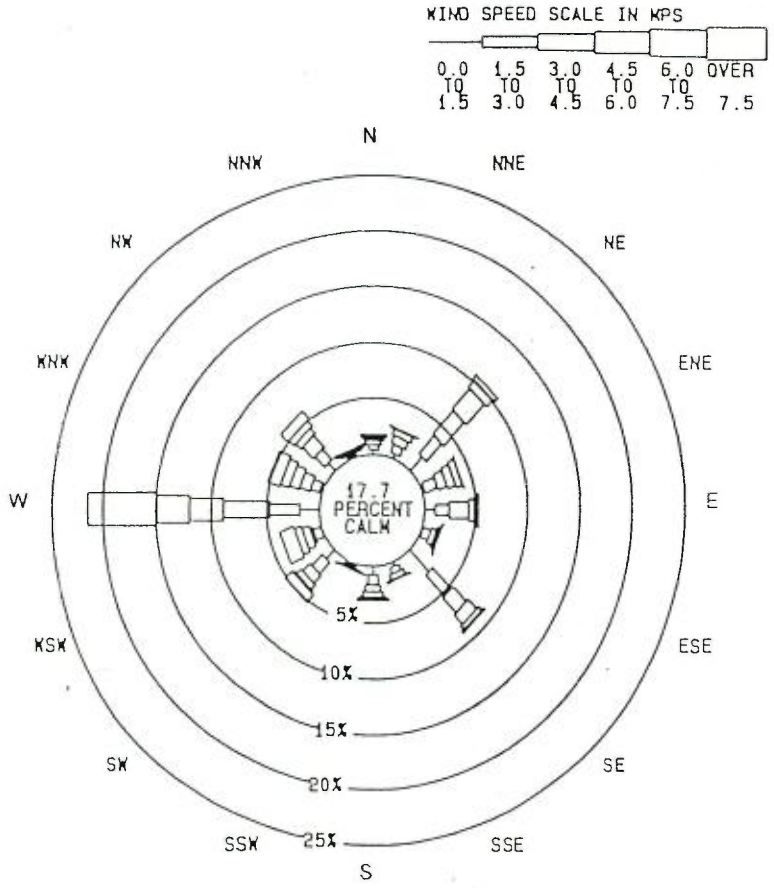
TABLE 4.6
TEMPERATURE
(°C)

	J	F	M	A	M	J	J	A	S	O	N	D
Mean Daily Minimum	12.9	13.0	11.1	6.7	4.1	2.4	0.6	1.9	3.9	6.8	8.9	11.0
Mean Daily Maximum	24.9	24.4	22.4	19.7	15.4	12.5	11.9	13.3	15.8	19.1	21.3	24.4

The mean relative humidity for the year is 73% (9:00am readings) and 53% (3:00pm readings).

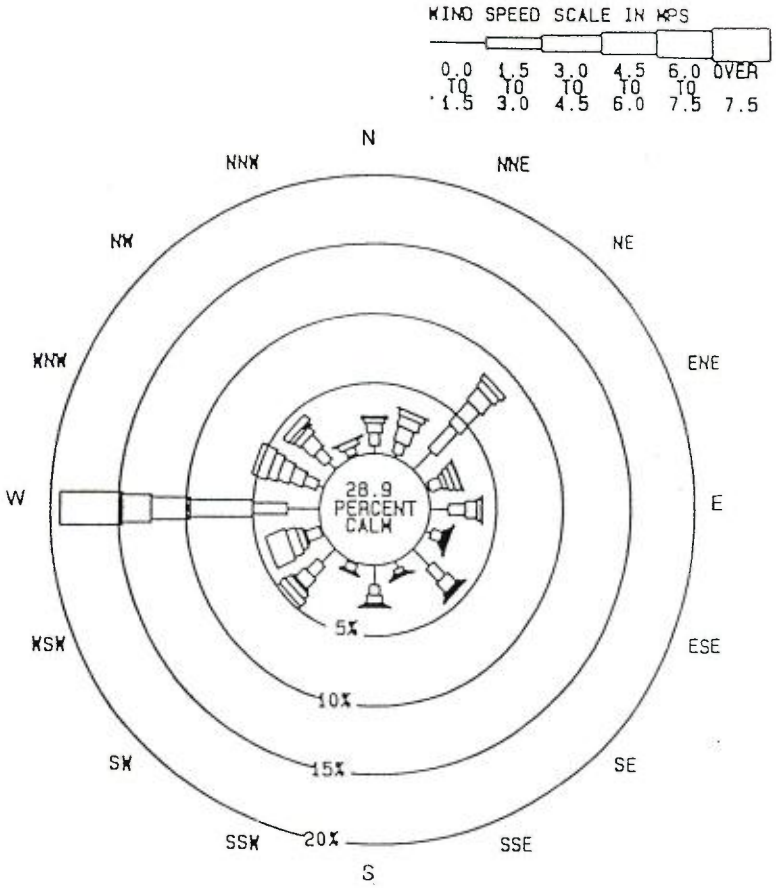
4.8.3 Wind Speed and Direction

Figure 9 illustrates average wind speed and direction for Bowral.



DISTRIBUTION OF WINDS
FREQUENCY OF OCCURRENCE IN PERCENT
BOWRAL 1967-1984 3PM

9am



DISTRIBUTION OF WINDS
FREQUENCY OF OCCURRENCE IN PERCENT
BOWRAL 1967-1984 9AM

3pm

Figure 9: WIND SPEED AND DIRECTION

Source: Nigel Holmes and Associates (12 years of records - Bowral)

1011/90338

In Summer (January) the prevailing winds are from the eastern quadrant strengthening in the afternoon. Winds from the west are predominant for about 12% of the time, occasionally (2%) exceeding 30km/hour.

Westerly winds prevail in the winter months for approximately 56% of the mornings and 63% of the afternoons. In the afternoon, wind speeds exceed 30km/hour for 11% of the time with winds from other directions being light and variable.

In autumn (April) and spring (October), winds are relatively transitional between the winter and summer dominant wind directions. Winds from the west prevail in both seasons, occasionally exceeding 30km/hour.

4.8.4 Air Quality

From the edge of the excavation, the proposed extension is approximately 550m from the boundary of the village of Exeter.

Existing air quality data were recorded by Metford Laboratories at three locations adjacent to the existing quarry and proposed extension. Sampling locations are shown in **Figure 8** and results are presented in **Table 4.7**.

TABLE 4.7
DUST MONITORING

Location	Period	Insoluble Solids (g/m^2/month)	Ash (g/m^2/month)	Combustible Matter (g/m^2/month)
D1	1/2–1/3/91	0.84	0.60	0.24
	1/3–3/4/91	0.62	0.47	0.15
	3/4–8/5/91	0.31	0.16	0.15
D2	1/2–1/3/91	0.99	0.72	0.27
	1/3–3/4/91	0.63	0.49	0.14
	3/4–8/5/91	0.53	0.39	0.14
D3	1/2–1/3/91	0.94	0.68	0.26
	1/3–3/4/91	0.62	0.42	0.20
	3/4–8/5/91	0.59	0.45	0.14

Typical dust deposition rates in rural areas have been measured in the range of 1.17 to 1.95g/m^2/month (Senate Select Committee on Air Pollution, 1969). Deposition rates recorded at Exeter are typically less than 1g/m^2/month.

These results were recorded over a period when the existing quarry was fully operational and are well below dust deposition rates that could be expected in rural areas. The results presented in **Table 4.7** demonstrate that the existing quarry operations do not have a significant impact on the air quality of Exeter and its surrounds.

There are no measurements of either long-term or short-term dust concentrations in the area. On the basis of a site inspection, a review of existing land use and dust deposition data presented in **Table 4.7**, Nigel Holmes and Associates (**Appendix 3**) estimated that the average annual dust concentration would be unlikely to exceed 20$\mu g/m^3$.

4.9 FLORA AND FAUNA

The site has been extensively cleared for the purposes of grazing with only scattered trees retained to the north along Rockleigh Road. There is a pocket of remnant vegetation along Indigo Creek to the southwest of the extension. Eucalyptus species observed in the vicinity of the site include Stringybark (**Eucalyptus globoidea**), Ribbon Gum (**Eucalyptus viminalis**) and Yellow Box (**Eucalyptus melliodora**).

The open grassland has been improved for grazing with suitable pasture grasses which are generally introduced species. The history of grazing and the absence of a shrub layer results in the site having low habitat value for native fauna species.

A wombat burrow exists on the southern side of the knoll (see **Section 4.3** and **Figure 6**) however the burrow appears to be at present inactive.

4.10 EXISTING BACKGROUND NOISE ENVIRONMENT

Wilkinson Murray Pty Limited (1992) measured existing noise levels at nearest residences surrounding the proposed quarry extension in January 1992. A full description of noise monitoring procedure and results are given in **Appendix 4** and summarised below.

4.10.1 Monitoring Procedure and Locations

Background noise monitoring was undertaken at four residential locations not associated with the development surrounding the proposed quarry extension during the period from January 2, 1992 to January 9, 1992. Monitoring locations chosen are listed below and shown on **Figure 8**.

* Location L1 "Bundalink" residence located approximately 1200m east from of the proposed quarry.

* Location L4 "Merry Hill" residence located approximately 550m from the western end of the proposed quarry.

* Location L5 "Rockleigh" residence located approximately 1000m north of the proposed quarry.

* Location L6 "Lylen" residence located over a kilometre to the north of the proposed quarry and set back approximately 35m from Werai Road.

The existing quarry ceased operations during the Christmas/New Year period and recommenced operations on the 6th January 1992. Measured noise levels between January 2, 1992 and January 9, 1992 are representative of ambient levels with and without current quarrying and processing operations. Further measurements were later carried out at "Rockleigh" on 27th November 1992 after noise control measures had been implemented at the processing plant.

Ambient noise measurements were made using Environmental Noise Loggers which recorded L_{A1}, L_{A10}, and L_{Aeq} noise levels at 15 minute sample intervals on a continuous basis throughout the monitoring period. The L_{A1}, L_{A10}, and L_{A90} are those noise levels exceeded for 1%, 10% and 90% of the sample time, respectively. The L_{Aeq} noise level is the Equivalent Continuous Noise level over the sample period. The L_{A90} noise level is generally adopted as the ambient background noise level for impact assessment purposes.

4.10.2 Monitoring Results

Monitoring results were affected by frequent bouts of heavy rain and winds greater than 1.5m/s during the measurement period. Wilkinson Murray Griffiths Pty Limited report that only measurements recorded on the 3rd, 7th and 8th January 1992 were during calm, fine weather conditions and hence are suitable for utilisation for noise impact assessment purposes.

Measurements taken on Friday 3rd January, 1992 are considered representative of existing background noise levels without the current quarry and processing plant operating. Existing noise levels with the current quarry and processing plant operating are indicated by measurements during Tuesday 7th and Wednesday 8th January, 1992. However, measurements made on 27th November at "Rockleigh" were used to indicate noise levels with the current operations at this location.

Complete noise survey results are graphed on Figures 3 to 35 of **Appendix 4**. The average minimum L_{A90} background noise levels at each monitoring location with and without existing operations are given in **Table 4.8**.

TABLE 4.8
EXISTING BACKGROUND NOISE LEVELS

Monitoring Location	Average Minimum L_{A90} Background Noise Level – dB(A)	
	Without Current Operations	With Current Operations
L1–"Bundalink" Residence	26	26
L4–"Merry Hill" Residence	25	24
L5–"Rockleigh" Residence	24	43
L6–"Lylen" Residence	30	28

Note:

In some cases, the background noise levels measured with the quarry and processing plant operational were lower than those measured without operations. These results therefore indicate that quarry operations have little or no effect upon the ambient noise environment in these areas and that the lower levels were due to fluctuations in ambient background noise levels.

The results are indicative of the whole area surrounding the quarry. The background noise levels measured at "Merry Hill" can be taken as applying to the Jefferson residence currently under construction and the nearby school.

4.11 VISUAL ASPECTS

4.11.1 Regional Scenic Quality

The proposed development site is a relatively level plateau bordered by steep to hilly terrain which is common in the Southern Tablelands area. It is cleared of native vegetation and utilised for grazing purposes. Pockets of natural vegetation occur along creek lines and in scattered groves. These contrast with the interspersed grazing areas, ornamental plantings, and scattered residences.

Generally, panoramic outlooks are limited by the topographic irregularity of more elevated areas and the extensive groves of hedges and windbreaks that border the rural properties.

4.11.2 Visual Prominence

Aerial and on ground views of the site are shown on **Plates 1** to **4**. The plateau of the proposed development site is not elevated above surrounding residences and public viewing areas and is not prominent.

It can be seen from residences on the southern and western sides of Indigo Creek (which also have views of the existing quarry), from Rockleigh Road, and from "Rockleigh" to the north (see **Plate 1**). **Figure 10** shows the location of sight lines and **Figures 10A** to **10C** show existing sight lines when viewed from various vantage points around the site.

Exeter village does not have views of the existing quarry or proposed development site. Some residences at the eastern end of School Lane can see the site but these views are generally partly obscured by tree stands.

Some views of the site are possible from the Main Southern Railway south and west of the site where the line is elevated and unobscured by vegetation stands.

The visual prominence of the existing quarry will reduce as rehabilitation of worked out areas is completed. The Company has successfully rehabilitated its previous quarry site further to the south on Part Portion 102. This land has been completely revegetated and returned to grazing and all significant signs of former quarrying operations have been removed (see **Plate 4**).

4.12 ABORIGINAL PREHISTORY

An archaeological survey of the proposed extension and surrounding area was undertaken by Matthew Barber of Resource Planning Pty Limited in November, 1992. No artefacts were recorded within the proposed extension.

In an earlier archaeological survey of the existing quarry undertaken by Elizabeth Rich in 1984 one isolated artefact was found under the transmission line easement adjacent to Rockleigh Road, and six artefacts were located on the eastern side of the confluence of Indigo Creek and an unnamed tributary that drains the current quarry area. This site was relocated and observed to be intact during the 1992 survey. The site is well removed from quarry disturbance and is fenced off from the quarry area. The isolated artefact below the tranmission line, however, was not relocated during the survey.

The archaeologists report is provided in **Appendix 5.**

4.13 ZONING

The proposed extension is zoned Rural 1(a) in the Shire of Wingecarribee Local Environmental Plan 1989 which permits extractive industry with the Consent of Council (see **Figure 11**). Land to the south is zoned Rural 1(c)–Rural (Small Holdings).

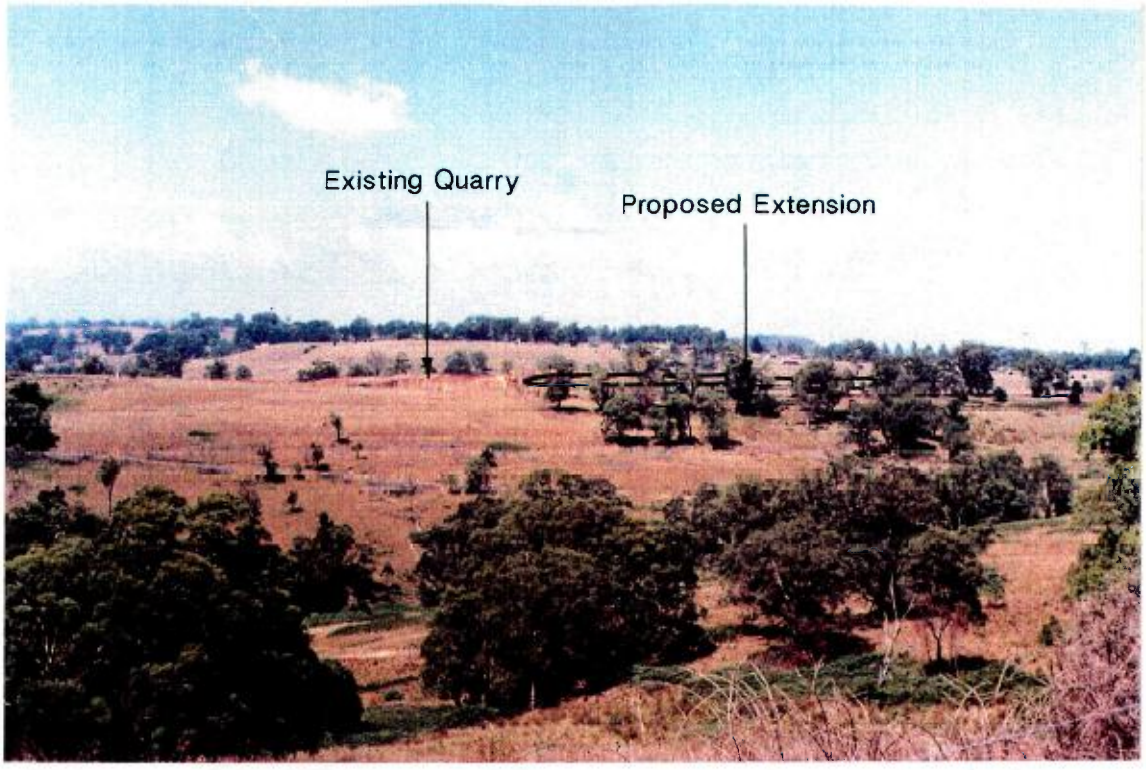


PLATE 1: View of existing quarry and proposed extension from 'Rockleigh'.

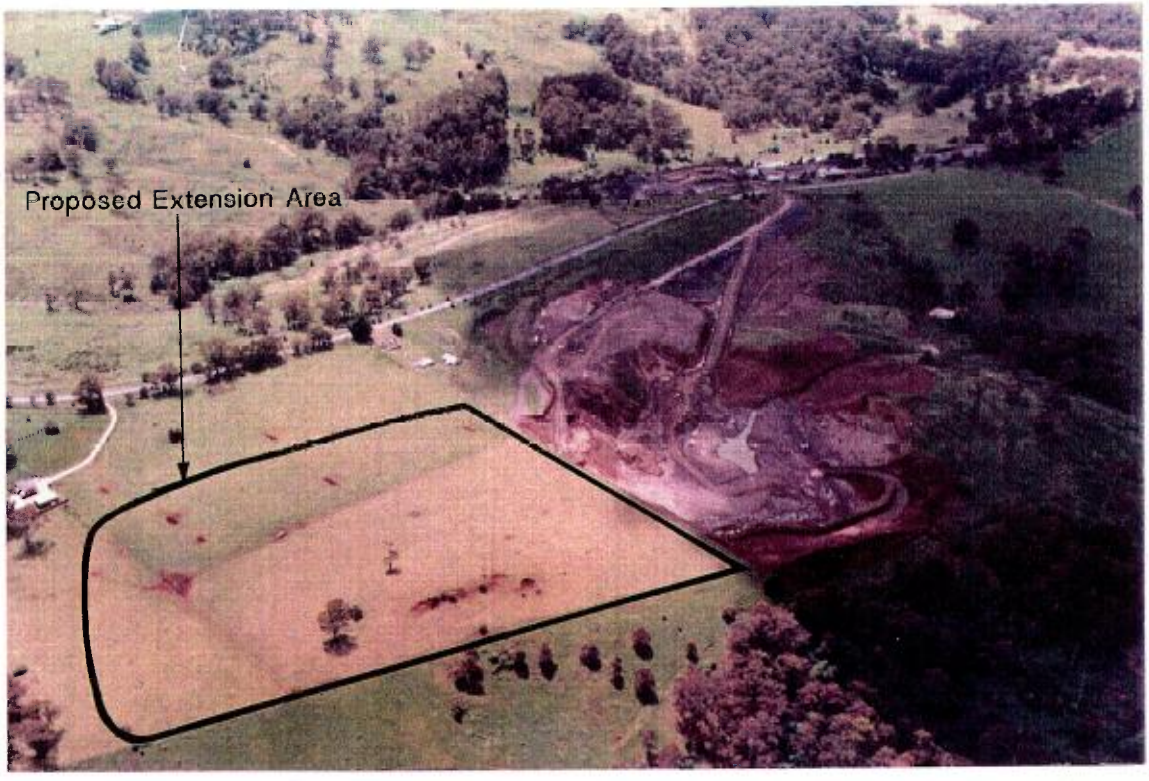


PLATE 2: Aerial view of proposed extension area including bund wall.

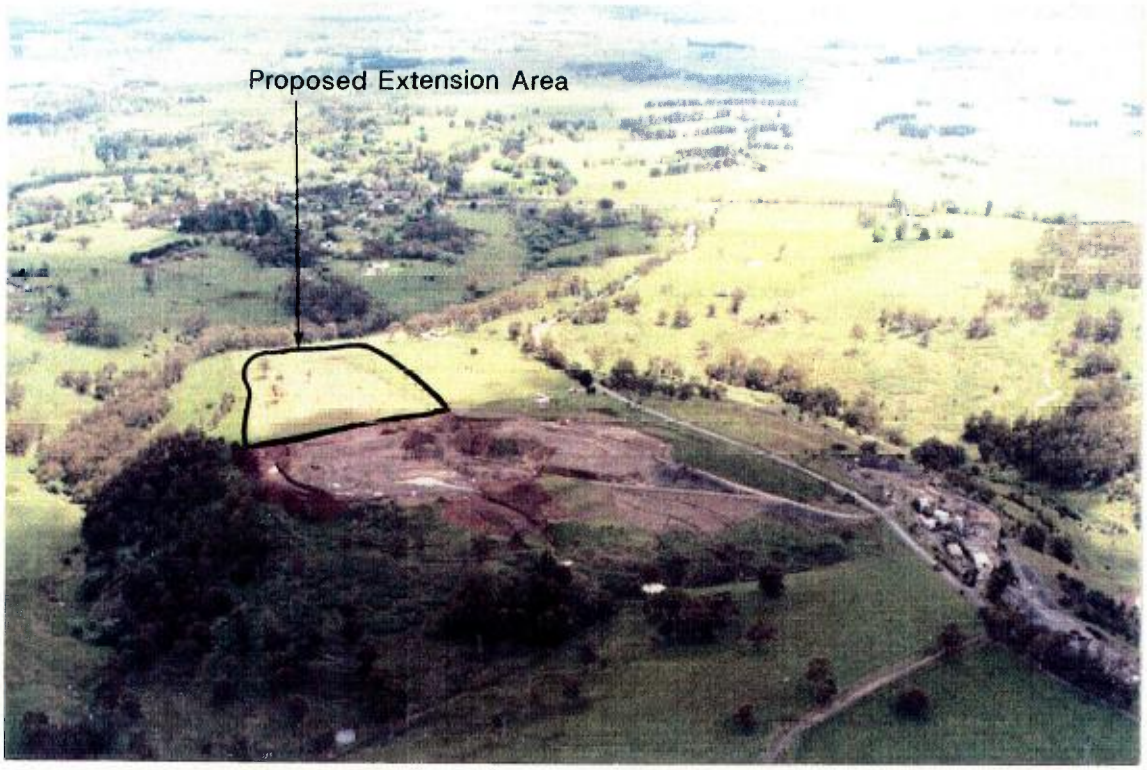


PLATE 3: Aerial view of existing quarry and extension viewed east to west showing existing processing facilities (right foreground), Rockleigh Road, and Exeter Village (background).

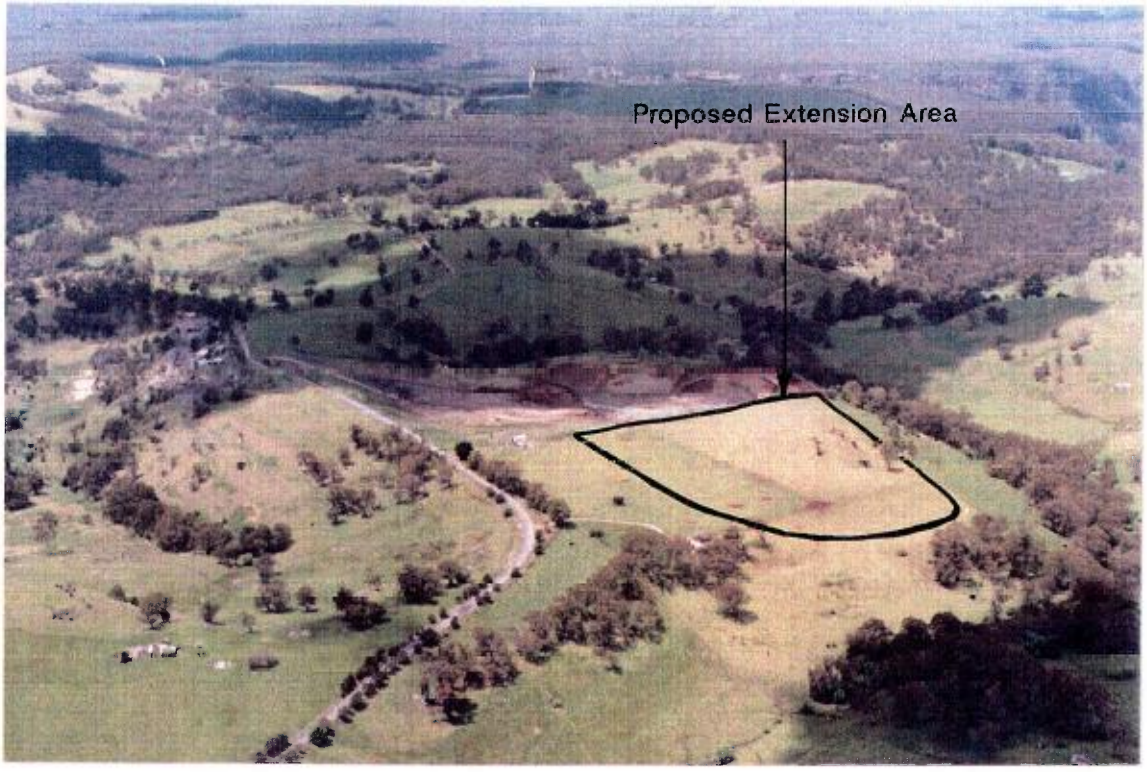


PLATE 4: Aerial view of existing quarry and extension viewed from west to east showing Company's previous quarry now completely rehabilitated (background).

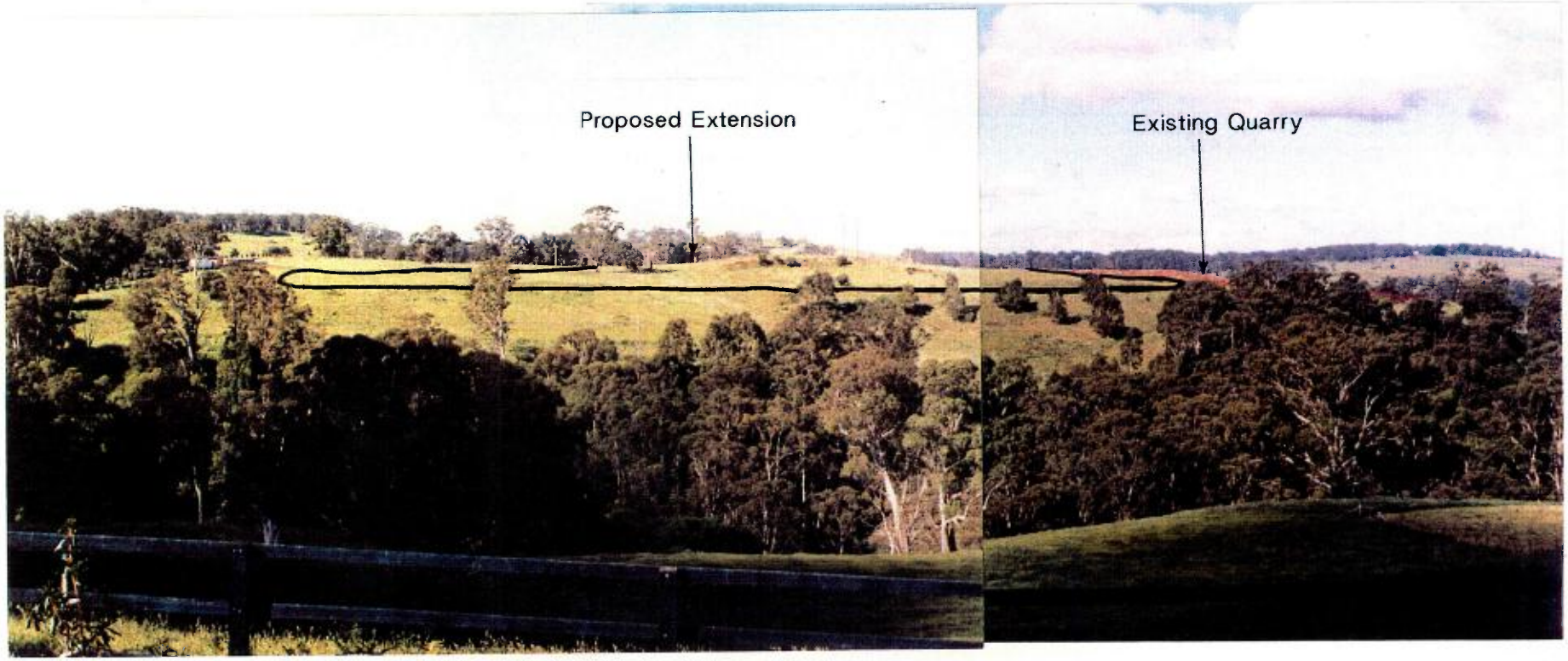


PLATE 5: View of existing quarry and proposed extension from 'Boeing Park'.

KEY
Exeter Village Zone
Proposed Quarry Extension (includes bund walls)

KEY:
Residence (owners)
Residence under construction
Visual Transect Location
Open Forest

Rural/Residential
Grazing
Grazing
Rural/ Residential

'Lylen' (Fryer)
'Rockleigh' (Nibico Pty Ltd)
'Willowbank' (Kingsford-Smith)
School 'Merry Hill'
(Beaumont & Durnford)
(Holmes)
(Jefferson)
(O'Keefe)
'Ringwood Farm' (Hopkins)
'Romsey Cottage' (Smythe)
(Southern Highlands Quarries P/L)
'Rockley' (Adoxa Pty Ltd)
(Wailes)
'Good N Windy' (Balding)
'Misty Lodge' (Seaman)
'Boeing Park' (Marshall)
'Boeing Park' (Marshall)
'Uig Lodge' (Becher)
'Indigo' (Green Park Pastoral Pty Ltd)
'Bundalink' (Maidenstone Pty Ltd)

EXETER
SOUTHERN FOREST
MIDDLE ROAD
23a
RAILWAY
WERAI ROAD
ROCKLEIGH ROAD
RINGWOOD ROAD
MAIN ROAD
Transmission
Indigo
Reedy
Creek
Easement
Stonequarry
132KV
740
700
660
650
640
630
600
680

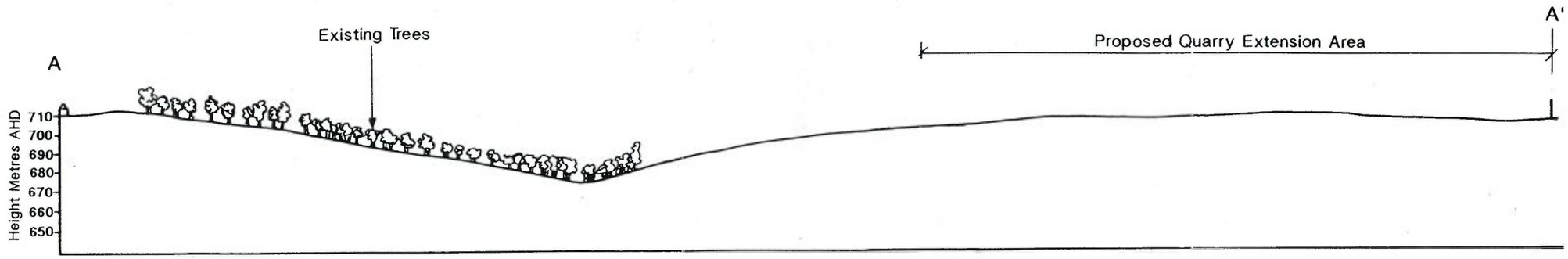
SOURCE: CMA 1:25000 Topo Moss Vale and Bundanoon

To Bundanoon

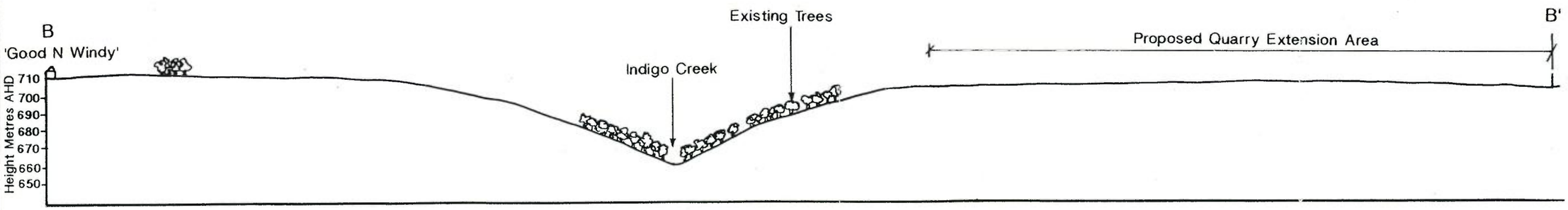
Figure 10:
VISUAL ENVIRONMENT

0 100 200 300 400 500
metres

1011/90338



TRANSECT A - A'



TRANSECT B - B'

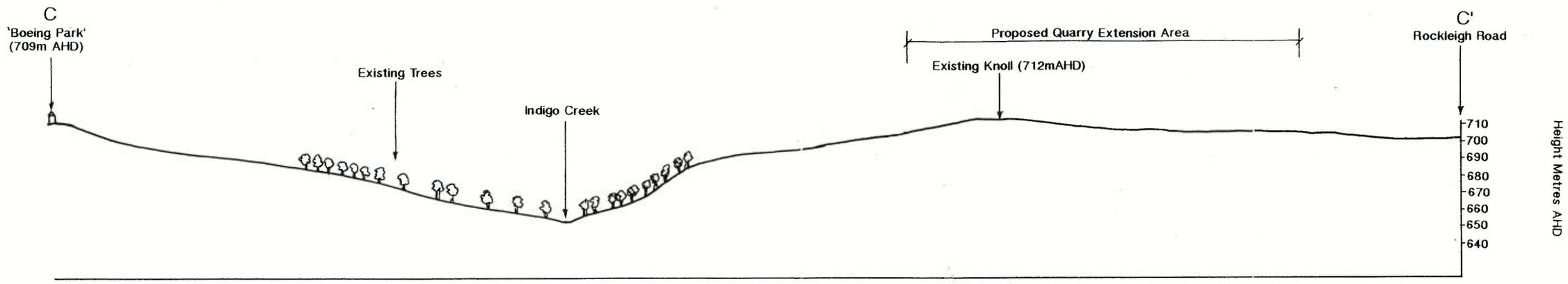
Horizontal Scale
0 25 50
metres

metres 30 0
Vertical Scale

NOTE: Location of Transects Shown on Figure 10

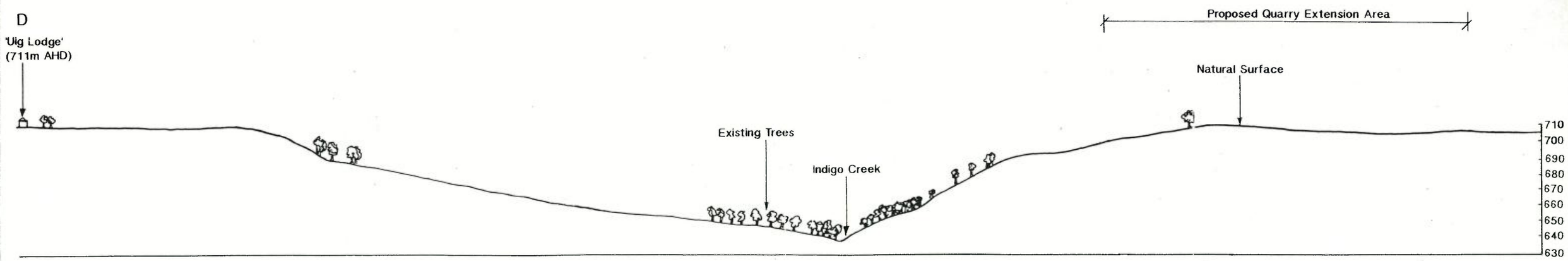
Figure 10(a):
EXISTING
VISUAL TRANSECTS

1011/90338



TRANSECT C - C'

D'



TRANSECT D - D'

Horizontal Scale

0 25 50
metres

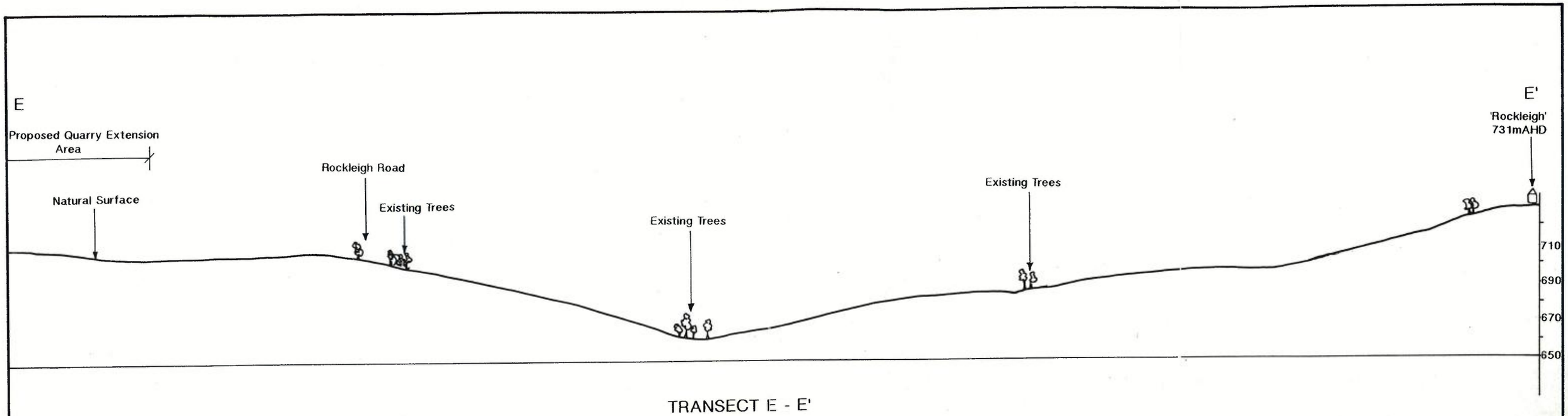
metres 30 0

Vertical Scale

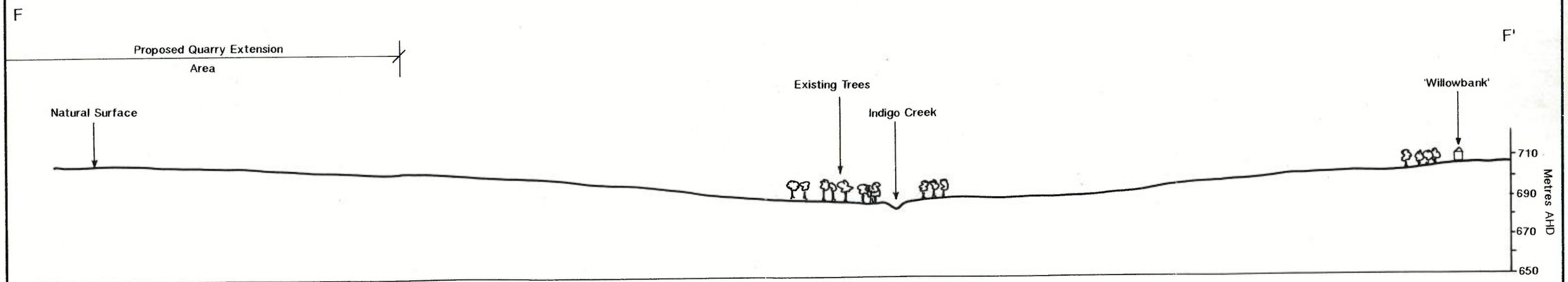
NOTE: Location of Transects Shown of Figure 10

Figure 10(b): EXISTING VISUAL TRANSECTS

1011/90338



TRANSECT E - E'



TRANSECT F - F'

Note: Location of Transects Shown on Figure 10

Figure 10(c):
EXISTING VISUAL TRANSECTS

1011/90338

Land subject to the development application is recognised as containing significant extractive materials and is protected under Clause 39 of the Local Environmental Plan as shown on **Figure 11**.

Clause 39 requires the following:

"(2) A person shall not carry out any development on land to which this clause applies without the consent of the council.

(3) The council shall not consent to the carrying out of development on land to which this clause applies otherwise than for the purpose of:

(a) Extractive industries and associated purposes.

(b) Agriculture and associated purposes.

(c) Local roads, or

(d) Home industries,

without the concurrence of the Director (of Planning).

(4) In deciding whether to grant concurrence under subclause (3), the Director shall take into consideration the following matters:

(a) The impact the proposed development, if carried out, would have on the availability of extractive materials; and

(b) Whether the benefit to the community of the proposed development, if carried out, is greater than the costs to the community of refusing consent, redesigning or relocating the development or rendering the extractive materials unavailable.".

Land zoned Exeter Village is located approximately 550m west of the proposed extension.

4.14 LAND USE

4.14.1 Residential

Exeter Village is located 550m at its closest point west of the proposed extension. An urban land review undertaken by Council in 1988 found that Exeter had experienced an inconsistent growth in the number of building applications for dwelling houses, averaging 11 applications per year since 1980 and a smaller number of land transfers. The study found that there was substantial capacity within the village area for urban expansion far beyond the projected growth for the next ten years.

KEY

Exeter Village Zone

Proposed Quarry Extension (includes bund walls)

KEY

Land containing extractive material (Clause 39 Wingecarribee LEP)

1(a) 1(a) Rural 'A'

1(c) 1(c) Rural (Smallholdings)

1(a)

1(c)

Boundary of 1(a) and 1(c)

EXETER

RAILWAY ROAD

WERAI ROAD

ROCKLEIGH ROAD

FOREST ROAD

MIDDLE ROAD

SUTTON SOUTHERN EXETER

11KV

Indigo Creek

Transmission ROAD

132KV

Transmission Easement

Stonequarry Creek ROAD

STONEQUARRY

Stonequarry

Easement

RINGWOOD ROAD

Creek

Reedy

Transmission

MAIN ROAD

To Bundanoon

730

740

700

660

630

640

650

680

600

SOURCE: CMA 1:25000 Topo Moss Vale and Bundanoon

1011/90338

Figure 11:
LAND ZONING

0 100 200 300 400 500
metres

4.14.2 Rural-Residential

Beyond the village area, on the eastern side of the railway, there are a number of rural-residential dwellings as shown on **Figure 4**. Many are located on small acreages and serve more as retreats or hobby farms, while others have substantial acreages and are farming enterprises. The number of rural-residential dwellings is increasing due to the attractiveness of the area and climate, proximity to Sydney and Wollongong and the increasing interest from the community in a rural life style.

4.14.3 Agriculture

The principal land use on the site and surrounding areas is cattle grazing. The land has a Class III classification under the Department of Agriculture's agricultural land suitability scale. The requirements of this class of land is that any pastures destroyed in the process of the proposed development need to be re-established at least to the standard of the existing pasture. Southern Highlands Quarries has extensive experience in pasture re-establishment in this area as demonstrated by its rehabilitation of the worked out quarry to the south to high quality grazing land.

Southern Highlands Quarries runs stud Charolaise and Hereford cattle on the proposed extension. In addition, the owner of Part Portion 102, has grazing rights to those parts of the property not directly used for quarrying or related activities.

Dust and noise from quarry operations have had no apparent effects on these adjoining grazing activities.

4.15 PUBLIC UTILITIES

Public utilities in the vicinity of the site are shown on **Figure 6**. These include power transmission lines, water supply, and telecommunications lines.

4.15.1 Electricity

The proposed site is traversed by a 11kV power line which services the immediate local area and a 132kV transmission line with a 30m wide easement which forms part of the major 132kV connection between the Fairfax Lane Substation and Pacific Power Supply Point at Goulburn. Illawarra Electricity has advised that towards the end of 1992, the 132kV transmission line is to be downgraded to a 33kV line (Pers.Comm. Frank Phillipson (29/9/92)).

4.15.2 Water Supply

The water main from Wingecarribee Shire Council's water pumping station off Stonequarry Creek parallels the southern boundary of Rockleigh Road in the vicinity of the processing plant as shown on **Figure 6**.

4.16 ROADS AND TRAFFIC

4.16.1 Road Network

The proposed development will not result in any increased traffic on public roads from that already existing.

Figure 5 shows the main transport routes used by traffic associated with the processing plant. These are:

(a) Exeter Road, Sutton Forest Road/Golden Vale Road/Hume Highway.

(b) Exeter Road/Sutton Forest Road/Illawarra Highway–north and south.

(c) Werai Road/Mount Broughton Road/Yarrara Road/Argyle Street (Moss Vale).

Exeter Road passes under the railway line to join Middle Road at a large open intersection in Exeter Village before joining Sutton Forest Road (Main Road 569).

The railway underpass has recently been realigned and ungraded by Wingecarribee Shire Council. A significant proportion of the materials used in the upgrading was contributed by Southern Highlands Quarries Pty Limited.

4.16.2 Traffic Flows

Daily traffic flows on these roads recorded by Council and the Roads and Traffic Authority for the most recent year available are listed in **Table 4.9.**

TABLE 4.9
AVERAGE DAILY TRAFFIC FLOW
(VEHICLES/DAY)

Road	Location	Traffic Flow	Year
MR569	Sutton Forest Road, 100m east of SH25	1440	1988
MR569	At Railway Bridge, Exeter	483	1986
MR569	2km north of Bundanoon	1863	1986
Werai Rd	100m north of Rockleigh Rd	1303	1990
Werai Rd	50m south of Rockleigh Rd	830	1990
Werai Rd	100m south of Middle Rd, Exeter	1139	1989
Golden Vale Rd	Midway	291	1991
Ringwood Rd	150m north of Middle Road, Exeter	1296	1989
Middle Rd	At Exeter Post Office	779	1989

Note: MR – Classifled main roads.

Upgrading proposals planned by Wingecarribee Shire Council as a result of a local traffic survey include:

1. The design of a traffic management scheme on Ringwood Road from the underpass to Norwood Street which limits traffic speeds, improves sight distances at the School Lane junctions, and improves pedestrian safety across Ringwood Road. As discussed in **Section 4.16.1**, the railway underpass has been subsequently realigned and reconstructed with a substantial part of the cost of works being supplied by Southern Highlands Quarries.

2. A design for the intersection of Bundanoon Road and Middle Road within Exeter village which improves sight distances, limits traffic conflicts and improves pedestrian safety across Bundanoon Road.

4.17 SOCIO-ECONOMIC ENVIRONMENT

Attractiveness of the Southern Highlands environment, coupled with its proximity to Sydney and Wollongong has lead to the increasing popularity of the area and subsequent increase in demand for small rural holdings and rural retreats. Over the 1987-1992 period, Wingecarribee Shire experienced substantial growth, of which almost 80% was derived from migration.

In 1976 Wingecarribee Shire had a population of 21,340 and has experienced a reasonably constant growth rate of approximately 2.8% per year. Shire populations of 24,484 and 28,187 were recorded in the 1981 and 1986 Census, respectively (Wingecarribee Shire, 1988). Based on preliminary data from the 1991 census, this growth rate has continued over the ensuing 5 year period with the Shire having an Estimated Residential Population of 33,218 in 1991 (Illawarra Regional Information Service, 1993). Over the 1976 to 1986 period approximately 74% of people lived in urban areas and approximately 73% of tenements in Wingecarribee Shire were in urban areas (Wingecarribee Shire, 1988).

The Department of Environment and Planning (1987) estimated that by the year 2001 the Shire would have a population of 43,400 (low) to 51,800 (high). These population estimates represent growth rates of 3.0% and 4.9%, respectively.

Preliminary statistics show that Exeter in 1991 had a population of 293 with approximately 27% of the population in the 25 to 39 age range, 12.6% in the range 40 to 49, and 14.3% in the 50 to 64 age group.

Local employment is provided by the Post Office, General Store, Railway Station, primary school, and farming enterprises. The existing quarry and processing plant is the major local employer providing direct on-site employment for 20 people as well as for up to 20 contract operators.

DESCRIPTION OF THE PROPOSED DEVELOPMENT

5.0 DESCRIPTION OF THE PROPOSED DEVELOPMENT

5.1 OUTLINE OF THE PROPOSAL

Southern Highlands Quarries Pty Limited proposes to extract approximately 2.3 million tonnes of hard rock from an area of approximately 6 hectares adjoining the western boundary of the existing quarry (see **Figure 2**).

To provide visual and acoustic screening for the proposed development, initially a 3m high vegetated bund is to be constructed around the northern, western and part of the southern perimeters of the extension. Screening afforded by the bund is to be supplemented with infill tree screening along the remaining southern perimeter of the extension.

The existing vegetated side slopes of the current and proposed extension will remain in place for the life of the extractive operations. The eastern side slopes that form the outer shell of the existing quarry are to be reshaped towards the end of the life of the proposed extension to merge with final landform contours.

A sedimentation dam will be constructed in the floor of the existing quarry. The dam will collect all runoff from the extension and form an integral part of the water and sediment management system.

Raw feed from the extension will be transported along the existing haul road which traverses the current quarry area.

Sections of an 11kV line will require relocation during Stage 1 construction phase. The 132kV power transmission line staunchion will be required to be relocated early in Stages 5 to 9. It is feasible that staunchion will be relocated within the existing easement as shown on **Figure 16**.

5.2 SITE PREPARATION

Initially screen planting will be undertaken along the western and southern perimeters of the proposed visual/acoustic bund (see **Figure 12**).

A system of catch drains and silt fences will be constructed downslope of the bund construction area to control sediment laden runoff during the construction phase and will remain in place until a suitable vegetative cover is established on the bund wall (see **Figure 13**). The existing channel draining the current quarry will be reshaped to have 2H:1V side batters and grassed. The main sedimentation dam (see **Figure 13**) will be constructed to provide sediment control for the quarry extension during the establishment phase.

Topsoil from the bund wall area and Stage 1 area will be stripped and initially used in rehabilitation of the existing quarry floor. Approximately 45,000m^3 of overburden will be removed with scrapers from the area designated Stage 1 on **Figure 13** and used to construct a visual/acoustic bund shown on **Figure 13** over

Water

ROCKLEIGH

Supply

Existing Bund Walls

Pipeline

House

ROAD

Road

Esmt

Haul

Overburden Emplacement Area

House

Sheds

PROPOSED EXTENSION TO QUARRY AREA

DIRECTION OF QUARRYING

BUND WALL 3M HIGH - PLANTED WITH QUICK-GROWING SCREENING SPECIES AS LISTED BELOW

PLANTING AT GROUND LEVEL ALONG EDGE OF EXTRACTION. (8-10M WIDTH)

Bund Wall

9500m³ Sedimentation Dam

Existing Quarry Area

Future Wildlife Refuge

Dam

Diversion Drain

Existing Sedimentation Dams

Grassed Waterway

RECOMMENDED SPECIES

TREES (12-20M)

Acacia decurrens	Green Wattle	12M
Acacia elata	Cedar Wattle	15M
Acacia melanoxylon	Blackwood	12M
Casuarina cristata	Belah	12M
Casuarina stricta	Drooping Sheoak	12M
Eucalyptus albens	White Box	20M
Eucalyptus cinerea	Argyle Apple	15M
Eucalyptus maculifera	Red spotted Gum	18M
Eucalyptus nicholii	Small leaved Peppermint	12M
Eucalyptus polyanthemos	Red Box	20M

GROUND COVERS

Grevillea poorinda 'Royal Mantle'

Hardenbergia violacea False Sarsaparilla

Kennedia rubicunda Dusky Coral Pea

SMALL TREES TO 10M

Acacia spectabilis Mudgee Wattle 6M

Melaleuca armillaris Bracelet Honeymyrtle 10M

Melaleuca bracteata White Cloud Tree 8M

Melaleuca decussata Crossleaf Honeymyrtle 6M

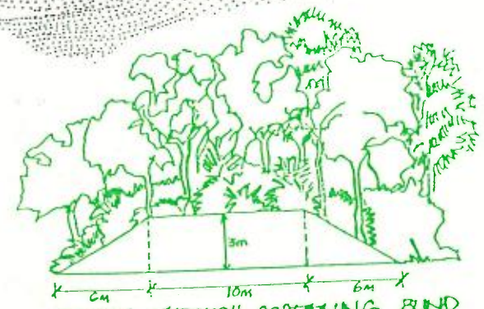
SHRUBS TO 5M

Banksia serrata Red Honeysuckle 4M

Callistemon linearis Narrowleaved Bottlebrush 2M

Cassia artemisioides Silver Cassia 2M

Grevillea asplenifolia 'Fernleaf Grevillea 3M



SECTION THROUGH SCREENING BUND

SOURCE: Campbell and Anderson Pty Limited, Bowral

101/90338

Figure 12:
SCREENING PROPOSALS

0 25 50 75 100
metres

a three to four three week construction period. As bund construction progresses, completed sections of the bund will be dressed with approximately a 100mm thick layer of topsoil before being grassed. Once a grass cover is established screen planting on the bund will be undertaken as described in **Section 6.9**.

5.3 PROPOSED EXTRACTIVE OPERATION

5.3.1 Extractive Materials

Material to be extracted from the proposed extension consists of highly jointed basalt and silty/clay material. Drilling has shown the material to be similar to that currently being extracted from Part Portion 102 and is suitable for production of high strength concrete, sealing aggregates and roadbase in compliance with the Roads and Traffic Authority and Standards Association of Australia specifications.

Material from the proposed extension will be processed at Southern Highlands Quarries Pty Limited existing processing plant on the northern side of Rockleigh Road and will be used to produce a comprehensive range of quarry products. These include rail ballast; 20mm, 14mm, 10mm and 7mm aggregates; 5mm dust and road base material.

5.3.2 Extraction Method

Initially overburden material will be removed using scrapers assisted by a dozer. At the completion of overburden removal from the area designated Stage 1 on **Figure 13** an hydraulic excavator and rear dump trucks will be used to remove overburden for the remainder of the life of the quarry. Overburden is to be removed on a campaign basis and used in rehabilitation of the existing quarry and worked out areas of the proposed development site.

An hydraulic excavator will be used to win and load the basalt. Rock will be extracted in a series of 3m to 4m high benches and extracted material will be loaded into rear dump trucks for transport to the existing processing plant.

Drilling has indicated that the material is highly fractured and similar to the resource currently being extracted. Based on geological assessment and Southern Highlands Quarries Pty Limited experience in working the resource, no drilling and blasting will be required to win the basalt.

5.3.3 Extraction Plan

Quarrying will be undertaken progressively in a series of stages. Stage 1 will commence at the eastern end of the proposed extension and from there, extraction will progress westward, quarrying on approximately a 130m wide face. Quarrying will continue in a westerly direction for approximately 300m to the western extremity of the proposed extraction area (see **Figures 13** and **14**).

Material will be extracted in 3m to 4m high benches approximately 30m in width, with material being extracted to a maximum depth of approximately 30m (approximately 680m AHD). A schematic diagram of the extraction sequence is

ROCKLEIGH

ROAD

Existing Bund Walls

Level Sill

Silt fence

Catch Drains

Bund Wall

Overburden Emplacement Area

Haul Road

Esmt

Esmt

Diversion Drain

Dam

To Indigo Creek

Existing Sedimentation Dams

Grassed Waterway

Existing Quarry

Grassed Waterway

Stage 1

Stage 2

Stage 3

Stage 4

Stage 5

Stage 6

Stage 7

Stage 8

Stage 9

DDH1

DDH2

DDH3

DDH4

DDH5

DDH6

Transmission

Transmission

1KV

132KV

Bund Wall

Catch Drains

Catch Drains

Silt Fence

Bund Wall

Future Wildlife Refuge

Proposed 9500m³ Sedimentation Dam

Figure 13:
ESTABLISHMENT PHASE

0 25 50 75 100
metres

SOURCE: Campbell and Anderson Pty Limited, Bowral

101/90338

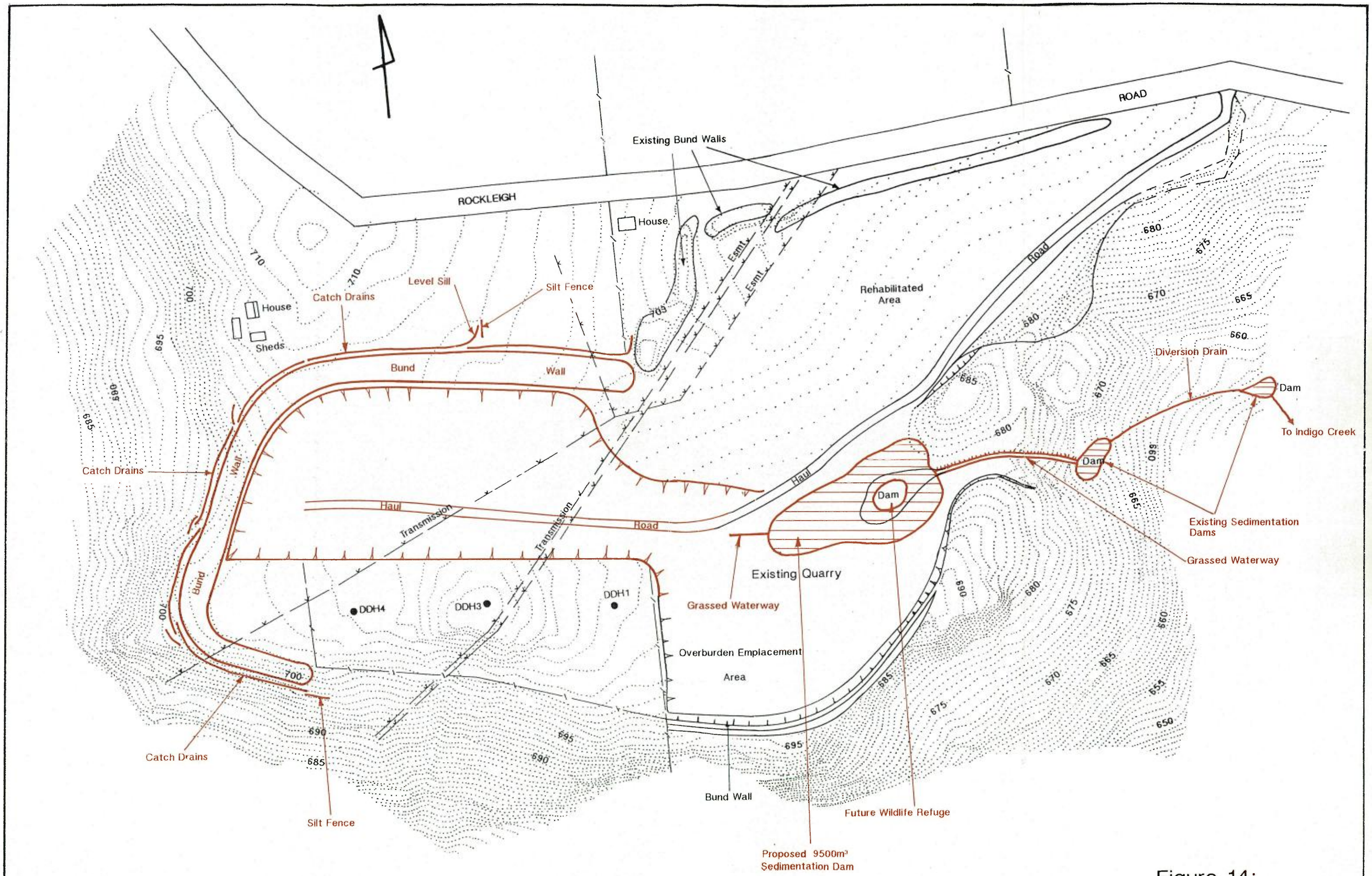


Figure 14:
STAGE 4

SOURCE: Campbell and Anderson Pty Limited, Bowral

101/90338

shown in **Figure 15.** A staged quarry plan for the proposed extension area has been developed. Each stage is based on extraction of basalt required to produce 250,000 tonnes of product from the processing plant. At an average annual production rate of 250,000 tonnes of product per year, it is expected that Stages 1 to 4 will take approximately 4 years to complete (see **Figure 14**). Overburden removed during Stages 1 to 4 will initially be utilised in rehabilitating parts of the existing quarry and will be subsequently used to rehabilitate extracted areas. Conceptual destinations for overburden on a staged basis, approximate production and overburden volumes are shown in **Table 5.1.**

TABLE 5.1
PRODUCTION AND OVERBURDEN VOLUMES

Stage	Expected Production Volume (tonnes)	Overburden Volume (m^3) (tonnes)	Overburden Removal Duration (days)	Overburden Destination	Backloaded Material (tonnes)
Stage 1					
1	250,000	85,000	15*	Bund wall, existing quarry	72,000
2	250,000	45,000	18	Stage 1	72,000
3	250,000	65,000	26	Stage 2	72,000
4	250,000	85,000	34	Stage 3,Stage 4	72,000
Stage 2					
5	250,000	85,000	34	Stage 4	72,000
6	250,000	40,000	16	Stage 5,Stage 4	72,000
7	250,000	50,000	20	Stage 6,Stage 3	72,000
8	250,000	55,000	22	Stage 7,Stage 2	72,000
9	255,000	50,000	20	Stage 8,Stage 9 Stage 1	73,000
Total	**2.3mt**	**560,000**	**205**		**649,000**

Note:

* **Scrapers used in Stage 1 for overburden removal.**

At the commencement of extraction in Stage 5 material will be extracted in a southerly direction on approximately a 60m wide face until the southern extremity of extraction is reached. For the remainder of Stages 5 to 9, quarrying will be generally in an easterly direction extending for approximately 240m until the boundary of the current quarry is reached. At an average production rate of 250,000 tonnes of product per year, extraction in Stages 5 to 9 will take approximately 5 years to complete.

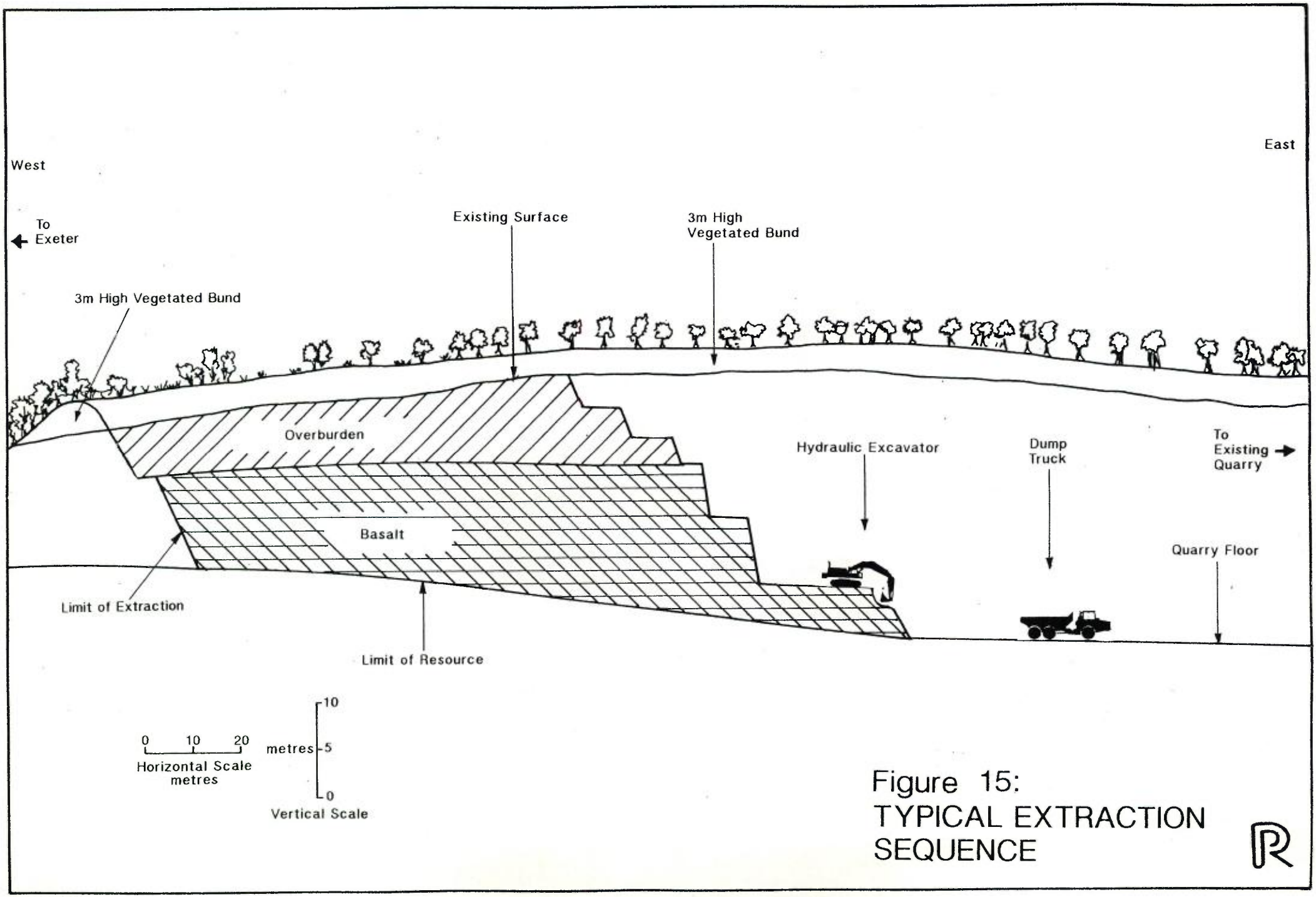


Figure 15:
TYPICAL EXTRACTION
SEQUENCE

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As shown in **Table 5.1** approximately 22% of material extracted is not utilised in production of marketable quarry product. This material is transported from the existing processing plant as backload in rear dump trucks to the quarry where it is used in rehabilitation. Backloaded material mainly consists of silt, clay and scalpings that are extracted from the raw feed during processing.

5.3.4 Reserves and Life of Operation

A geological assessment of the proposed quarry extension area undertaken by Resource Planning Pty Limited (1990) identified approximately 1.86 million tonnes of extractable hard rock at a density of 2t/m^3. Based on Southern Highlands Quarries Pty Limited experience in utilising both fresh basalt and some overburden materials, total usable material is estimated at approximately 2.3 million tonnes.

At an average production rate of 250,000 tonnes per year it is estimated that the proposed quarry extension will have an extractive life of approximately 9 years.

5.4 EQUIPMENT AND MATERIAL HAULAGE

5.4.1 Equipment

Equipment to be used on the site will be similar to that utilised in the current quarry and is listed in **Table 5.2.** Make and model of equipment may change as older equipment is replaced.

TABLE 5.2
EQUIPMENT

Normal Quarrying Operations

1 x Liebherr 974 Hydraulic Excavator (2.5m^3)
2 x Volvo A35 Rear Dump Trucks (35 Tonne)
1 x Water Cart (8 Tonne Diesel Truck)

Overburden Removal (Additional) for Stage 1

2 x Cat 631 Scrapers (23.7m^3) (Stage 1 only)
1 x Hydraulic Excavator (2.5m^3)
1 x D7 Bulldozer
2 x Rear Dump Trucks (35 Tonne)

5.4.2 Material Haulage

Material will be transported from the proposed quarry extension in two rear dump trucks. The trucks will travel along the existing gravel haul road which traverses

Part Portion 102 and crosses Rockleigh Road to the existing processing facilities. The haul road is privately owned and maintained by Southern Highlands Quarries Pty Limited.

At a maximum processing plant production rate of above 300,000 tonnes, an average of 40 trips (80 movements) per day between the quarry and plant will be required.

5.4.3 Road Transport

Relocation of extractive operations to the proposed quarry extension area will not alter current traffic levels associated with the existing development. Personnel access to the site is gained via Rockleigh Road and the private haul road. The proposed extension of the quarry involves the use of a private haul road as described in **Section 5.4.2** and a small section of Rockleigh Road. Transport of finished product from the crushing plant is covered by separate development consent from Wingecarribee Shire Council (see **Section 2.2** and **Section 4.16**).

5.5 REHABILITATION AND FINAL LAND USE

The proposed extension will be rehabilitated to form a low valley up to 30m deep as shown on **Figure 16**. The valley will drain in an easterly direction and will have maximum side slopes of 10%. The final landform will be shaped to be free draining with a central grassed drainage line that will form a minor tributary of Indigo Creek.

The proposed quarry extension will be rehabilitated on a progressive basis to minimise the amount of disturbed and unvegetated land that is exposed at any time. Rehabilitation will consist of topsoiling re-shaped areas to a minimum depth of 100mm, followed by fertilising and vegetating as described in **Section 6.10**.

The proposed extension will be rehabilitated to merge with the surrounding landform.

5.6 FACILITIES

Use will be made of the existing administrative, workshop and washroom facilities at the company's existing processing plant. No additional facilities will be required by the proposed quarry extension.

5.7 SERVICES

No new services will be required to service the proposed quarry extension. Water for dust suppression will be drawn from the proposed sedimentation dam

to be located on the existing quarry floor. This supply will be supplemented from the reticulated supply at the processing plant.

A stanchion of the 132kV transmission line that traverses the site will be required to be relocated early in Stages 5 to 9. It is feasible that the line will be relocated within the existing easement as shown on **Figure 16.** Sections of an 11kV line will also require relocation during Stages 1 to 4.

5.8 WASTE DISPOSAL

Extracted material that is not used to produce saleable product will be utilised in rehabilitation of the site. Normal domestic wastes produced will continue to be disposed of at an approved Council site.

5.9 HOURS OF OPERATION

Extractive operations and haulage of raw feed to the processing plant will occur between the hours of 7.00 am and 6.00 pm Monday to Friday and 7:00am to 3:00pm Saturdays. No work will occur on Public Holidays or Sundays.

In addition, plant maintenance may be carried out between the current hours of 6.00 am and 6.00 pm on Saturdays.

5.10 WORKFORCE

Three people will be employed full time in the quarry extension comprising hydraulic excavator operator, and two rear dump truck drivers. The water cart operator is employed at the processing plant and the quarry area on an as need basis. During periods of overburden removal, an additional four people may be employed operating a second hydraulic excavator, two additional rear dump trucks and a bulldozer.

Southern Highlands Quarries Pty Limited currently employs an environmental officer who will also be required to undertake rehabilitation of the site. The Quarry Manager will be responsible for site environmental management.

5.11 ENERGY REQUIREMENTS

On-site equipment will be all diesel powered and estimated to use approximately 600L per day during normal operations. Excavators, scrapers and the bulldozer will be refuelled on-site from a mobile unit. Rear dump trucks will refuel from existing fuel storage facilities at the processing plant.

ROADSIDE PLANTING OF MIXED TREES AND SHRUBS - BUFFER TO ROAD AND ASSIST WILDLIFE CORRIDORS.

ROAD

ROCKLEIGH

Esmt

Trans

Diversion Drain

To Indigo Creek

Existing Sedimentation Dams

Grassed Waterway

Transmission Line and Staunchion relocated

TREE LOTS TO BE DEVELOPED ACROSS FINAL LANDFORM - TO BE USED AS GRAZING LAND.

9500m³ Sedimentation Dam

Wildlife Refuge

RECOMMENDED SPECIES - TREE LOTS

Eucalyptus albens	White Box	20M
Eucalyptus cinerea	Argyle Apple	15M
Eucalyptus maculata	Red Spotted Gum	18M
Eucalyptus nicholii	Small leaved Peppermint	12M
Eucalyptus polyanthemos	Red Box	20M

RECOMMENDED SPECIES - ROADSIDE PLANTING

Acacia decurrens	Green Wattle	12M
Acacia spectabilis	Mudgee Wattle	6M
Banksia serrata	Red Honeysuckle	4M
Callistemon linearis	Narrowleaved Bottlebrush	2M
Cassia artemisioides	Silver Cassia	2M
Eucalyptus albens	White Box	20M
Eucalyptus cinerea	Argyle Apple	15M
Eucalyptus polyanthemos	Red Box	20M
Melaleuca bracteata	White Cloud Tree	8M

SOURCE: Campbell and Anderson Pty Limited, Bowral

101/90338

Figure 16:
FINAL LANDFORM

0 25 50 75 100
metres

ENVIRONMENTAL MANAGEMENT PROCEDURES

6.0 ENVIRONMENTAL MANAGEMENT PROCEDURES

6.1 WATER MANAGEMENT PLAN

6.1.1 Surface Runoff

The water management plan has been designed to convey runoff from undisturbed areas away from the proposed site. This objective is assisted by the location of the proposed quarry site being on a plateau and the construction of a bund on the northern, western, and part of the southern boundary of the site.

A series of catch drains as described in **Section 5.2** and shown on **Figures 13** and **14** are to be constructed to collect runoff from the bund area.

Surface runoff from the proposed extension will drain towards the existing quarry. A 9500 cubic metre sedimentation dam (see **Figure 13** and **Section 6.2.1**) will be constructed within the floor of the existing quarry with an initial catchment area of 3.5 hectares. As quarrying progresses the dams catchment area will increase approximately to 7.5 hectares at the completion of Stage 4 and 9.9 hectares at the completion of Stage 9.

A grassed waterway will be constructed between the proposed quarry extension and the sedimentation dam (see **Figure 13**). The waterway has been designed to convey peak discharge of 1.73m^3/s from a 5% AEP (Annual Exceedance Probability) storm event from a fully developed quarry (i.e., 9.9 hectares of catchment). The waterway will be constructed with 6H:1V side batters, will be 5m wide and designed to convey the 5% AEP peak discharge at non-erosive velocities of less than 2.0m/s. A minimum freeboard of 0.5m will be provided.

Flows in the waterway will be directed to the 9500 cubic metre sedimentation dam. The spillway of the dam has been designed to convey peak discharges from a fully developed quarry for a 1% AEP storm event estimated at 3.0m^3/s. To accommodate this discharge, a spillway 6m wide will be required and during a 1% AEP storm event, flow depth over the spillway will be 0.5m. An additional 0.5m of freeboard will be provided.

Discharge from the spillway will be conveyed via the existing drainage channel and sedimentation dams to be eastern tributary of Indigo Creek. The drainage channel has been designed to convey peak discharge from a 5% AEP storm event of 2.0m^3/s at non-erosive velocities of 2.0m/s or less.

To the west of the saddle (see **Section 4.7**) in the proposed extension, the bund wall will direct runoff from the extension prior to quarrying and divert flows to the southern end of the bund wall. The bund wall will be constructed to be free draining at the southern end (see **Figures 13** and **14**).

Prior to extraction, the southern end of the bund wall will have a catchment area of approximately 2.4 hectares. During a 5% Annual Exceedance Probability storm event, peak discharge at the bund wall will be approximately 0.28m^3/s. A level sill 5m long will be constructed at the southern end of the bund wall to dissipate flow and convey discharge at non-erosive velocities of 1m/s or less to

adjoining vegetated and pastured land. As extraction enters the latter parts of Stages 1 to 4 and progresses into Stages 5 to 9 the effective catchment of the southern end of the bund wall will be significantly reduced with runoff from the quarried area draining towards the existing quarry.

Surface runoff from land adjoining the proposed extension will remain largely unaltered from its present regime.

The quarry floor will be maintained in a free draining condition. Surface runoff and groundwater accessions to the quarry area will be conveyed via the central grassed waterway to the main sedimentation dam prior to discharging to the Indigo Creek drainage system.

6.1.2 Water Demands

Initially, water required for dust suppression, as described in **Section 6.4**, will be drawn from the 9500 cubic metre sedimentation dam. Water demands will be supplemented from the existing reticulated supply which services the processing plant north of Rockleigh Road and is used to meet current dust suppression needs.

6.1.3 Water Quality

To maintain current water quality in Indigo Creek and its eastern tributary, runoff from the proposed quarry extension will be conveyed via a grassed waterway to the 9500 cubic metre sedimentation dam which has been designed to collect runoff from a 24 hour 10% AEP storm event. All waterways and diversion channels will be vegetated to minimise sediment generation potential and maximise the quality of water leaving the site.

The quarry floor will be maintained in a free draining condition with all runoff being directed to the sedimentation dam. In the low probability occurrence of diesel and oil based product being spilt within the quarry during refuelling of mobile equipment, spillage will drain to the sedimentation dam where it can be contained and cleaned up.

No other chemicals or potential pollutants are used in the extractive operation.

6.2 SEDIMENT AND EROSION CONTROL

Sediment and soil erosion controls incorporated into the proposed development include:

1. Establishment of a 9500 cubic metre sedimentation dam that services the entire extraction area.

2. Confining sediment laden runoff to a single catchment to minimise maintenance requirements and maximise runoff control.

3. Vegetation and maintenance of diversion drain channels and outlets.

4. Maintenance of an adequate vegetation cover on all non-quarried areas.

5. Limitation of the total area of disturbance at any point in time and rehabilitation of disturbed areas as rapidly as practicable.

6. Diversion of clean runoff from quarry and disturbed areas.

7. Adequate maintenance of waterways and dam spillways.

6.2.1 Establishment Phase

During the establishment phase, a series of vegetated catch drains will be constructed around the outer perimeter of the disturbed area for the visual/acoustic bund to direct sediment laden runoff during the construction phase. Each catch drain will be constructed to discharge via a level sill constructed at the outlet of each drain. A silt fence will be constructed downslope of each level sill and will provide further sediment control and flow dissipation prior to runoff discharging to adjoining vegetated land.

Once the bund wall is constructed it will be topsoiled and grassed with improved pasture species to provide a stable vegetative cover.

To service runoff from the proposed extension a 9500 cubic metre sedimentation dam will be constructed in the eastern section of the current quarry (see **Figures 13**). The Environment Protection Authority (see **Appendix 1**) has recommended that the dam should collect runoff from a 10% Annual Exceedance Probability storm event. To comply with this recommendation, a 9500 cubic metre dam, i.e., a dam approximately 2m deep, 120m long and 40m wide will be required. The dam will be constructed below final ground level and will have 2.5H:1V side batters (topsoiled and vegetated above top water level) and 0.5m of freeboard. The dam will be designed to operate as a wet detention basin.

The drainage channel and 9500 cubic metre sedimentation dam will be modified to provide for a minimum freeboard of 0.5m and will be vegetated. The wall of the existing sedimentation dam adjacent to the tributary of Indigo Creek will be modified to provide a 6m wide level sill at its discharge point to dissipate flow to the tributary of Indigo Creek.

6.2.2 Quarry Operation

Once the bund wall is constructed and suitable vegetative cover is established, silt fences will be removed and trapped sediment will be collected and incorporated in rehabilitation of the site.

All sediment laden runoff from areas disturbed through quarrying will be directed to the main sedimentation dam which will act as a wet detention basin affording approximately 24 hours retention time for runoff from a 10% AEP, 24 hour storm event. The sedimentation dam will be maintained in a fully operational condition with sediment accumulating on the floor of the dam being removed prior to the dam's effective capacity being reduced to 70% of its design capacity.

Topsoil and overburden will be stripped on a campaign basis which will coincide with periods of rehabilitation. To minimise handling requirements and the total disturbed area that is not rehabilitated, overburden and topsoil will be stripped and used in rehabilitation in one operation where possible. Any material required to be temporarily stockpiled, will be placed within the quarry and within the catchment of the sedimentation dam. Where it is necessary to stockpile material for prolonged periods, stockpiles will be seeded with pasture species to minimise dust and sediment generation potential.

A detailed soil and erosion plan will be prepared in consultation with the Department of Conservation and Land Management during the development phase.

6.3 SOLID WASTE DISPOSAL

All topsoil, overburden and reject material from processing operations will be utilised in ongoing rehabilitation of previously quarried areas and will not be transported off-site.

6.4 DUST CONTROLS

Dust controls to be incorporated in the proposed development include:

1. Maintenance of haul roads and trafficked areas in a moist condition during periods of operation. To achieve this a water cart capable of applying water at a rate of 1.5L/m^2/hour will be available during all periods of operation.

2. Provision of an on-site water supply for dust suppression purposes (see **Section 6.1.2**) that minimises the Company's reliance on the use of treated town water whilst ensuring an adquate water supply is available for dust suppression.

3. Adoption of a quarry plan that shields most quarry activities from prevailing winds and hence reduces dust generation potential.

4. Rehabilitation of disturbed areas on an ongoing basis to minimise the amount of non-vegetated land and hence minimise dust generation potential.

6.5 NOISE CONTROL

A number of noise control measures are proposed to reduce noise emission levels from proposed quarry operations. These measures have been described by Wilkinson Murray Pty Limited in the noise impact assessment (refer to **Section 7.7** and **Appendix 4**) and include:

1. Construction of a 3m high bund wall around the northern and western perimeter of the proposed quarry extension (refer to **Figure 13** and **Section 5.2**).

2. In the initial stage of the proposed operation (Stage 1) the knoll and low ridge to the north on the central portion of the extension area will provide some shielding of overburden removal operations allowing utilisation of scrapers for this activity. Removal of the low ridge during Stages 1 and 2 will eliminate some shielding of overburden removal operations, necessitating that operations be undertaken with equipment with lower noise emission levels. From the end of Stage 1 onward, overburden removal will be undertaken by an excavator and bulldozer which have a lower noise emission level than the scrapers proposed to be used during Stage 1 operations.

3. Haul trucks will be fitted with noise control kits consisting of a high performance exhaust silencer, acoustically enclosing the engine, using sound absorbent foam, and fitting an acoustic louvre over the radiator. It is calculated that a noise reduction of 6dB(A) will be achieved by these measures.

4. The excavators will be fitted with noise control kits, containing:

   * High performance exhaust silencer.

   * Additional enclosure, lined with sound absorbent foam, on the engine.

   * Air intake and discharge silencers/acoustic louvres.

   These measures are expected to achieve a noise reduction of approximately 10dB(A).

5. Quarry operation hours will be restricted to Monday to Friday 7:00am to 6:00pm and 7:00am to 3:00pm Saturday. Only maintenance will be undertaken between the hours of 6:00am to 6:00pm Saturday and no work will occur on Sundays or Public Holidays.

6.6 BUFFER ZONE

The Department of Planning and Wingecarribee Shire Council (**Appendix 1**) refer to quarry buffer zones. Council indicates that a distance of 1km is desirable to mitigate against impacts from noise, dust, vibration, visual intrusion, etc. It could be expected that large quarries utilising blasting may require a 1km buffer to minimise impacts, particularly to meet the requirements of the Environment Protection Authority with respect to noise and vibration levels. However, each individual quarry proposal needs to be examined on its own merit.

In quarries that do not undertake blasting, it would be expected that a lesser buffer distance would be acceptable.

The important parameter in considering an appropriate buffer distance for the Exeter site is minimal impact from dust, noise and visual impacts. Each of these parameters may result in different buffer distances. For instance, the Exeter quarry extension will be shielded by a bund wall and the necessary visual buffer once the wall is rehabilitated may be less than for other parameters.

Detailed noise and dust modelling studies conducted for the Exeter extension have shown that design goals can be met at the property boundary.

6.7 ROAD MAINTENANCE

Most of the traffic associated with the proposed development will consist of haul trucks travelling between the proposed quarry extension and the Southern Highlands Quarries Pty Limited processing plant north of Rockleigh Road. The private haul road used by haul trucks and Rockleigh Road where it is crossed by quarry traffic will be fully maintained by Southern Highlands Quarries Pty Limited.

6.8 ENERGY CONSERVATION

To ensure efficient energy management, all equipment and plant will be maintained in good condition and operated only as required. The use of modern plant and mobile equipment will also aid in energy conservation.

6.9 SITE SCREENING

Screening will be undertaken prior to extraction commencing in the extension area (see **Figure 12** and **Section 5.2**).

Existing areas of screening have been developed along roadways and quarry embankments. These will be retained and continue to be supplemented along adjoining exposed quarry sections.

Screening will be developed near the site entry and extended along Rockleigh Road towards the west. Screening in this location will complement the existing vegetation band and strengthen its buffering effects.

A visual bund will be constructed around the northern, western and part of the southern limit of the extension area to a height of 3m. Shrubs and trees will be planted on the bund (see **Figure 12**) and at ground level to provide an effective visual buffer between the quarry and the properties located across Indigo Creek. Screening species utilised will consist of the following.

TABLE 6.1
SCREENING SPECIES

Botanical Name	Common Name	Height
TREES (12–20m)		
Acacia decurrens	Green Wattle	12m
Acacia elata	Cedar Wattle	15m
Acacia melanoxylon	Blackwood	12m
Casuarina cristata	Belah	12m
Casuarina stricta	Drooping Sheoak	12m
Eucalyptus albens	White Box	20m
Eucalyptus cinerea	Argyle Apple	15m
Eucalyptus mannifera	Red Spotted Gum	18m
Eucalyptus nicholii	Small-leaved Peppermint	12m
Eucalyptus polyanthemos	Red Box	20m
SMALL TREES (6–10m)		
Acacia spectabilis	Mudgee Wattle	6m
Melaleuca armillaris	Bracelet Honeymyrtle	10m
Melaleuca bracteata	White Cloud Tree	8m
Melaleuca decussata	Crossleaf Honeymyrtle	6m
SHRUBS		
Banksia serrata	Red Honeysuckle	4m
Callistemon linearis	Narrowleaved Bottlebrush	2m
Cassia artemisioides	Silver Cassia	2m
Grevillea aspleniifolia	Fernleaf Grevillea	3m
GROUNDCOVERS		
Grevillea poorinda	'Royal Mantle'	
Hardenbergia violacea	False Sarsaparilla	
Kennedia rubicunda	Dusky Coral Pea	

Trees are to be planted at 3m to 4m intervals in groups of 6 to 8 of the same species together. Shrubs and groundcovers are to be planted at 1m centres in groups of 9 to 12 of the same species together.

Species have been selected for their suitability to the local conditions. Several trees and shrubs are native to the area and all are recommended by the Forestry Commission of New South Wales for planting in open, highland situations. **Figure 12** shows the screening proposals around the quarry.

6.10 LANDSCAPE AND REHABILITATION PLAN

Southern Highlands Quarries Pty Limited has established successful rehabilitation techniques for its past quarrying operations as demonstrated by its rehabilitation of former quarry operations on the southern end of Part Portion 102. This area has been re-established to grazing land with a pasture cover at least to the standard of previous pasture cover in a period of some 5 years since completion of extractive operations.

Figure 16 shows the conceptual final landform for the quarry. Both the existing quarry and the proposed extension will be rehabilitated on an ongoing basis with improved pasture species and tree lots as indicated in **Table 6.2**.

TABLE 6.2
TREE LOTS SPECIES

Botanical Name	Common Name	Height
Eucalyptus albens	White Box	20m
Eucalyptus cinerea	Argyle Apple	15m
Eucalyptus mannifera	Red Spotted Gum	18m
Eucalyptus nicholii	Small-leaved Peppermint	12m
Eucalyptus polyantheros	Red Box	20m

The landform will be shaped to reflect the surrounding slopes and hills and graded to drain freely to existing creek and channel lines.

Tree lots will be planted across the extraction area to enable the site to be utilised for grazing purposes. These lots will be valuable for shading stock and as faunal habitat. Fencing will be required around the lots until the trees have matured.

The sedimentation dam will remain and serve to provide long term sediment control for the site and enhance the habitat value of the area through provision of a significant water body. The bund wall surrounding the extension will be removed at the end of quarrying activities and the material used in rehabilitation. A verge of trees will remain as shown on **Figure 16** and contours on previously disturbed land will merge with undisturbed natural landforms.

Roadside vegetation in the form of informal grouping of trees and shrubs bordering the existing quarry entry road and Rockleigh Road will be planted. Planting undertaken during the screening stage will be retained and extended as a buffer to the road and to develop habitat corridors for wildlife.

Recommended species for roadside planting are listed in **Table 6.3**.

TABLE 6.3
ROADSIDE SPECIES

Botanical Name	Common Name	Height
Acacia decurrens	Green Wattle	12m
Acacia spectabilis	Mudgee Wattle	6m
Banksia serrata	Red Honeysuckle	4m
Callistemon linearis	Narrowleaved Bottlebrush	2m
Cassia artemisioides	Silver Cassia	2m
Eucalyptus albens	White Box	20m
Eucalyptus cinerea	Argyle Apple	15m
Eucalyptus polyanthemos	Red Box	20m
Melaleuca bracteata	White Cloud Tree	8m

Tree lots and roadside species will be planted as outlined in **Section 6.9**. That is, trees will be planted at 3m to 4m intervals in groups of 6 to 8 of the same species together. Shrubs and groundcovers will be planted at 1m centres in groups of 9 to 12 of the same species together. Weeds will be controlled by progressive rehabilitation and regular inspections. Any weed outbreaks will be removed.

6.11 CONTROLS ON OPERATION

Extractive operations will be conducted in accordance with Development Consent conditions imposed by Wingecarribee Shire Council and licence conditions imposed by the Environment Protection Authority. The site will be inspected by Environment Protection Authority officers to ensure compliance with the Clean Air Act, Clean Water Act and Noise Control Act and associated licences and licence conditions.

The Mines Inspection Branch of the Department of Mineral Resources will also inspect the proposed development periodically to ensure compliance with safety requirements.

ANALYSIS OF ENVIRONMENTAL INTERACTIONS AND IMPACTS

7.0 ANALYSIS OF ENVIRONMENTAL INTERACTIONS AND IMPACTS

7.1 TOPOGRAPHY AND SURFACE STABILITY

The proposed quarry extension will result in the central section of a 6 hectare plateau being reshaped to form a shallow east-west orientated valley. The valley will form an extension of the Indigo Creek drainage system. The existing outer rim of the plateau will remain on the northern, western and southern boundaries of the extraction area. The plateau rim will have an elevation varying between 695m AHD and 709m AHD. A knoll which exists in the central section of Stages 5 to 9 extraction phases and has a maximum elevation of approximately 711m AHD will be removed during the extraction process. The existing rim of the current quarry will be reshaped (see **Figure 16**) to merge with the proposed valley landform. The entire site will be rehabilitated and vegetated with tree groves and improved pasture species to provide a stable and sustainable landform in the short and long term.

The proposed quarry extension will have a negligible impact on the regional topography and landform stability of the area.

7.2 GEOLOGY

The proposed development will involve the net removal of approximately 2.3 million tonnes of a regionally significant hard rock resource. Based on assessments undertaken as part of this study it is considered that the remainder of the basalt resource immediately to the south and west of the proposed extraction area would be difficult to extract without significant environmental impact. Consequently, it is considered that the proposed development will optimise the use of a significant hard rock resource which has been identified in Illawarra Regional Environmental Plan No. 1 and Wingecarribee Local Environmental Plan.

7.3 SOIL EROSION

Adoption of the sediment and erosion control measures outlined in **Section 6.2** will minimise in the short and long term, sediment generation and erosion potential of the site. The provision of an integrated water management and erosion control system will afford development of a high level of control over the potential for soil erosion at the site.

An ongoing rehabilitation programme is incorporated into the development with major rehabilitation of the existing quarry floor occurring early in the proposed development. Once vegetated, the existing quarry floor will further reduce erosion potential of the site and will act as filter between disturbed areas and the on-site sedimentation control system.

The establishment of a final landform with maximum slopes of 10% that are vegetated with pasture species and tree lots will result in the site having a low sediment generation potential in the short and long term. The provision of a 9500 cubic metre sedimentation dam at the downstream end of the quarry area will provide additional sediment control in the long term. Maintenance of the sedimentation dam during the life of the quarry will ensure that it remains in a fully functional condition.

Reshaping and vegetating the existing drainage channel that conveys runoff from the quarry to the tributary of Indigo Creek will significantly improve the long term stability of the channel and will reduce its current sediment generation potential.

7.4 HYDROLOGY AND WATER QUALITY

The proposed development will not alter the catchment area of Indigo Creek downstream of the site and will not significantly alter the site's current runoff regime. Reshaping of the site associated with hard rock extraction and site rehabilitation may increase site runoff in the short term while vegetative cover is being establish. This effect will be offset by the storage retention capacity of the 9500 cubic metre sedimentation dam.

Groundwater resources associated with the fractured basalt aquifer will be altered in the short term through the removal of basalt. This impact will be localised and will be offset by rehabilitation of the site which involves replacing topsoil, overburden and reject material. The impact will be further offset through the provision of a significant on-site storage dam.

Runoff controls as described in **Sections 6.1** and **6.2** have been adopted to ensure that the proposed development does not detrimentally affect the quality of water within Indigo Creek.

All runoff from extraction areas will be conveyed to the 9500 cubic metre sedimentation dam. In the advent of accidental spillage of diesel or oil during refuelling, spillages will be contained by the sedimentation dam from where they can be collected and disposed of in an environmentally acceptable manner.

7.5 AIR QUALITY

A detailed analysis of potential impacts of the proposed development on air quality of the surrounding area has been undertaken by Nigel Holmes and Associates. The analysis is presented in full in **Appendix 3** and potential impacts are summarised in **Sections 7.5.1** and **7.5.2**.

7.5.1 Short-Term Air Quality

Figures 17A to **17D** show the predicted increase in dust concentrations and deposition levels for Stages 1 and 4. For dust concentrations, an annual

KEY

Exeter Village Zone

Proposed Quarry Extension (includes bund walls)

Residences (owners)

Residence under construction

KEY

20 Dust Contours

SOURCE: CMA 1:25000 Topo Moss Vale and Bundanoon

1011/90338

Figure 17(a):

PREDICTED INCREASE IN ANNUAL AVERAGE DUST CONCENTRATION FOR STAGE 1 – (µg/m³)

0 100 200 300 400 500 metres

KEY
Exeter Village Zone
Proposed Quarry Extension (includes bund walls)
Residences (owners)
Residence under construction

KEY
Dust Contours

RAILWAY
RD
WERAI
'Lylen' (Fryer)
ROCKLEIGH
'Rockleigh' (Nibico Pty Ltd)
11KV
FOREST
MIDDLE
ROAD
SUTTON
SOUTHERN
EXETER
EXETER
Willowbank (Kingsford-Smith)
Indigo
Transmission
ROAD
School
'Merry Hill' (Beaumont & Durnford)
(Holmes)
(Jefferson)
(O'Keefe)
'Ringwod Farm' (Hopkins)
'Romsey Cottage' (Smythe)
(Wailes)
'Good N Windy' (Balding)
RINGWOOD
'Misty Lodge' (Seaman)
'Boeing Park' (Marshall)
(Marshall)
'Uig Lodge' (Becher)
'Indigo' (Green Park Pastoral Pty Ltd)
ROAD
MAIN
To Bundanoon
Reedy
Transmission
132KV
Creek
'Rockley' (Adoxa Pty Ltd)
(Southern Highlands Quarries P/L)
PROPOSED QUARRY EXTENSION
Existing Processing Plant
Existing Quarry
Easement
Easement
Creek
ROAD
Stonequarry
STONEQUARRY
Gumtree Gully
Transmission
Bundalink (Maidenstone Pty Ltd)
'Tarah'
Indigo
Creek
Creek
700
650
630
660
640
680
600
0.2
0.5
1
2
5

SOURCE: CMA 1:25000 Topo Moss Vale and Bundanoon

Figure 17(b):
PREDICTED INCREASE IN ANNUAL AVERAGE DUST DEPOSITION FOR STAGE 1 - (g/m²/month)

0 100 200 300 400 500
metres

1011/90338

KEY

Exeter Village Zone

Proposed Quarry Extension (includes bund walls)

Residences (owners)

Residence under construction

KEY

20 Dust Contours

PROPOSED QUARRY EXTENSION

Existing Quarry

Existing Processing Plant

Easement

Transmission

11KV

132KV

RAILWAY

ROAD

ROCKLEIGH

WERAI

FOREST

MIDDLE ROAD

SOUTHERN

EXETER

EXETER

RINGWOOD

MAIN ROAD

STONEQUARRY

Creek

Indigo Creek

Gumtree Gully

'Lylen' (Fryer)

'Rockleigh' (Nibico Pty Ltd)

'Willowbank' (Kingsford-Smith)

School

'Merry Hill' (Beaumont & Durnford)

(Holmes)

(Jefferson)

(O'Keefe)

'Rockley' (Adoxa Pty Ltd)

'Ringwod Farm' (Hopkins)

'Romsey Cottage' (Smythe)

(Wailes)

'Good N Windy' (Balding)

'Misty Lodge' (Seaman)

'Boeing Park' (Marshall)

(Marshall)

'Uig Lodge' (Becher)

'Indigo' (Green Park Pastoral Pty Ltd)

'Bundalink' (Maidenstone Pty Ltd)

'Tarah'

Reedy

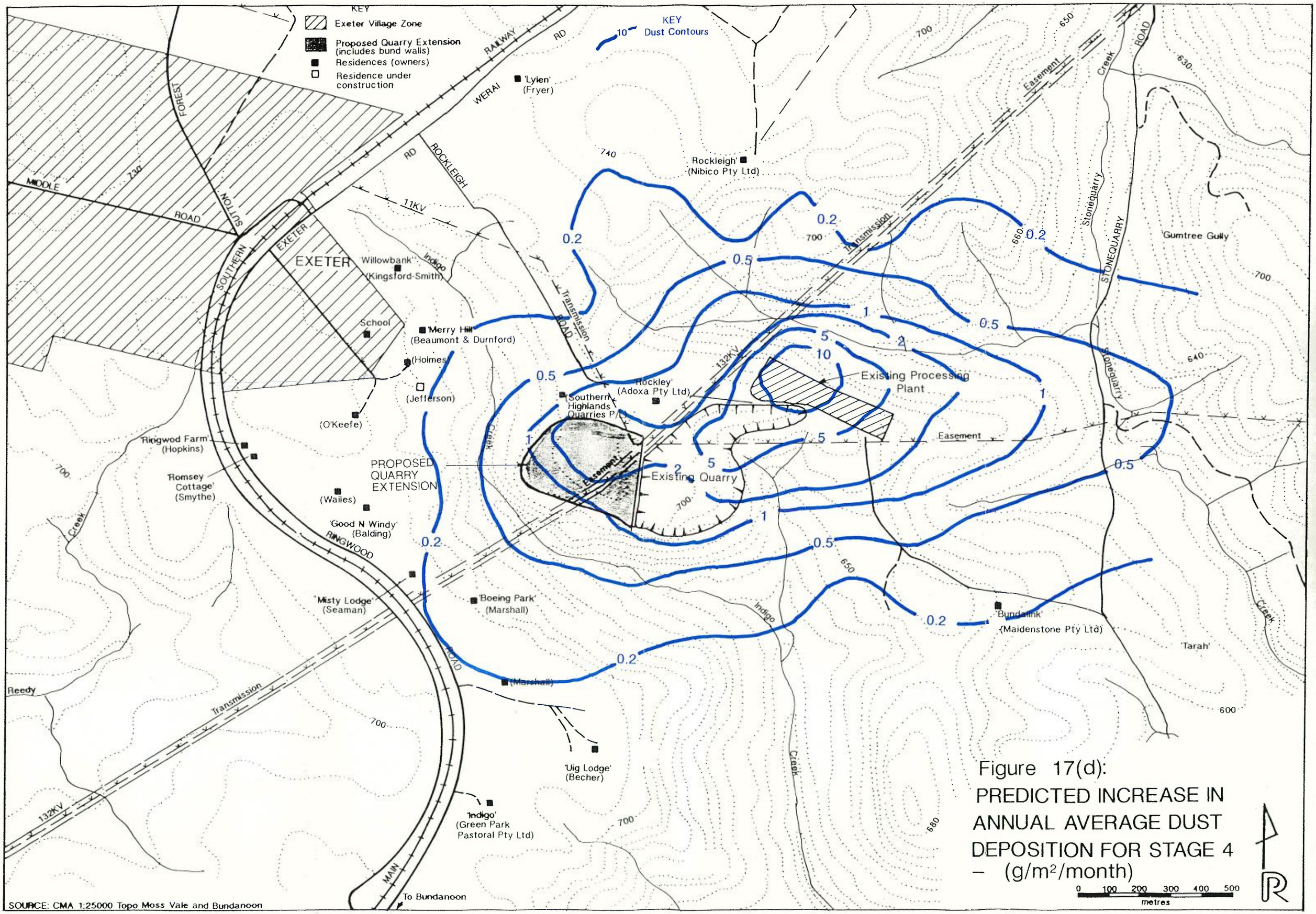
To Bundanoon

SOURCE: CMA 1:25000 Topo Moss Vale and Bundanoon

1011/90338

Figure 17(c):
PREDICTED INCREASE IN ANNUAL AVERAGE DUST CONCENTRATION FOR STAGE 4 — (µg/m³)

0 100 200 300 400 500
metres



SOURCE: CMA 1:25000 Topo Moss Vale and Bundanoon

Figure 17(d):
PREDICTED INCREASE IN ANNUAL AVERAGE DUST DEPOSITION FOR STAGE 4 – (g/m^2/month)

0 100 200 300 400 500
metres

1011/90338

average level of 90$\mu g/m^3$ is the upper limit of acceptability. **Figure 17A** indicates that during Year 1 when construction of the bund wall is taking place, the predicted increase in dust concentration due to operation of the quarry is less than 10$\mu g/m^3$ at the closest non-company controlled residences. If the existing background concentration of 20$\mu g/m^3$ is assumed then it can be seen that total dust concentrations will be no more than 30$\mu g/m^3$, which is well below the acceptable annual average figure of 90$\mu g/m^3$. Since approximately 50% of these particles will be greater than 50μm then the total dust loading will also comply, by a significant margin with the Environment Protection Authority's 50$\mu g/m^3$ annual average goal for particles greater than 10μm particles. **Figure 17C** shows the predicted increase in dust concentration for Stage 4, which represents normal quarry operations when the quarrying activities are closest to the residences. In this instance no residence in predicted to experience increases in dust concentration due to quarry operations above 5$\mu g/m^3$.

7.5.2 Long-Term Air Quality

Figures 17B and **17D** indicate the predicted increase in annual average dust deposition levels due to operation of the quarry of Stages 1 and 4, respectively. In both cases, the maximum predicted increase at any non-company owned residence is less than 0.5g/m^2/month, which when added to the existing dust fallout levels of less than 1g/m^2/month would give a total deposition level of 1.5g/m^2/month. The predicted increase is well within the Environment Protection Authority's allowable increase in 2g/m^2/month (annual average) for this type of environment and the impacts of the quarry operation are unlikely to have an adverse or even perceptible impact on nearby residences. It should be noted that the dust monitoring data presented in this report includes fallout from the existing processing plant and that these emissions have also been included in the modelling predictions. There is therefore an element of "double-counting" in the assessment which would tend to overestimate dust impacts.

Nigel Holmes and Associates conclude that their predictions indicate that at all stages in the development of the quarry, the dust deposition levels will remain below the Environment Protection Authority and NH & MRC long-term air quality goals at all residences.

7.6 FLORA AND FAUNA

The quarrying activity will remove the existing grassland and scattered trees within the site. This impact will be mitigated in the long term by proposed rehabilitation measures. Screening of the site with native trees and shrub species will increase the floral diversity and faunal habitat value of the site.

The creation of a significant water body in the floor of the existing quarry will serve to further enhance the habitat value of the area.

If the wombat burrow identified in **Section 4.9** becomes occupied prior to the knoll being removed, the wombats will be caught and relocated to a suitable habitat.

None of the fauna species recorded on the site or considered likely to occur on the site are listed as endangered (threatened or vulnerable and rare) by the New South Wales National Parks and Wildlife Service. The site was assessed in accordance with the requirements of the Endangered Fauna (Interim Protection) Act 1991 and as the proposal will not significantly effect the environment of endangered fauna it is considered that a Fauna Impact Statement is not required for the proposed development.

7.7 NOISE IMPACTS

A full report of the noise impact assessment completed by Wilkinson Murray Pty Limited for the proposed development is given in **Appendix 4**. The assessment criteria, noise modelling and impact assessment detailed in **Appendix 4** are summarised in the following sections.

7.7.1 Assessment Criteria

Noise design goals have been set for continuous and intermittent quarry operation noise emissions. The existing background noise level without quarry operations has been used for impact assessment purposes. These levels are below 30dB(A) and the Environment Protection Authority recommend in such situations that a background level of 30dB(A) be adopted.

Continuous Quarry Operation Noise Emissions

It is generally accepted that noise from continuous quarrying operations will not cause annoyance providing it does not exceed the background noise level by more than 5dB(A). Consequently, for most quarry operations a noise criterion of 35dB(A) has been adopted to assess noise impacts at surrounding residences.

Construction of an acoustic/visual bund wall will occur over a one month period at the beginning of Stage 1 of the proposed operations. Construction noise is temporary in nature and experience has shown that residents will accept higher noise levels for this type of activity. The Environment Protection Authority recommend for short term construction periods of four weeks or less that the L_{A10} noise emission level must not exceed the background noise level by more than 20dB(A). Adopting this rationale, Wilkinson Murray Pty Limited have set a noise criterion of 50dB(A) at surrounding residences during construction of the bund wall.

Intermittent Operation Noise Emissions

In addition to the steady noise levels resulting from continuous quarry operations, intermittent noise levels of an impulsive nature will occur when extracted material is dumped into haul trucks.

These noise emissions usually only occur when the first bucket load is dumped into a truck which is likely to occur in the vicinity of once every 5 minutes only during overburden removal.

Considering the frequency of occurrence of such noise events, a criterion of background noise level plus 15dB(A), (i.e., 45dB(A)) is appropriate to assess noise impact at nearby residences.

7.7.2 Impact Analysis

Quarry operation noise emission levels at five of the nearest surrounding residences have been calculated using the Environmental Noise Model. This is a widely accepted Computer Model which incorporated the following factors:

* Sound power levels and location including elevation of equipment.

* Attenuation with distance including hemispherical spreading, air absorption (90% relative humidity, 5°C) and ground absorption. In addition, allowance is made for adverse meteorological conditions by modelling a moderate temperature inversion of 3°C per 100m which gives similar characteristics to a stable atmosphere with a light breeze towards the receiver location.

* Shielding provided by natural topography.

Sound power levels of proposed equipment were determined by reference to equipment suppliers and by undertaking measurement of equipment currently used at the quarry. Sound power levels assumed for each item of equipment are tabulated in **Appendix 4**. The calculations incorporated attenuation provided by proposed noise control measures in **Section 6.5**.

Six stages of proposed operation were modelled by Wilkinson Murray Limited. Single point calculations were made at five residential locations (refer to Tables 3 and 5 in **Appendix 4**) and contour calculations for each operational scenario are shown on **Figures 18A** to **18C**.

7.7.3 Impact Assessment

Noise levels from the proposed quarry extension are expected to generally comply with the relevant assessment criteria.

Some exceptions are:

1. The noise levels expected at "Rockleigh" from the quarry operation will marginally exceed the long term operational design goal of 35dB(A) for the life of the quarry. A level of 36dB(A) has been estimated at this location from the proposed extraction operation and 37dB(A) when overburden is being removed. However, these levels will be dominated by noise emanating from the dump trucks as they cross Rockleigh Road travelling to and from the processing plant, an event that would last for only a few seconds during each truck movement. This operation currently occurs as part of the existing quarry and processing plant operations and, consequently, the noise levels will not change. In fact, the quarry noise of 36dB(A) to 37dB(A) will be less than the noise from the processing plant which will continue at approximately 43dB(A).

KEY

Exeter Village Zone

Proposed Quarry Extension (includes bund walls)

Residences (owners)

Residence under construction

KEY

Noise Contours dB(A)

EXETER

PROPOSED QUARRY EXTENSION

Existing Quarry

Existing Processing Plant

'Lylen' (Fryer)

'Rockleigh' (Nibico Pty Ltd)

'Willowbank' (Kingsford-Smith)

'Merry Hill' (Beaumont & Durnford)

(Holmes)

(Jefferson)

(O'Keefe)

School

'Rockley' (Adoxa Pty Ltd)

(Southern Highlands Quarries P/L)

'Ringwod Farm' (Hopkins)

'Romsey Cottage' (Smythe)

(Wailes)

'Good N Windy' (Balding)

'Misty Lodge' (Seaman)

'Boeing Park' (Marshall)

(Marshall)

'Uig Lodge' (Becher)

'Indigo' (Green Park Pastoral Pty Ltd)

'Bundalink' (Maidenstone Pty Ltd)

'Tarah'

'Gumtree Gully'

Figure 18A:
STAGE 1 - EXTRACTION

0 100 200 300 400 500
metres

SOURCE: CMA 1:25000 Topo Moss Vale and Bundanoon

1011/90338

KEY

Exeter Village Zone

Proposed Quarry Extension (includes bund walls)

Residences (owners)

Residence under construction

KEY

Noise Contours dB(A)

RAILWAY

RD

WERAI

'Lylen' (Fryer)

FOREST

ROCKLEIGH

RD

MOOLE

ROAD

SUTTON

SOUTHERN

EXETER

EXETER

11KV

'Willowbank' (Kingsford-Smith)

Indigo

'Rockleigh' (Nibico Pty Ltd)

Transmission

ROAD

School

'Merry Hill' (Beaumont & Durnford)

(Holmes)

(Jefferson)

(O'Keefe)

132KV

'Rockley' (Adoxa Pty Ltd)

'Southern Highlands Quarries P/L)

Existing Processing Plant

Easement

Existing Quarry

PROPOSED QUARRY EXTENSION

'Ringwod Farm' (Hopkins)

'Romsey Cottage' (Smythe)

(Wailes)

'Good N Windy' (Balding)

RINGWOOD

ROAD

'Misty Lodge' (Seaman)

'Boeing Park' (Marshall)

(Marshall)

'Uig Lodge' (Becher)

'Indigo' (Green Park Pastoral Pty Ltd)

MAIN

To Bundanoon

Reedy

Transmission

132KV

Creek

Easement

Creek

ROAD

Stonequarry

STONEQUARRY

Gumtree Gully

'Bundalink' (Maidenstone Pty Ltd)

'Tarah'

Creek

Indigo

Creek

Creek

700

740

730

640

650

680

630

600

20

25

30

35

40

SOURCE: CMA 1:25000 Topo Moss Vale and Bundanoon

Figure 18B:
STAGE 4 - EXTRACTION

0 100 200 300 400 500
metres

KEY

Exeter Village Zone

Proposed Quarry Extension (includes bund walls)

Residences (owners)

Residence under construction

KEY

Noise Contours dB(A)

20

25

30

35

40

EXETER

MIDDLE ROAD

SOUTHERN EXETER ROAD

FOREST ROAD

RAILWAY

WERAI

RD

ROCKLEIGH RD

'Lylen' (Fryer)

'Rockleigh' (Nibico Pty Ltd)

'Willowbank' (Kingsford-Smith)

School

'Merry Hill' (Beaumont & Durnford)

(Holmes)

(Jefferson)

(O'Keefe)

Ringwod Farm (Hopkins)

'Romsey Cottage' (Smythe)

(Wailes)

'Good N Windy' (Balding)

'Misty Lodge' (Seaman)

'Boeing Park' (Marshall)

(Marshall)

'Uig Lodge' (Becher)

'Indigo' (Green Park Pastoral Pty Ltd)

'Rockley' (Adoxa Pty Ltd)

Southern Highlands Quarries P/L

PROPOSED QUARRY EXTENSION

Existing Quarry

Existing Processing Plant

Easement

Transmission

11KV

132KV

Indigo Creek

Stonequarry Creek

STONEQUARRY ROAD

RINGWOOD ROAD

MAIN ROAD

To Bundanoon

Gumtree Gully

Bundalink (Maidenstone Pty Ltd)

Tarah

Reedy Creek

730

740

700

650

630

640

600

680

SOURCE: CMA 1:25000 Topo Moss Vale and Bundanoon

Figure 18C:
STAGE 7 - EXTRACTION

0 100 200 300 400 500
metres

1011/90338

2. The design goal during the construction stage (50dB(A)) is expected to be marginally exceeded by 2dB(A) at "Boeing Park" and exceeded by 3dB(A) at "Merry Hill".

3. Quarry noise levels at "Boeing Park" and "Merry Hill" are expected to marginally exceed the 35dB(A) design goal during overburden removal towards the end of the life of the quarry around Stage 7. However, overburden removal around this stage of the quarry life is expected to last no more than one month in any one year.

4. If the Jefferson residence, currently under construction is ultimately completed and occupied, then the noise level affecting this residence will become relevant. Levels approximately 1dB(A) higher than those estimated for "Merry Hill" will apply at this residence. On this basis, noise levels associated with overburden removal and material extraction may exceed the design goal during the later stages of the quarry by up to 4dB(A).

5. Noise levels at the school are expected to be approximately 1dB(A) to 2dB(A) less than those at "Merry Hill" and therefore may slightly exceed the construction stage design goal for a short period and the overburden design goal during later stages.

Intermittent noise levels generated by loading haul trucks are generally expected to comply with the adopted design goal. Slight exceedance of the goal has been calculated at "Merry Hill" in Stages 4 and 7. Equally the intermittent noise levels expected at the school and the Jefferson residence are expected to marginally exceed the goal during Stages 4 and 7.

Wilkinson Murray Pty Limited conclude that it is not expected that noise emissions from proposed quarry operations will cause annoyance to residents in the vicinity of the quarry.

7.7.4 Cumulative Impacts

There is potential for noise levels associated with the proposed quarry to add to other noise levels in the area, in particular noise levels generated by the existing processing plant. The only nearby receiver location where the processing plant is audible on a consistent basis is Rockleigh. Here, a plant noise level of 43dB(A) has been measured.

The noise level anticipated from the quarry operations at Rockleigh is 36dB(A), occurring intermittently as dump trucks cross Rockleigh Road during most of the life of the quarry. When this level adds to the 43dB(A) from the processing plant, the overall level which will result is 44dB(A). This level represents an insignificant change from the 43dB(A) of the plant alone and no change from that is existing due to the plant and existing quarry.

7.8 VISUAL AMENITY

Provision and early establishment of a 3m high vegetated bund around the perimeter of the proposed extension will preclude views of quarry operations from residences adjoining the proposed development site. Establishment of native species on and at the base of the bund as described in **Section 6.9** will serve to merge screening proposals with existing native vegetation that bounds the steeper sections of Indigo Creek valley.

As shown on **Figures 19A** to **19C** once the bund is constructed, quarry activities will be screened from surrounding residences, users of Ringwood Road and Rockleigh Road. During the construction phase, the activities involved in constructing the bund will be visible from adjoining residences. These activities are expected to take approximately 4 weeks to complete after which the bund is to be seeded with grass species. It is considered the visual impact associated with this phase of quarry development will be minimal as once the bank achieves grass cover it will form an extension of the existing upper slopes of Indigo Creek valley.

Extractive activities will remain screened for the remaining life of the quarry with trees and shrubs planted at the base of the bund providing visual screening even in the final stage when the bund wall is removed and the material used in final rehabilitation of the quarry floor.

The existing landform will be replaced with a shallow valley that drains to the east. Native woodlots and improved pasture species will be established in the valley providing a continuation of the surrounding vegetation and terrain. This will be further accentuated by the construction of a significant water body on the existing quarry floor.

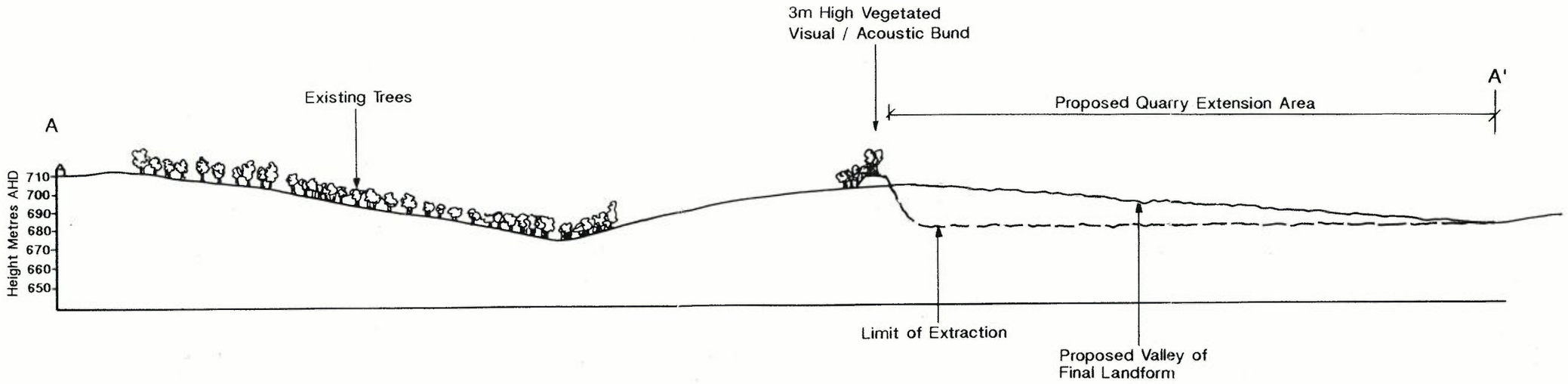
For travellers on the railway, visual impacts will be minimal due to the continually varying views as seen from the train. Short term views from the railway will be of a gradually maturing vegetation screen that will form a continuum of natural vegetation that borders the headwaters of Indigo Creek.

7.9 ABORIGINAL PREHISTORY

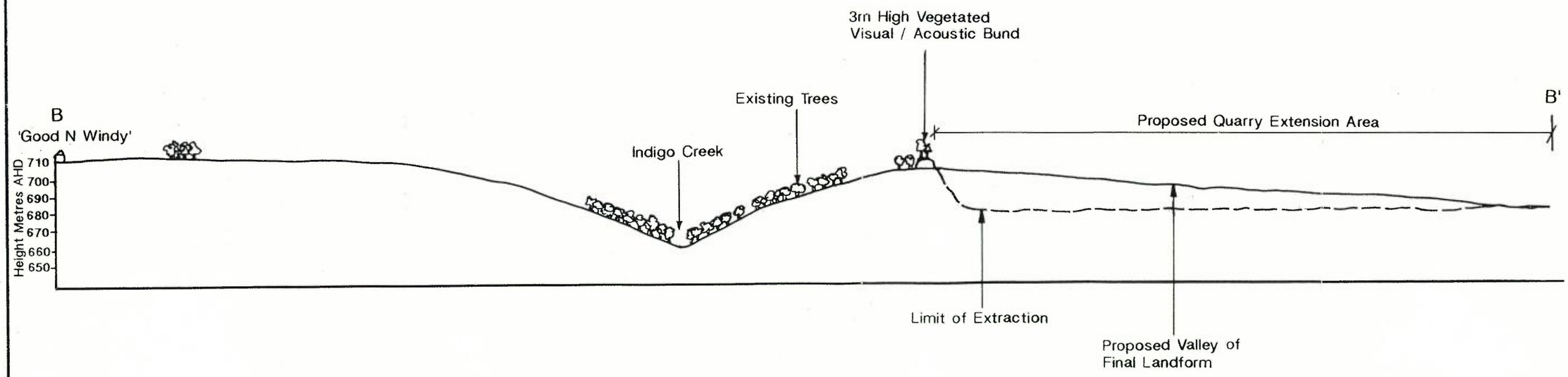
No archaeological sites were identified within the proposed development area. Artefacts identified in an earlier survey at the confluence of Indigo Creek and its tributary were intact and will remain undisturbed by the proposed development.

7.10 ZONING AND LAND USE

No modifications of existing zonings will be required to permit the development. No known planning proposals will be affected by the development of this site.



TRANSECT A - A'



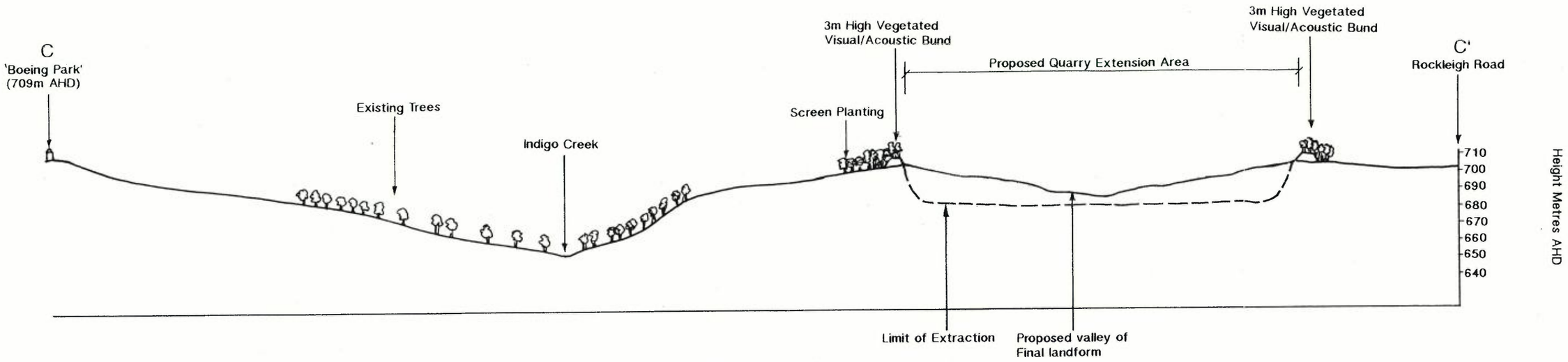
TRANSECT B - B'

Horizontal Scale
0 25 50
metres

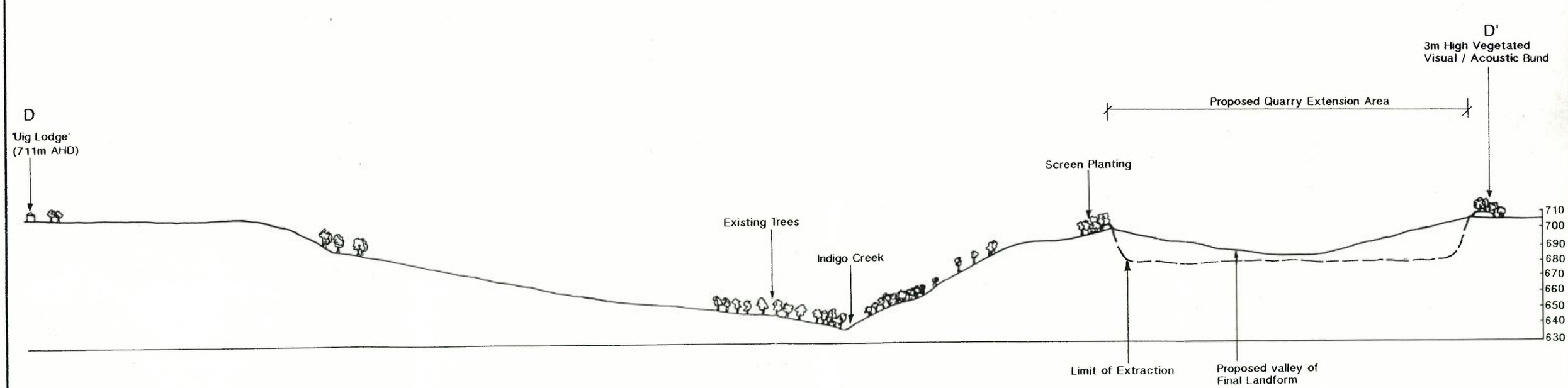
metres 30 0
Vertical Scale

Figure 19(a):
POST QUARRY
VISUAL TRANSECTS

1011/90338



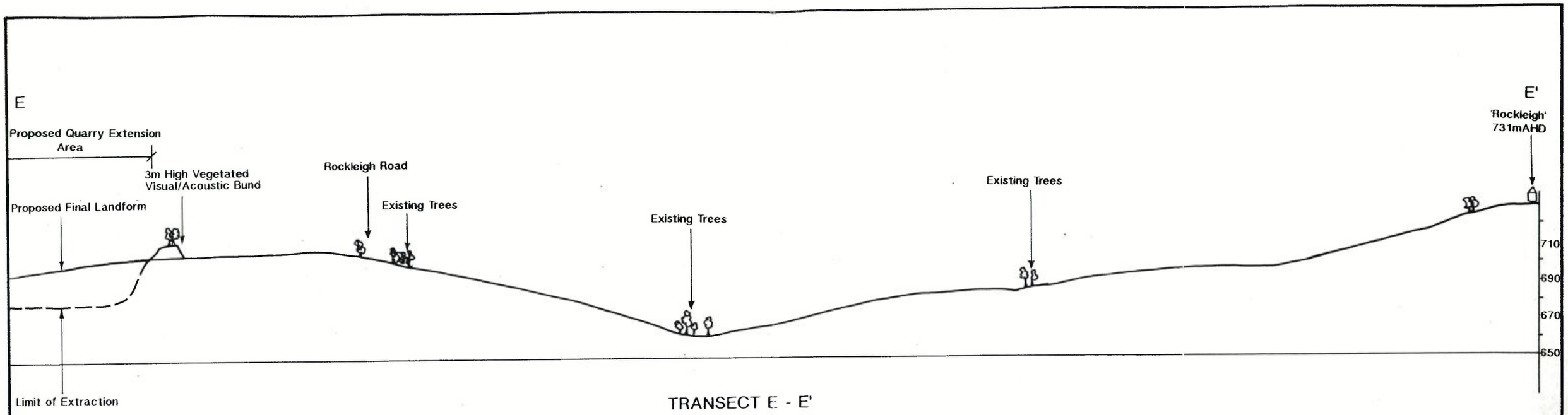
TRANSECT C - C'



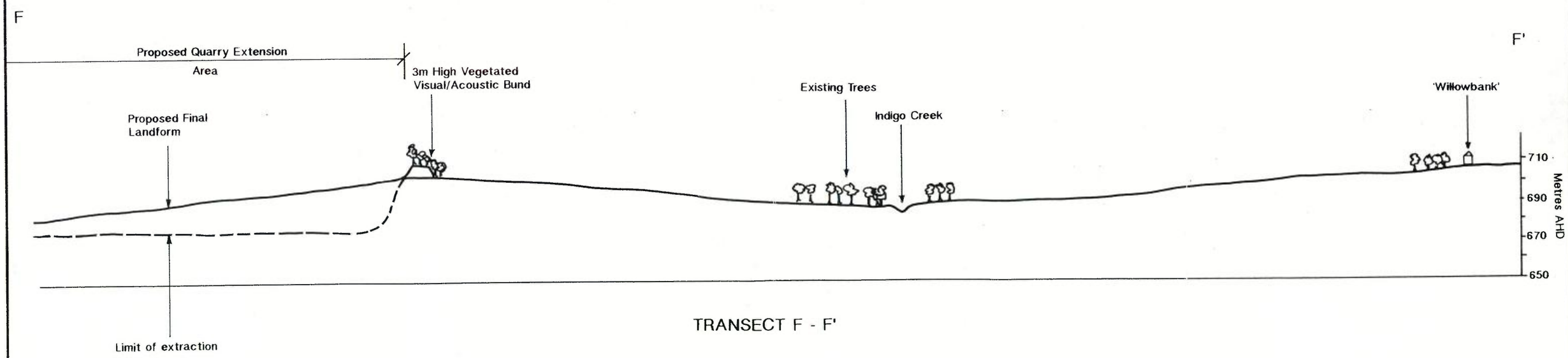
TRANSECT D - D'

Figure 19(b): POST QUARRY VISUAL TRANSECTS

1011/90338



TRANSECT E - E'



TRANSECT F - F'

Note: Location of Transects Shown on Figure 10

Figure 19(c):
POST QUARRY
VISUAL TRANSECTS

1011/90338

The proposed extension of the quarry will result in the temporary disturbance of up to 6 hectares of grazing land. This will be offset by an ongoing rehabilitation programme. The revegetation of the area with pasture grasses would provide for grazing of the area, in line with the Department of Agriculture classification of the land suitability as Class III. The Company will continue to graze stud Charolais and Hereford cattle on the bulk of the properties under its control that are not utilised for quarrying activities. Rehabilitation of the land to grazing will compliment the existing quarry activities and in the long term all land will be returned to productive grazing.

Based on impact assessments undertaken as part of this study, the proposed development can be undertaken without having a significant impact on adjoining residences and land uses. Continued development pressure within Exeter and surrounding areas may lead to the situation in the future where exploitation of this significant resource may be impeded by encroaching development.

Due to the nature of the operation and provision of a significant on-site water storage, it is considered the proposed development will not detrimentally affect the site's current low bushfire potential.

There have been no impacts on the property owner's existing cattle grazing on land adjoining quarry operations from noise and dust. The quarry extension will similarly not results in detrimental impacts on these activities.

There will be no impact on Exeter Park west of the Main Northern Railway Line.

7.11 SERVICE INFRASTRUCTURE

The proposed development will require the relocation of an 11kV power line and one stanchion which supports the 132kV power line that traverses the site. The staunchion will be relocated within the existing easement as shown on **Figure 16** and there will be no impact on adjoining properties. Illawarra Electricity have indicated that the line is to be downgraded to a 33kV line at the end of 1992 and that the proposed development will not have a significant impact on the operation of the transmission line.

No other utilities will be affected by the proposed development.

7.12 SOCIO-ECONOMIC

The proposed development is a continuation of an existing extractive operation and will provide ongoing employment for 4 people within the quarry and will indirectly provide ongoing employment for up to another 36 people associated with Southern Highlands Quarries Pty Limited's processing plant north of Rockleigh Road. The development will be a key element in the economic future of the Concrite Group and its employees.

No increase in extraction rates above existing levels or increase in the number of people employed in the operation, is planned and as such the proposed development has little potential to impact on the social infrastructure of Exeter or the surrounding area beyond the present situation.

Assessment of potential impacts in terms of dust, noise and visual amenity on surrounding land and adjoining residences indicate that the development can be undertaken without significantly altering the amenity of Exeter or adjoining residences.

The development proceeding will facilitate the potential for Southern Highlands Quarries Pty Limited quarry activities to continue to generate in excess of $1.5 million per year in local expenditure and salaries.

7.13 HEALTH AND SAFETY

As outlined in **Section 6.4** a number of dust control measures have been incorporated in the proposal to ensure that dust generation levels will be sufficiently low enough not to impose an health hazard to either on-site workers or surrounding residents.

Relevant safety controls as identified in **Section 6.11** will be adhered to during the life of the proposed development. The proposed extraction area will be fenced in accordance with the requirements of the Mines Inspection Branch of the Department of Mineral Resources to prevent stock access.

7.14 ENERGY IMPACTS

The quarry extension will utilise existing equipment currently used for quarry operations. Consequently, there will be no nett increase in current energy usage on-site as a result of the proposed development.

7.15 CUMULATIVE IMPACTS

The proposed quarry extension is at its closest point approximately 550m from Southern Highlands Quarries Pty Limited processing plant north of Rockleigh Road and consequently, has the potential to have cumulative impacts in terms of dust and noise generation with the existing plant. This potential has been assessed by Nigel Holmes and Associates (see **Appendix 3**) and Wilkinson Murray Pty Limited (see **Appendix 4**) in regard to dust and noise levels, respectively. Assessment of cumulative impacts indicates that relevant planning goals for dust deposition levels will not be exceeded and noise emissions from the proposed development will not have a significant cumulative impact on noise levels from processing operations.

As extraction rates are consistent with existing operations, and as extractive operations within the existing quarry will cease when operations commence in the proposed extension, there will be no cumulative impact beyond that associated with operations on the existing quarry area and proposed extension. In terms of traffic generation, raw feed will be transported on a privately owned haul road that is used solely by the development.

Development of the proposed extension area will provide a continued supply of hard rock to the processing plant. This will result in on-going truck movements to and from the existing processing plant. Traffic levels and any impacts associated with the continuation of the processing plant are not expected to alter from those experienced at present over the life of the proposed extension and will result in no significant change to traffic movements on the Local and Main Road network.

REFERENCES

REFERENCES

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Department of Environment and Planning, 1984. Draft Illawarra Regional Environmental Plan No. 1.

Resource Planning Pty Limited, 1990. Basalt Reserve Assessment Rockleigh Road Quarry, Exeter. Prepared for Southern Highlands Quarries Pty Limited (March 1990).

Smith, V., 1974. A Geological Assessment of the Construction Material Resources of the Mittagong-Moss Vale Area. Department of Mineral Resources, Geological Society of New South Wales. Report GS 1974/120 (unpubl.).

Wingecarribee Shire Council, 1988. Wingecarribee Urban Land Review.

Wingecarribee Shire Council, 1989. Wingecarribee Local Environmental Plan.

Woodward, John, 1985. Hard Rock Deposits, Shire of Wingecarribee. Report to the Honourable Bob Carr, Minister for Planning and Environment. Woodward, J., and Gilpin, A., Commissioners of Inquiry (February, 1985).

APPENDICES

APPENDIX 1

CORRESPONDENCE FROM GOVERNMENT AUTHORITIES

RESOURCE PLANNING PTY LIMITED

ENVIRONMENTAL AND GEOLOGICAL CONSULTANTS

Telephone: (049) 34 2355
Facsimile: (049) 33 1107

Metford Road,
Metford N.S.W. 2323

Mailing Address:
P.O. Box 388,
East Maitland 2323

31st October, 1990.

The Director
Department of Planning
G.P.O. Box 3927
SYDNEY NSW 2001

Dear Sir/Madam,

RE: EXTENSION OF HARD ROCK QUARRY
ROCKLEIGH ROAD, EXETER
– SOUTHERN HIGHLANDS QUARRIES PTY LIMITED

Resource Planning Pty Limited has been engaged by Southern Highlands Quarries Pty Limited to prepare an Environmental Impact Statement for extensions to their existing quarrying operations.

The Company currently operates a quarry on Part Portion 102 and processing plant on Lot 2 DP 611935 in the Parish of Sutton Forest near Exeter. The quarry currently produces in the order of 200,000 to 300,000 tpa of quarry products.

To ensure a continuation of quarrying operations the Company seeks to expand quarrying operations onto an adjoining parcel of land described as Lot 2 DP 537292. The attached plan shows the location of the proposed quarry extension.

In accordance with Clause 35 of the Environmental Planning and Assessment Act 1979 and Regulations 1980, could you please advise of the Department's requirements with respect to this development.

Yours faithfully,

Valerie Smith
Director

New South Wales Government

Department of Planning

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

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

Contact : V. Thomson
Ext. 2077

Our reference : 82/3164

Your reference :

Resource Planning Pty Limited
PO Box 388
EAST MAITLAND NSW 2323

Dear Sir

Proposed Extension of Hard Rock Quarry, Lot 2, DP 537292, Rockleigh Road, Exeter

---

Thank you for your letter of 31 October, 1990 indicating that you are consulting with the Director with regard to the preparation of an environmental impact statement (EIS) for the above development.

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

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

- noise impact assessment on nearest residences;
- proposals to minimise dust emissions from excavation and trafficking operations;
- assessment of any additional traffic generated by the proposed extension of the quarry.

4. Attachment No. 2 is a guide to the type of information most likely to be relevant to the development you propose; not all of the matters raised therein may be appropriate for consideration in the EIS for your proposal; equally, the guide is not exhaustive.

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

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

Yours faithfully,

Charles Hill
Acting Manager
Assessments Branch
As Delegate for the Director

DEPARTMENT OF PLANNING
ATTACHMENT NO. 1

STATUTORY REQUIREMENTS FOR ENVIRONMENTAL IMPACT STATEMENTS

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

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

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

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

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

DEPARTMENT OF PLANNING
ATTACHMENT NO 2

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

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

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

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

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

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

1. Description of the proposal.

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

2/...

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

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

Particular details that may be relevant include:

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

2. Description of the Environment.

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

3. Analysis of Environmental Impacts.

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

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

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

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

4. Contact with relevant Government Authorities.

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

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

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

New South Wales Government

Department of Planning

ILLAWARRA & MACARTHUR REGIONAL OFFICE

Mr. P. Jamieson
Resource Planning Pty. Ltd.
P.O. Box 388
EAST MAITLAND NSW 2323

State Office Block
84 Crown Street
Wollongong, 2500
P.O.Box 61
Wollongong East, 2520

Telephone :(042) 268111 Ext:

Fax No. :(042) 268127

Contact :

Our Reference : W91/1138 JE

Your Reference :

2 December, 1991

Dear Mr. Jamieson

Proposed Hard Rock Quarry Extension at Exeter

I refer to your recent enquiry regarding the above site in which you sought details of quarry buffer zones.

The Illawarra Regional Environmental Plan No. 1 contains provisions relating to extractive materials but does not set a minimum distance for the buffer. The Report of the Mt. Misery Blue Metals Working Party may be of use to you as it sets out the parameters for determining the "operational buffer" and the wider "planning buffer". The concept of the dual buffers is now under consideration throughout the Illawarra Region.

At present, there is no mandatory buffer distance required for extractive sites. As a guide, a nominal 1,000 metre planning buffer has been suggested in the absence of specific proposals to retain future options for an operational buffer. The size of an operational buffer is determined at the development application stage when actual environmental impacts can be assessed. The operational buffer is particularly dependent on the location and extent of dwelling houses in proximity to the proposed quarry. It is determined by the ability of the quarry to meet the requirements of the State Pollution Control Commission for noise and vibration levels at the closest dwelling houses.

The actual extent of the operational buffer should be determined on its merits. To this end, the E.I.S. should examine appropriate limits, given the physical and geological constraints of the site. It is no longer acceptable that adjoining land-owners should be unduly restricted in the use of their land as a result of quarrying operations.

The S.P.C.C. is charged with the responsibility for ensuring that levels of noise, air and water quality remain within acceptable levels. Accordingly, the SPCC will have considerable input into determining suitable buffer limits for the Exeter Quarry extension.

I trust that this clarifies the matter for you.

Yours sincerely

R. K. Woodward
Deputy Regional Manager (Illawarra/Macarthur)

Wingecarribee Shire Council

OUR REF.: D 10136 IM:PB
ENQUIRIES: I McNeill
YOUR REF.:

COUNCIL CHAMBERS, ELIZABETH STREET
MOSS VALE, N.S.W., 2577
P.O. BOX 141 DX 4961 BERRIMA DISTRICT
PHONE. (048) 68 1066 TELEX 25708
FAX: (048) 68 0260

4 December 1990

Note: New Fax No (048) 691203

Ms Pam Dean-Jones
Senior Consultant
Resource Planning Pty Limited
P O Box 388
EAST MAITLAND 2323

Dear Madam

Extension of Hard Rock Quarry -
Rockleigh Road, Exeter -
Southern Highlands Quarries Pty Limited

Reference is made to your letter dated 13 November 1990 regarding the above. In response to your request I advise that, notwithstanding those matters specified by the Director of Planning, Council will expect the impact statement to address the following specific issues:-

(a) The means by which the applicant will be able to maintain an effective buffer between the extremity of quarry operations and adjoining private properties. To mitigate any undesirable impact from noise, dust, vibration, visual intrusion, etc it is Council's opinion that quarry operations should not be contemplated within a distance of one kilometre from any existing dwelling house.

(b) The likely impact of the proposal on the local road system. Having regard to the fact that the application will prolong the life of existing quarry operations, the total effect of quarry transport vehicles on local road routes needs to be clearly identified.

(c) The means by which local watercourses and in particular Indigo Creek will be protected from sedimentation. It is particularly relevant in Council's opinion that a comprehensive hydraulics and water management assessment be included in the impact statement.

(d) The total site rehabilitation of worked areas.

If you require further assistance or explanation concerning the above, please contact Mr I McNeill of Council's Town Planning Department.

Yours faithfully

D J McGowan
Chief Town Planner
for
C Collins
Shire Clerk

Department of Minerals and Energy
NEW SOUTH WALES GOVERNMENT

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

Resource Planning Pty Ltd
PO Box 388
EAST MAITLAND NSW 2323

Our Ref: L90/0706

Attention: Ms Pam Dean-Jones

Dear Ms Dean-Jones,

EXTENSION OF HARD ROCK QUARRY, ROCKLEIGH ROAD, EXETER
SOUTHERN HIGHLANDS QUARRIES PTY LTD

I refer to your letter of 13th October, 1990 seeking this Department's comments on the proposed extension to the above hard rock quarry.

Hard rock aggregate is not a mineral under the Mining Act, 1973 and, therefore, the Deparment of Minerals and Energy has no statutory authority over its extraction apart from its role under the Mines Inspection Act, 1901 with repect to safe conduct of quarrying operations. Notwithstanding this, identification of the Exeter Quarry site in the Illawarra Regional Environmental Plan No. 1 as a regionally significant resource means that this Department has an important advisory role regarding development of the quarry. This is because this Department is the accepted government authority on extractive resource assessment and planning.

In order to assist this Department in any assessment it may be requested to provide, the environmental impact statement (EIS) should address the following resource aspects of the proposal:

1. The amount of hard rock available for extraction and the method used to determine that amount, e.g. drilling.

2. Yearly production and expected life of the operation.

3. Characteristics of the material to be extracted, i.e. composition, texture, grain size, deleterious minerals, jointing, etc.

4. Quality of the material to be produced and methods used to determine the quality.

5. Details of extraction and processing methods.

6. Proposed uses and markets for the hard rock aggregate.

In presenting the resource data in the EIS the use of clearly drawn and well-presented plans, including at least one cross-section, is suggested. Technical data should be appended and referred to in the body of the EIS.

Your request for production statistics has been passed on to the Statistical Section of this Department for processing. Also, please note that, to facilitate early reply, all correspondence should be addressed to the Director-General.

If you have any queries on this matter please contact Mr G. MacRae on (02) 901 8369.

Yours faithfully,

S.R. Lishmund
for **Director-General**

7/12/90

New South Wales Government

Soil Conservation Service

SOUTH EAST REGIONAL OFFICE

The Manager,
Resource Planning Pty Ltd,
P.O. Box 388,
East Maitland NSW 2323

N.S.W. Government Offices
159 Auburn Street
P.O. Box 390
Goulburn, N.S.W. 2580
Phone: (048) 23 0655
Fax: (048) 21 9413
Contact:

Our reference:

Your reference:

Attention Pam Dean-Jones

Dear Pam,

Extension Hard Rock Quarry,
Rockleigh Road, Exeter,
Southern Highlands Quarries Pty Ltd.

Thank you for the opportunity to comment on the development of these quarry extensions at Sutton Forest. I would also like to take this opportunity to apologise for my delay in writing to you on this matter.

To assist you I have outlined below the matters which I believe should be addressed in your EIS.

1. Protected Lands

The company's land as described on your map includes areas that have been mapped under Section 21 B.1.a. of the Soil Conservation Act as Protected Lands.

Maps and lists of the Protected Lands in the area can be inspected at either the Nowra or Goulburn offices, or at the Moss Vale office when it opens in several months.

On areas of Protected Lands, it is illegal to:-

(a) Ringbark, cut down, fell, poison or otherwise destroy, or cause to be ringbarked, cut down, felled, poisoned or other wise destroyed; or

(b) Top, lop, remove or injure, or cause to be topped lopped removed or injured,

any tree on any protected land without first gaining the approval of the approval of the Commissioner of the Soil Conservation Service.

On this site the mapped Protected Lands are described in the act as;

> Section 21 B 1 (a) Land within catchment areas, being land of which the surface generally has, in the opinion of the Commissioner have a slope generally greater than 18 degrees from the horizontal;

If any of the developments are to be located on Protected Lands and it will be necessary to destroy or injure trees, the company may be required to lodge an application with the Service at the time of development.

Protected Lands and the company's management proposals for these lands will need to be addressed in the EIS.

2. Erosion And Sediment Control Plan

At the detail design stage the Service would recommend the company to develop an erosion and sediment control plan to the satisfaction of the SCS.

This plan would need to cover the development and production phases of the operation as well as the final site rehabilitation. Topics that should be covered in this plan include:-

a. Time scale and phasing of the various aspects of the operation,

b. Topsoil stripping, stockpiling and topsoil reuse,

c. Stabilisation and other aspects of the infra structure development,

d. Details of the erosion and sediment control earthworks and structures,

e. Site rehabilitation and revegetation.

Although full details are not required at the EIS, this document will need to describe the broad details of the various components of this plan, and also give some idea of the species and techniques to be used for revegetation.

It would also be desirable for the EIS to nominate what company officer will be responsible for the site environmental management.

3. Site Meeting

As many of the government agencies may have differing standards for the development, it would be ideal if a site meeting could be arranged by the proponent and council for all the involved statutory bodies before final production of the EIS. This will assist with the interpretation of the project and may also help minimise any conflicting government agency

I hope that these notes are of assistance to you. If you would like to discuss any of the matters raised you may contact Lester Lynch our Director of Environment and Research on 048 23 0654.

Yours Faithfully,

Steve Nichols
for D A Manson
Regional Director,

25 January 1991

New South Wales Government

State Pollution Control Commission

State Office Block
84 Crown Street
Wollongong 2500
P.O. Box 513 Wollongong East 2520

Resource Planning Pty Ltd
PO Box 388
EAST MAITLAND NSW 2323

Our Reference:

Your Reference: 150,398 GD:KM

Contact:

Garry Dover 268108

Telephone: 042 [illegible]

Facsimile: 042 272348

21 MAY 1991

Dear Sir

Proposal to Extend the Hard Rock Quarry
Rockleigh Road, Exeter

I refer to your letter of 13 October 1990 concerning the preparation of an Environmental Impact Statement for the above proposal, and I apologise for not replying earlier.

In preparing the EIS the following matters should be addressed.

a) Water Pollution

The control of run-off from disturbed areas of the site and the collection of stormflows from the extraction area and other areas from where vegetation has been removed. The sediment dams should collect run-off from a one in ten year 24 hour storm.

b) Air Pollution

Control of dust from the extraction area, from stockpiles and from access roads used by vehicles and extraction equipment.

c) Noise Pollution

Control of noise from equipment used on site, from blasting should this be proposed and the hours and days of operation of the site. A Noise Impact Statement on the closest affected residence will be required.

d) Rehabilitation of the Site

Advice should be sought from the Soil Conservation Service on the impact of the development of the site and should also include a plan of management and proposals to progressively rehabilitate the site.

..../2

As the site is greater than 2 hectares in area then formal approval of the quarry will be required under the State Pollution Control Commission Act prior to commencing extraction operations. The applicant will need to apply following development consent being granted.

Should you have any enquiries please contact the above officer.

Yours faithfully

JOE WOODWARD
Regional Manager - South Coast
for Secretary

DEPARTMENT
OF LANDS

Ms Pam Dean-Jones
Senior Consultant
Resource Planning Pty Ltd
PO Box 388
EAST MAITLAND 2323

YOUR REF.:
OUR REF.:
CONTACT OFFICER R P Cole
TELEPHONE NO.: 048 230 659

26/4/91

ATTENTION: MR. PETER JAMIESON

Dear Ms. Dean-Jones,

DEPARTMENT OF LANDS COMMENT ON EXTENSION TO HARD ROCK QUARRY AT EXETER.

Reference is made to your letter of the 13th of October, 1990 and the recent facts of the same correspondence. The only Crown land in the area is Exeter Park vested in Wingecarribee Shire Council.

Areas of general concern would include any adverse impact of the enlarged quarrying operations on the Park and the public enjoyment of same. It is assumed that the operations shall all take place on the eastern side of the Railway line.

Yours sincerely

R P COLE
for Regional Director
Illawarra/South Eastern Region

159 Auburn Street Goulburn NSW Australia 2580 PO Box 223 Goulburn NSW Australia 2580
Telephone (048) 23 0665 Fax (048) 23 0675

New South Wales Government

NSW Agriculture & Fisheries

Central West, South East and Illawarra Region

28 November 1990

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

Telephone: (063) 638 250/251
Facsimile: (063) 638 356
Our Ref: AJD/WO'K

Ms Pam Dean-Jones
Senior Consultant
Resource Planning Pty Ltd
P O Box 388
EAST MAITLAND NSW 2323

Dear M/s Dean-Jones,

Extension of Hard Rock Quarry Rockleigh Road, Exeter for Southern Highlands Quarries

Thank you for your letter of 13 November 1990 requesting information on issues which the NSW Agriculture and Fisheries Department wish addressed in the Environmental Impact Statement for the above project.

The following aspects of land management should be given attention:

1. **Surface Runoff**

   The statement should provide for the prevention of any contaminated water from the proposed site entering Indigo Creek. Diversion banks on the southern side for this purpose will need to be revegetated immediately they are constructed as the area is prone to infestations of Serrated Tussock. This particular weed is wind blown and would thrive in the high fertility basalt soils of the site.

2. **Sediment**

   Sediment control needs to be addressed to prevent siltation of the adjacent Indigo Creek.

3. **Erosion**

   Control systems should be detailed for any areas which would be prone to erosion both on natural landforms and any stockpiles of topsoil removed prior to quarrying operations. The existing stockpiles adjacent to the current mine are well vegetated and a similar approach is all that would be required. The soil conservation service should be consulted in the design of an erosion plan.

4. **Noxious Weeds**

Control of Noxious Weeds such as Serrated Tussock and Blackberries in areas on or adjacent to the proposed site should be addressed in the Environmental Impact Statement.

5. **Pastures**

The proposed extension is on the Department's agricultural land suitability scale as Class III. Any pastures destroyed in the process of the proposed development would need to be re-established at least to the standard of the existing pasture.

6. **Revegetation**

Provision for revegetation of all disturbed areas after the cessation of operations should also be included in the Environmental Impact Statement.

7. **Fencing**

If grazing is to be continued on the adjacent land on the western side, the quarry operations will need to be securely fenced to prevent accidental animal ingression to the site.

Yours faithfully,

D J McDONALD
REGIONAL DIRECTOR
NSW AGRICULTURE & FISHERIES
ORANGE

Illawarra Electricity

Head Office: Bridge Street, Coniston
All mail to: General Manager, P.O. Box 1249, Wollongong 2500
Telephone: (042) 28 7511 DX5204 Wollongong
Facsimile No. (042) 28 2248

Our Ref: FP/LGJ

Your Ref:

Contact: Mr F Phillipson

Phone: (042) 28-2292

13 December 1990

Pam Dean-Jones
Senior Consultant
Resource Planning Pty Ltd
P O Box 388
EAST MAITLAND NSW 2323

Dear Madam

EXTENSION OF HARD ROCK QUARRY - ROCKLEIGH ROAD EXETER

I refer to your letter of 13 October 1990 in connection with the above matter and wish to advise that the proposal as outlined has significant implications for Illawarra Electricity's operations in this area. The area proposed for development is crossed by a 132 kV transmission line which connects our major 132 kV Fairfax Lane Substation to the Electricity Commission Supply Point at Goulburn and an 11 kV distribution line serving the immediate local area.

Quarrying activities provide serious hazards to the safe operation of these assets, the main concerns being -

a) Damage to overhead conductors from fly rock

b) Damage to structures and their foundations from blasting

c) Dust pollution of insulators leading to possible electrical failure.

Such activities would certainly not be approved on Illawarra Electricity easements and would also be of considerable concern if conducted within close proximity of our assets.

It would seem clear that if the development is to proceed it would be necessary to relocate the transmission lines well clear of the proposed developments, assuming suitable easements could be agreed with adjacent property owners. In the event that such a relocation were required the costs involved would be to your clients account. The environmental impact of such a relocation would also seem to be a matter which would need to be addressed by the proposed EIS.

The investigation of alternative route options and the estimation of likely costs of relocation is also a matter requiring significant work and cost to this organisation. Should you require such work to be done the actual costs of such work would also be to your clients account.

Should you require any further information at this stage please contact our Supervising Design Engineer, Mr Frank Phillipson on telephone (042) 28-2292.

Yours faithfully

for M W GREENTREE
General Manager

Roads and Traffic Authority
Southern Region
Illawarra Division

Our Reference 495.5351 WW:IB

W Wilson - (042) 202448

Your Reference

71 – 77 Kembla Street
Wollongong
New South Wales 2500
Telephone (042)29 3711
Facsimile (042)27 3705
PO Box 477
Wollongong East NSW 2520
DX 5178

Ms Pam Dean-Jones
Senior Consultant
Resource Planning Pty Limited
Box 388 PO
EAST MAITLAND 2323

21 DEC 1990

SHIRE OF WINGECARRIBEE. EXTENSION OF HARD ROCK QUARRY, ROCKLEIGH ROAD, EXETER. SOUTHERN HIGHLANDS QUARRIES PTY LIMITED.

Dear Ms Dean-Jones

Reference is made to your letter dated 13 October 1990 seeking the Authority's comments on the proposed Environmental Impact statement for the above project.

The following traffic issues should be included in the Environmental Impact Statement as required for extractive industry under SEPP II:-

1. Point of access to the classified road system,

2. Number and type of vehicle movements per day,

3. Effect on the local and classified road systems, and

4. Provision of any roadworks necessitated by the increased vehicles.

Yours faithfully

M. Bilaniwskyj

M Bilaniwskyj
Divisional Engineer

[AKI686L]

New South Wales Government

Water Resources

Resource Planning Pty Ltd
PO Box 388
EAST MAITLAND NSW 2323

Attention: Mr Peter Jamieson

Telex: 121188
Facsimile: (02) 895 7281
Telephone: (02) 895 6211
Ext: 7454
Contact Name: A. Kemp
Our Reference: 004059B

28-6-91

Dear Sir,

Re: EXTENSION OF HARD ROCK QUARRY - ROCKLEIGH ROAD EXETER

I refer to your recent telephone call and FAX message with regard to the above project proposed by Southern Highlands Quarries Pty. Ltd.

Enclosed for your information and retention are the following Departmental documents:

a) " A Guide to Stream Channel Management";

b) "The 7 - Step method of Controlling Bank Erosion and Sediment Build-Up"; and

c) "General Requirements for Environmental Impact Statements". (This is essentially a checklist of water resources matters to be addressed in the assessment of environmental impacts

The Department would appreciate being sent a draft copy of the environmental impact statement for review when completed.

I trust the above and enclosed information will prove useful.

Yours faithfully,

for A. Kemp
Manager
Investigations Unit
Technical Services
Division

File No.: F1996

Our Ref.: SF002:NF

5 December 1990

NSW
NATIONAL
PARKS AND
WILDLIFE
SERVICE

Pam Dean-Jones
Resources Planning Pty Ltd
PO Box 388
EAST MAITLAND NSW 2323

Dear Madam

RE: EXTENSION OF EXETER QUARRY
SOUTHERN HIGHLANDS QUARRIES PTY LTD

I refer to your letter of 17 October which has been forwarded to the Regional Archaeologist from our Nowra Office.

The subject area was surveyed for archaeological sites in 1984 (copy of report attached). One artefact scatter and one isolated artefact were recorded during the survey. Since this survey, considerably more archaeological fieldwork has been undertaken on the Southern Highlands, providing a better framework to assess the results of individual surveys. In the light of this information and the fact that there was very little ground visibility at the time of the original survey, the Environmental Impact Statement should include another assessment of the archaeological values of the area. This should address the following issues:-

(a) Whether the previously recorded site still exists, and if it does, whether it will be affected by the proposed quarry extension.

(b) How much of the subject area is of high archaeological potential, and of this, how much was inspected during the previous survey.

(c) Whether there are areas which are likely to contain sites but these were not visible at the time of the original survey because of heavy vegetation cover.

(d) Consultation with the Illawarra Local Aboriginal Land Council.

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

(e) The significance of any sites found in a local and regional context, in terms of the nature of the artefact assemblages.

You are advised that the Service has no specific concerns regarding nature conservation values.

Your faithfully

Sue Feary
Regional Archaeologist
for DIRECTOR

MOSS VALE RURAL LANDS PROTECTION BOARD

61 John Street, CAMDEN
All Communications to be addressed to the Secretary
P.O. Box 141, CAMDEN, N.S.W. 2570
Phone: Camden (046) 559 165
Fax: (046) 553 054

Our Ref: AWA:PED:3104406

14 December 1990

The Senior Consultant
Resource Planning Pty Limited
P.O. Box 388
EAST MAITLAND NSW 2323

Dear Madam

Extension of Hard Rock Quarry
Southern Highlands Quarries Pty Limited

I refer to your letter dated 13 October 1990 to the Pastures Protection Board at Goulburn, which has been passed to this Board for comment.

The proposed extension to the quarry was discussed at the Meeting of the Board on 26 November 1990. It was resolved that this Board does not have any specific issues that should be addressed in the Environmental Impact Statement.

Thankyou for your consideration.

Yours faithfully

A.W. ATKIN
Secretary

APPENDIX 2

SOIL PROFILE DESCRIPTIONS

APPENDIX 2
SOIL PROFILE DESCRIPTIONS

Exeter S1

Chocolate Soil, Dr 4.12

Profile located on completely cleared flat top of low ridge with a gradient of approximately 1%. Improved pasture groundcover 90%, friable surface condition, no bedrock outcrop and stable erosion condition. Tertiary basalt parent material.

A — 10cm, lower depth, 7.5YR 4/3, pH 6.0. Silt loam, normal plastic, non-sticky, weak consistence and crumbly shear. Weak pedality (sub-angular blocky, 10-20mm, rough-faced peds). No cutans, cracks <2mm, stones <2% (Angular 2-6mm). Abundant roots in-ped and ex-ped, no pans or concretions.

B — 30cm+, lower depth, 5YR 3/3, pH 7.0. Light clay, normal plastic, slightly sticky, strong consistence and brittle shear. Moderate pedality (sub-angular blocky, 20-50mm, rough-faced peds). No cutans, cracks <2mm, 2-10% stones (2-20mm, sub-angular). Few roots, no pans or concretions.

Exeter S2

Chocolate Soil, Dr 4.11

Profile located on completely cleared crest of knoll with 90% improved pasture ground cover. Surface condition friable, no bedrock outcrop, tertiary basalt parent material, slow internal drainage. Stable current erosion condition although evidence of previous sheet erosion.

A — 0-10cm, 7.5YR 4/6, pH 5.5. Light sandy clay loam, normal plastic, non-sticky, weak consistence, crumbly shear. Weak pedality (sub-angular blocky, rough-faced peds, 10-20mm breaking to 5-10mm). Cracks less than 2mm, less than 2% stones (2-6mm). Many roots, no pans or concretions.

B — 10-25cm+, 5YR 3/3, pH 5.5. Light clay, strong consistence, brittle shear. Moderate pedality (columnar rough-faced peds, 20-50mm breaking to 10-20mm). Cracks less than 2mm, less than 2% stones (2-20mm), few roots, no pans, concretions or inclusions.

Exeter S3

Chocolate Soil, Dr 4.11

Profile located in exposed batter on upper slope of knoll. Surface condition friable, <10% bedrock outcrop, few scattered surface boulders up to 40cm diameter. Active minor slumping, moderate soil erodibility, moderate erosion hazard in exposed area.

A 28cm, average lower depth, 7.5YR 4/4, pH 6.0. Light sandy clay loam, normal plastic, non-sticky. Weak consistence and crumbly shear. Weak pedality, rough-faced peds. No cutans, cracks <2mm, stones <2% (sub-angular, 2-6mm, scattered surface boulders 200mm-600mm). Roots common, no pans or concretions.

B 1.5m average lower depth, 5YR 3/6, pH 6.0. Clear boundary, clay loam, normal plastic, non-sticky. Strong consistence and brittle shear. Moderate pedality (columnar, 20-50mm, smooth-faced peds). Cutans common, cracks up to 10mm, <2% stones (sub-angular 2-6mm). Few roots, no pans or concretions.

APPENDIX 3

AIR QUALITY ASSESSMENT

Prepared By Nigel Holmes & Associates

AIR QUALITY ASSESSMENT
EXETER QUARRY EXTENSION

Prepared

for

Resource Planning Pty Ltd

by

Nigel Holmes & Associates
80 Curtis Road
Balmain NSW 2041
Phone (02) 810-8224

9 November 1992

CONTENTS

FIGURES

(All figures are at the end)

TABLES

1.0 INTRODUCTION

This report has been prepared by Nigel Holmes & Associates for Resource Planning Pty Ltd on behalf of Southern Highlands Quarries Pty Limited. It assesses the air quality impacts expected as a result of an extension to the existing hard rock quarry approximately 600 m east of the township of Exeter (see Figure 1).

The evaluation of the impacts includes a review of the proposed quarry extension plan, a review of the dispersion meteorology of the area, and an estimate of the quantity of dust emitted from various sources of dust within the quarry. Finally a computer-based dispersion model has been used to estimate dust fallout and dust concentrations in the vicinity of the quarry.

2.0 DESCRIPTION OF THE PROPOSAL AND LOCAL SETTING

Figures 1 and 2 show the locations of the areas which are to be quarried and the locations of the process area and stockpiles.

The quarry extension will be developed over approximately 9 years as shown in Figure 2. The quarry is located approximately 600 m east of Exeter with the nearest residence (not associated with development) located 420 m to the southwest of the quarry. Residences are also located to the northwest, north, southeast and south of the quarry (see Figure 1).

Total reserves are 2.25 Mt. Production (ex-crushing plant) is expected to range from 250,000 t/year to 300,000 t/year, with a peak annual production of 300,000 t. Quarrying will involve the removal of topsoil and overburden and its transport to previously worked areas for use as fill in the progressive rehabilitation of the worked out areas. Rock will be removed, without blasting, by hydraulic excavator (2.5 m^3 capacity) and loaded to two 35 t off-highway haul trucks, which will transport the rock to a dump hopper and primary crusher.

Development consent has already been obtained for the processing area. The assessment in this report therefore addresses the impact of the quarrying and haulage activities. However dust emissions from the processing plant have been included in the modelling studies as the impact of the quarry and the processing area will be cumulative.

The following information is included to assist in assessing cumulative impacts associated with the existing crushing plant and the proposed quarry extension. The layout of fixed equipment and stockpiles is shown in Figure 2. After, crushing, screening and stockpiling, the product will be loaded by front-end loader to 25 tonne highway trucks for transport to the end-user. Material not suitable for use in product will be used in progressive rehabilitation of the Quarry. Material will be transported as back load in off-highway haul trucks.

Table 1 summarises the overburden and rock production rates (ex-crushing plant) per year of operation of the quarry extension.

TABLE 1
QUARRY PRODUCTION, OVERBURDEN VOLUMES AND DESTINATIONS

Year	Overburden Volume (m^3)	Production Tonnage	Waste Material tonnage	Overburden Destination
1	85,000	250,000	72,000	Existing quarry,bund wall
2	45,000	250,000	72,000	Stage 1
3	65,000	250,000	72,000	Stage 2
4	85,000	250,000	72,000	Stage 3 & 4
5	85,000	250,000	72,000	Stage 4
6	40,000	250,000	72,000	Stage 4 & 5
7	50,000	250,000	72,000	Stage 3 & 6
8	55,000	250,000	72,000	Stage 2 & 7
9	50,000	250,000	72,000	Stage 1,8 & 9
Total	560,000	2,225,000	649,000	

Dust controls will comprise those currently employed at the crushing plant, and watering of haul roads and other trafficked areas. The access road to the quarry and crushing plant (that is Rockleigh Road) will be sealed to the plant entry point.

3.0 CLIMATE AND DISPERSION METEOROLOGY

The computer-based dispersion model used to predict dust deposition and concentration levels requires data on wind speed, wind direction, atmospheric stability categories and mixed layer height [1]. The data base used and the way in which it has been used to derive the parameters required for dispersion modelling is discussed below.

---

[1] The term mixed-layer height, refers to the height above the ground through which ground-based emissions will eventually be dispersed once a plume has been thoroughly mixed. An elevated plume, initially above the mixed-layer height will remain isolated from the ground until such time as the mixed-layer height reaches the height of the plume. In general the mixed-layer height will increase during the day as the sun causes convection to deepen the turbulent layer of the atmosphere close to the ground. Mixed-layer height will also increase if the wind speed increases because higher wind speeds will increase turbulence as the wind blows over the rough ground.

3.1 Wind Speed and direction

The closest meteorological monitoring station to the site is the Bureau of Meteorology station at Bowral (approximately 25 km to the northeast). The data available comprise observations of wind speed, wind direction and cloud cover made at 9 am and 3 pm over the eighteen year period 1967 to 1984. In practice because of missing data, only twelve years of data are available.

Figure 3 presents wind rose diagrams compiled from all the valid the 9 am and 3 pm wind speed and direction observations over the 1967 to 1984 interval. As might be expected there are more calm periods observed at 9 am than at 3 pm, but apart from the generally lower wind speeds that apply in the morning the pattern of winds that apply for the two times are similar, with the most common winds coming from the west, followed by the northeast. The 3 pm observations also show a minor peak in the occurrence of southeasterly winds which is not apparent in the 9 am data.

3.2 Atmospheric Stability [2]

Atmospheric stability can be derived from information on wind speed and cloud cover using a procedure set out by Turner (1968). This has been done and a stability class has been determined for each pair of wind speed wind direction observations. The overall distribution of stability conditions over the data period is shown in Table 2.

TABLE 2
DISTRIBUTION OF ATMOSPHERIC STABILITY CATEGORIES

Stability	Percentage occurrence
A	5.6
B	30.0
C	34.1
D	30.3
E	0.0
F	0.0

[2] In dispersion modelling, the term stability class is used to categorise the rate at which a plume will disperse. In the Pasquill-Gifford stability class assignment scheme (as used in this study) there are six stability classes, A through to F. Class A relates to unstable conditions, such as might be found on a sunny day with light winds. In such conditions plumes will spread rapidly. Class F relates to stable conditions, such as occur when the sky is clear, the winds are light and an inversion is present. Plume spreading is slow in these circumstances. The intermediate classes B, C, D and E relate to intermediate dispersion conditions.

It is notable that Table 2 indicates no stable (E or F) class stability conditions apply at the site. This is a consequence of the available observations being daytime observations. No night-time data are available. This does not reduce the relevance of the meteorological data base because the quarrying operations will be confined to daytime periods.

3.3 Mixed-layer Height

Mixed-layer heights are not critical in determining dust concentrations and dust fallout levels from surface sources of dust, but approximate values are required by the dispersion model. These have been provided to the data file used by the model by assuming that seasonal average values of 1200 m for autumn and spring, 1000 m for winter and 1500 m for summer. As noted earlier the model is insensitive to the precise values for mixed-layer height, for all reasonable values.

3.4 Data file for modelling

The meteorological data file produced by the above procedure was then processed to produce a joint frequency file of wind speed, wind direction and stability class which was suitable for use with the dispersion model.

Appendix A summarises the data as a series of tables showing the percentage occurrence of different stability categories, wind speeds and wind directions. The table has been compiled using all available 9 am and 3 pm observations.

3.5 Rainfall

Although rainfall data are not significant in determining dispersion, they are of interest in determining the rate of generation of dust from stockpiles and other exposed areas.

Rainfall data from Bowral (Parry Drive) (latitude 34 degrees 29 minutes south and longitude 150 degrees 24 minutes east, elevation 690 m) are presented in Table 3.

TABLE 3
RAINFALL DATA

Month	Mean (mm)	Median (mm)	Number of rain days (number of days)
Jan	89	64	14
Feb	84	68	13
Mar	112	92	13
Apr	78	56	11
May	75	53	12
Jun	91	65	11
Jul	42	32	10
Aug	63	32	10
Sep	58	53	11
Oct	85	74	13
Nov	94	77	13
Dec	71	68	12
Year	942	962	143

Sources: Rainfall data from Bureau of Meteorology (1988A)

4.0 EXISTING AIR QUALITY

Existing air quality data was recorded by Metford Laboratories at three locations adjacent to the proposed quarry extension (see Figure 1). The results are presented in Table 4.

TABLE 4
DUST MONITORING

Location	Period	Insoluble Solids (g/m^2/month)	Ash (g/m^2/month)	Combustible Matter (g/m^2/month)
D1	1/2-1/3/91	0.84	0.60	0.24
	1/3-3/4/91	0.62	0.47	0.15
	3/4-8/5/91	0.31	0.16	0.15
D2	1/2-1/3/91	0.99	0.72	0.27
	1/3-3/4/91	0.63	0.49	0.14
	3/4-8/5/91	0.53	0.39	0.14
D3	1/2-1/3/91	0.94	0.68	0.26
	1/3-3/4/91	0.62	0.42	0.20
	3/4-8/5/91	0.59	0.45	0.14

These results were recorded when the existing Southern Highlands Quarries Pty Limited quarry was fully operational. Typical dust deposition rates in rural areas have been measured in the range of 1.17 to 1.95 g/m^2/month (Senate Select Committee on Air Pollution, 1969). Deposition rates recorded at Exeter are less than 1 g/m^2/month.

There are no measurements of either long-term or short-term dust concentrations in the area and again on the basis of a site inspection and a review of existing land use and the dust deposition data presented above it can be estimated that annual average dust concentration would be unlikely to exceed 20 $\mu g/m^3$ [3].

---

[3] In the vicinity of mining operations dust concentrations can be approximately estimated from dust deposition data using the "rule of thumb" that an area receiving 4 g/m^2/month (annual average) will record a concentration of 90 $\mu g/m^3$ (annual average). Thus deposition levels of approximately 1 g/m^2/month would experience concentrations of approximately 22 $\mu g/m^3$ (annual average). This "rule of thumb" only applies in areas where the predominant source of particles in the air is soil-derived dust. It should not be applied in areas where the predominant sources are smoke or stack emissions.

5.0 AIR QUALITY CRITERIA

The effects of dust on health and amenity can be assessed by comparing dust deposition rates and dust concentrations with recognised air quality criteria established as a result of research both in New South Wales and in the United States. To cover the full range of possible adverse impacts it is necessary to make reference to criteria for both long-term (annual averages) and short-term (24-hours) periods.

5.1 Short-term criteria

Concentration

In assessing the acceptability of projects the Environment Protection Authority of New South Wales (EPA) formerly referred to the US EPA primary and secondary ambient 24-hour air quality standards, which are 260 and 150 microgram/cubic metre respectively. These have been changed recently to make specific reference to the particles sizes of the dust and the air quality goal now refers to a concentration of 150 micrograms/cubic metre for sub-ten micrometre particles. The primary standard is designed to protect the public against adverse health effects with an "adequate margin of safety" [4], and is not to be exceeded more than once per year. The secondary standard is designed to protect against "known or anticipated adverse effects of a pollutant", and again is not to be exceeded more than once per year.

The United States also publish criteria known as Alert, Warning and Emergency level criteria for 24-hour average particulate matter concentrations. These are as follows:

Alert -	375	microgram/cubic metre
Warning -	625	microgram/cubic metre
Emergency -	875	microgram/cubic metre.

A pollutant reaching concentrations between the primary standard and the alert level would be expected to cause "mild aggravation of symptoms in susceptible persons, with irritation symptoms in the healthy population". Between the alert and warning level concentrations there would be "significant aggravation of symptoms and decreased exercise tolerance in persons with heart or lung disease, with wide spread symptoms in the healthy population". Between the warning level and emergency level there would be "premature onset of certain diseases in addition to significant aggravation of symptoms and decreased exercise tolerance in healthy persons".

---

[4] Text between inverted commas in this section has been taken from Stern et al. (1987) "Fundamental of Air Pollution - Second Edition" - see Section 9.0 for full reference.

Deposition
There are no air quality criteria for short-term dust deposition rates.

5.2 Long-term criteria

Concentration
The EPA refer to the National Health and Medical Research Council (NH&MRC) (Australia) 90 microgram/cubic metre annual average goal when assessing long-term dust impacts. This level is recommended as the maximum permissible level that should be permitted in urban environments. The 90 microgram/cubic metre annual goal is now supplemented with the US EPA 50 micrograms/cubic metre annual goal for sub-ten micrometre particles. In practice because approximately 50 per cent of particles in dust near mining and quarrying industries are in the sub-ten micrometre range then the two goals are very similar.

Deposition
In the past the EPA has considered that residential areas would begin to experience dust related nuisance impacts when annual average dust (insoluble solids) deposition levels exceeded 4 grams/square metre/month, and that dust impacts would be at unacceptable levels when they reached 10 grams/square metre/month (SPCC 1983). Recently, the EPA (Dean et al., 1990) has refined these criteria. **Table 5** shows the maximum acceptable increase in dust deposition over the existing dust levels.

For example, in rural/semirural areas with annual average deposition levels of between 1 and 2 grams/square metre/month, as applies for the present location (see **Section 5.0**) an increase of up to 2 grams/square metre/month would be permitted before it is considered that a significant degradation of air quality had occurred.

The above criteria for dust fallout levels are set to protect against nuisance impacts and they are not relevant for interpreting the significance of dust in quarry working areas, where the concept of dust fallout level becomes meaningless in, for example, areas where overburden is being dumped.

TABLE 5-ENVIRONMENTAL PROTECTION AUTHORITY CRITERIA FOR DUST FALLOUT

Existing dust fallout level (grams/square metre/month)	Maximum acceptable increase over existing fallout levels - (grams/square metre/month)	
	Residential	Other
2	2	2
3	1	2
4	0	1

6.0 EMISSIONS INVENTORIES

Dust emissions have been estimated by analysing the quarry operations for Stage-1 and Stage-4. The reason for selecting these two years for assessing impacts is that in Stage-4 quarrying operations make the closest approach to non-company owned houses. In Stage-1, although the quarrying operations are further away from residences, a scraper will be used to remove overburden and build a bund wall on the western side of the pit. This operation has the potential to generate significant quantities of dust. It has been assumed conservatively that the maximum production rate (ex-crushing plant) of 300,000 t/year applies and that this requires the excavation of approximately 385,000 tonnes of rock.

The operations which apply under these conditions (that is, how much material is moved, how far it is moved and so on) have been used with emission factors developed, both locally and by the United States Environmental Protection Agency (US EPA), to estimate the amount of dust produced from each operation in the quarry. Estimated emission amounts for each activity are presented in Table 6. Details of the calculations are presented in Appendix B.

For the purpose of estimating dust deposition and concentration levels it is also important to know the distribution of particle sizes in the dust from various activities. This information been taken from research undertaken in the Hunter Valley and in the United States. The distributions used are summarised in Table 7.

TABLE 6
INVENTORY OF DUST EMISSIONS
AFTER APPLICATION OF CONTROLS - kg/year

ACTIVITY	ESTIMATED EMISSION OF DUST	
	STAGE-1	STAGE-4
1. Excavator loading trucks	5989	5989
2. Road haulage		
- from pit to dump hopper	26400	40480
- from product stockpile to sealed road	8640	8640
3. Dumping rock to hopper	1350	1350
Loading of waste material	382	382
4. Crushing		
- Primary and secondary	28770	28770
- Tertiary	83700	83700
5. Screening	43200	43200
6. Rehabilitation		
- Transport	2623	2623
- Loading	6887	6887
- Unloading	3482	3482
7. Conveyors and transfer points	12078	12078
8. Loadout to highway trucks	6000	6000
9. Wind erosion from unsealed road, stockpile area and plant area.	7691	20498
10. Building of bund wall	63024	
TOTAL	**300216**	**264079**

TABLE 7
DISTRIBUTION OF PARTICLE SIZES FOR DUST FROM QUARRYING

PROCESS	% Fine Particles (≤ 2.5 micrometres)	% Inhalable Particles (2.5 - 15 micrometres)	% Coarse Particles (≥ 15 micrometres)
PIT AREA			
Excavator Loading	4	40	56
Haulage	6	53	41
Pit erosion	0	67	33
Scraper	6	53	41
PROCESS AREA			
Screening	4	40	56
Primary and Secondary crushing	20	50	30
Tertiary crushing etc	20	50	30
Conveyors	0	67	33
Transfer Points	4	40	56
Process area erosion	0	67	33
REHABILITATION			
Transport	6	53	41
Loading	4	40	56
Unloading	4	40	56
STOCKPILES			
Loading	4	40	56
Unloading	4	40	56
Haulage	6	53	41
Erosion	0	67	33

7.0 PREDICTED DUST DEPOSITION LEVELS

7.1 Introduction

The computer-based dispersion model DUSTGLC has been used to predict the increase in annual average long-term dust deposition rates and dust concentration levels for an area approximately 3.6 km (E-W) by 2.4 km (N-S)with the quarry at the centre. The model DUSTGLC has been widely used in the Hunter Valley and a detailed description of its theoretical basis and the results of a model validation study have been presented in the Lemington Open Cut Environmental Impact Statement (CSR 1984).

7.2 Long-term air quality

Figures 4 to 7 show the predicted increase in dust concentrations and deposition levels for Stages 1 and 4. For dust concentration an annual average level of 90 $\mu g/m^3$ is the upper limit of acceptability. Figure 4 shows that during Stage-1 when construction of the bund wall is taking place, the predicted increase in dust concentration due to operation of the quarry is less than 10 $\mu g/m^3$ at the closest non-company owned residences. If the existing background concentration of 20 $\mu g/m^3$ is assumed then it can be seen that total dust concentrations will be no more than 30, which is well below the acceptable annual average figure of 90 $\mu g/m^3$. Since approximately 50% of these particles will be greater than 50 μm then the total dust loading will also comply, by a significant margin with the EPA's 50 $\mu g/m^3$ annual average goal for particles greater than 10 μm particles. Figure 6 shows the predicted increase in dust concentration for Stage-4, which represents normal quarry operations when the quarrying activities are closest to the residences. In this instance no residence is predicted to experience increases in dust concentration due to quarry operations above 5 $\mu g/m^3$.

Figures 5 and 7 show the predicted increase in annual average dust deposition levels due to operation of the quarry for Stages 1 and 4 respectively. In both cases, the maximum predicted increase at any non-company owned residence is less than 0.5 $g/m^2/month$, which when added to the existing dust fallout levels of less than 1 $g/m^2/month$ would give a total deposition level of 1.5 $g/m^2/month$. The predicted increase is well within the EPA's allowable increase of 2 $g/m^2/month$ (annual average) for this type of environment and the impacts of the quarry operation are unlikely to have an adverse or even perceptible impact on nearby residences. The predicted increase in dust deposition at the lease boundary is generally less than 2 $g/m^2/month$. It should be noted that the dust monitoring data presented in this report would include fallout from the existing processing plant and quarry activities and that these emissions have also been included in the modelling predictions. There is therefore an element of "double-counting" in the assessment which would tend to overestimate the dust impacts.

8.0 CONCLUSIONS

The analysis presented here has used dispersion modelling to predict annual average dust deposition and dust concentrations expected for Stage-1 and Stage-4 in the life of the quarry.

It is predicted that at all stages in the development of the quarry the dust deposition levels will remain below the EPA and NH&MRC long-term air quality goals at all residences.

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APPENDIX A
BOWRAL WIND DATA IN NUMERIC FORM

BOWRAL DATA 9AM/EPM

ALL PASQUILL STABILITY CLASSES

WIND SPEED CLASS (MPS)

WIND SECTOR	.51 TO 1.50	1.51 TO 3.00	3.01 TO 4.50	4.51 TO 6.00	6.01 TO 7.50	7.51 TO 9.00	9.01 TO 10.50	GREATER THAN 10.50	TOTAL	MEAN SPEED
NNE	.003311	.008447	.007991	.006279	.002169	.000228	.001256	.000342	.030023	3.87
NE	.011872	.023174	.026027	.018265	.007534	.001598	.002283	.000342	.091096	3.78
ENE	.002854	.009361	.005708	.005479	.004795	.000114	.000114	.000228	.028653	3.85
E	.010388	.014155	.013470	.005822	.001826	.000228	.000228	.000000	.046119	3.05
ESE	.002397	.006279	.002854	.002854	.001256	.000000	.000228	.000228	.016096	3.51
SE	.015639	.019749	.015982	.006279	.002283	.000457	.000571	.000457	.061416	3.03
SSE	.002854	.003881	.002626	.001142	.000685	.000114	.000228	.000000	.011530	3.10
S	.008105	.007192	.004566	.002283	.001027	.000457	.000114	.000342	.024087	2.93
SSW	.001027	.002740	.001142	.001256	.000228	.000114	.000114	.000000	.006621	3.31
SW	.009361	.011986	.010388	.005251	.004224	.001941	.002740	.002283	.048174	4.28
WSW	.002511	.008447	.003767	.005251	.007420	.001484	.005365	.007192	.041438	6.53
W	.020662	.027169	.044064	.029338	.025571	.018493	.019863	.018379	.203539	5.70
WNW	.003767	.007877	.010388	.008790	.008676	.003995	.005479	.003653	.052626	5.66
NW	.006621	.012329	.013242	.007306	.004338	.003082	.002169	.001598	.050685	4.29
NNW	.001256	.003881	.000685	.001712	.000571	.000114	.000685	.000342	.009247	4.01
N	.003539	.008105	.004338	.003995	.001712	.000114	.000228	.000114	.022146	3.40
CALM									.256507	
TOTAL	.106164	.174772	.167237	.111301	.074315	.032534	.041667	.035502	1.000000	3.41

NUMBERS BELOW BASED ON ALL OBSERVATIONS
NUMBER OF INVALID OBSERVATIONS = 0
NUMBER OF VALID OBSERVATIONS = 8760

APPENDIX B
DETAILS OF DUST EMISSION ESTIMATES

APPENDIX B
ESTIMATES OF DUST EMISSIONS

This appendix provides estimates of dust emission from each of the principle operations on the quarry. The quarrying operation will take place over 9 years, during which time the excavation area will move over an area approximately 240 m by 300 m. The amount of dust produced will remain approximately constant over the life of the quarry and many of the dust sources, such as the crushing plant, stockpiles and haul roads will remain fixed in location. To provide a picture of "worst-case" impacts it has been decided to estimate dust emissions for Year-4. This will give haul roads a maximum length and give rise to maximum dust emission from this activity. In addition quarrying activities will be closest to residences in this period. It is also assumed that the crushing plant is producing quarry product at its planned maximum rate of 300,000 tonnes of product per annum. This will involve the removal of a total of approximately 385,000 tonnes of rock of which 85,000 t is waste material which is returned to the quarry for spreading. The remainder of this appendix provides estimates of dust emission for each dust producing activity. Stage-1 has also been considered as a special case because during this period topsoil and overburden will be removed by scraper and used for construction of a bund wall. This will result in dust-generating activities at the western edge of the pit.

Blasting and Drilling

There will be no blasting and drilling.

Excavator loading trucks

The emission factor (in kg of dust per tonne of rock loaded) for loading feed rock into a 35 tonne off-highway trucks is given by Equation 1 (US EPA 1985) as follows,

$$E = \frac{k.(0.00090).(\frac{S}{5}).(\frac{U}{2.2}).(\frac{H}{1.5})}{(\frac{M}{2})^2.(\frac{Y}{4.6})^{0.33}} \qquad (1)$$

where,

k	=	particle size multiplier (taken as 0.73 for batch dropping operations and sizes < 30 μm),
s	=	material silt content (taken as 1.6 %),
U	=	mean wind speed (taken as 3.5 $m.s^{-1}$),
H	=	drop height (taken as 2 m),
M	=	material moisture content (0.7 %), and
Y	=	the capacity of the dumping device (taken as 2.5 m^3).

Using Equation 1 and the parameters listed below the dust emission factor is 0.0045 kg/t. With a production rate of 385,000 t/year the total amount of dust from this source is estimated to be 1350 kg/year.

Unloading of 85,000 t of waste material back in the pit will result in additional dust emissions of 382 kg/y.

An additional 85,000 cubic metre of overburden will also be removed during Stages 1 and 4. Assuming a density of 1.8 t/cubic metre and a silt content of 10%, gives a dust emission rate of 4257 kg/year. Therefore the total dust emission rate for loading to trucks in the pit is 5989 kg/year

Road Haulage

Rock from the quarry has to be transported from the active face of the quarry to the dump hopper. In Stage-4 this will involve a round trip of approximately 1840 m. Assuming 385,000 tonnes of rock are transported in this way in 35 tonne trucks then the number of trips will be 11000. Using the EPA dust emission factor of 2.0 kg of dust per vehicle km (after the application of water to suppress dust) the amount of dust from haulage of rock will be 40,480 kg/year. For Stage-1 the round trip is estimated to be 1200 m. This results in dust emissions of 26,400 kg/year

Product will need to be transported off-site in 25 t trucks. Assuming the haul distance is approximately 180 m on-site on unpaved roads, then the total haul distance on unsealed road will 360 m return. The total dust from product haulage will be 8640 kg/year [0.36x2x(300,000/25)]

Dumping rock to dump hopper

Approximately 385,000 t of rock will be dumped to the dump hopper. The amount of dust generated in this process can be estimated using Equation 1. It will be similar, but because of the larger capacity of the dumping device, it will be less than the quantity generated during the loading operation. For assessment purposes it has been taken to be the same and has been set at 1350 kg of dust per year.

Crushing and screening

Of the 385,000 t passes through the primary crusher, only 300,000 t will be conyeyed to the secondary crusher, the remaining 85,000 t will be removed as scalpings and waste and not processed furhter. it has been assumed that material passing through the primary and secondary crusher generates dust at the rate of 140 g/t of material processed (US

EPA, 1985). Water sprays will reduce this by approximately 70 % so that the total dust from crushing will be 28770 kg [(385,000+300,000)x0.140x(1-0.7)].

Tertiary crushing has an emission rate of 930 g/t, which can be reduced by 70 % through the use of water sprays to produce 83,700 kg [300,000x0.930x(1-0.7)].

Screening produces dust at the rate of 80 g/t of dry material processed, which again is reduced by 70 % by the use of water sprays (US EPA, 1985). Assuming on average six levels of screening for all the product the total amount of dust due to screening will be 43,200 kg [300,000x0.080x6x(1-0.7)].

Loadout of product

Take as 0.02 kg/t, which gives 6000 kg/year.

Conveyor transfer points and loading to stockpiles

Dust emission from transfer of material from one conveyor to another and to stockpiles (in kg of dust per tonne of throughput) of can be estimated from Equation 2 as follows:

$$E = \frac{k.(0.00090).(\frac{S}{5}).(\frac{U}{2.2}).(\frac{H}{1.5})}{(\frac{M}{2})^2.} \qquad (2)$$

where, all terms have previously been defined.

Conservatively assuming a drop height of 3 m, Equation 2 gives an emission factor of 2.013 g/t. Assuming that 300,000 t of material passes, on average, through 20 transfer points the total dust generated will be 12,078 kg.

Rehabilitation Activity

This involves the movement of top soil and overburden material onto worked out areas. For Stage 4 the volume of overburden will be approximately 85,000 m^3. Assuming that the density of overburden is 1.8 t/m^3, then approximately 153,000 t of overburden will be removed during Stage 4. The average round trip is approximately 300 m. The number of trips required by 35 tonne trucks is 4371. For unpaved roads, the emission factor is 2.0 kg/vehicle km for watered roads. The total dust emitted from the transportation of the overburden will be approximately 2623 kg.

For the loading and unloading of the overburden, Equation 1 was used. The 85,000 t of waste material was also included in this activity . For loading a drop of 3 metres was assumed and for unloading a drop of 1.5 metres was assumed. The emission factors are 41.3 g/t for loading and 20.9 g/t for unloading of overburden, and 6.68 g/t for loading and 3.34 g/tfor unloading of waste product. For 153,000 of overburden and 85,000 t of waste material the total annual dust emissions will be 6887 kg for loading and 3482 kg for unloading.

Wind erosion from exposed areas and from stockpiles

The US EPA (1985) Equation for wind erosion from exposed area (in kg/ha/day) is:

$$E = 1.9\left(\frac{s}{1.5}\right)\frac{(365-p)}{235}\frac{f}{15} \qquad (3)$$

where,

p = the mean number of days with rainfall greater than 0.25 mm (taken as 143), and;

f = the percentage of time the unobstructed wind speed exceeds 5.4 m/s at the mean height of the stockpile (taken as 11 %).

s = silt content (taken as 10%) for exposed areas (see particle size distribution provided by Peter Jamieson, dated 23 July 1991).

Using the parameters with Equation 3 gives an e
stimated wind erosion emission rate of 8.78 kg/ha/day. Assuming areas, of 0.7 ha for unsealed roads, 0.4 ha for stockpiles, 0.3 ha for plant area and 1 ha un-rehabilitated quarry floor in Stage-1 and 5 ha in Stage-4, the total exposed area will be 2.4 ha in Stage-1 and 6.4 ha in Stage-4. Wind erosion from this will be 7,691 and 20,498 kg in Years 1 and 4 respectively.

Scrapers

Scrapers will be used to remove overburden in Stager-1. A total of 85,000 m^3, will be removed making of which 45,000 m^3 will be used to build a bund wall. Equation 4 shows the estimated dust emission in kg/km travelled for this operation.

$$E=7.3\times10^{-6}\times S^{1.3}\times W^{2.4} \qquad (4)$$

where:

s = silt content of topsoil assumed to be 10%

w = weight of scraper assumed to be 63 t.

This gives an emission rate of 3.03 kg/km. For a scraper of 42 t capacity moving a total of 153,000 tonne of topsoil and overburden per year, making a total of 3643 trips of 400 m length, the total dust emission are estimated to be 4415 kg/year. However there will be an intensive period when 45,000 m^3 or 81,000 tonnes of topsoil are moved in three weeks to build the bund wall. This gives a total emission rate of 3636 kg in three weeks. If it is assumed, conservatively that this rate of dust generation persists throughout the year, then a total annual dust emission rate of 63,024 kg is obtained. This value has been used in the modelling of Stage-1 dust impacts, assuming that all the dust is generated in the most westerly area of the pit.

FIGURES

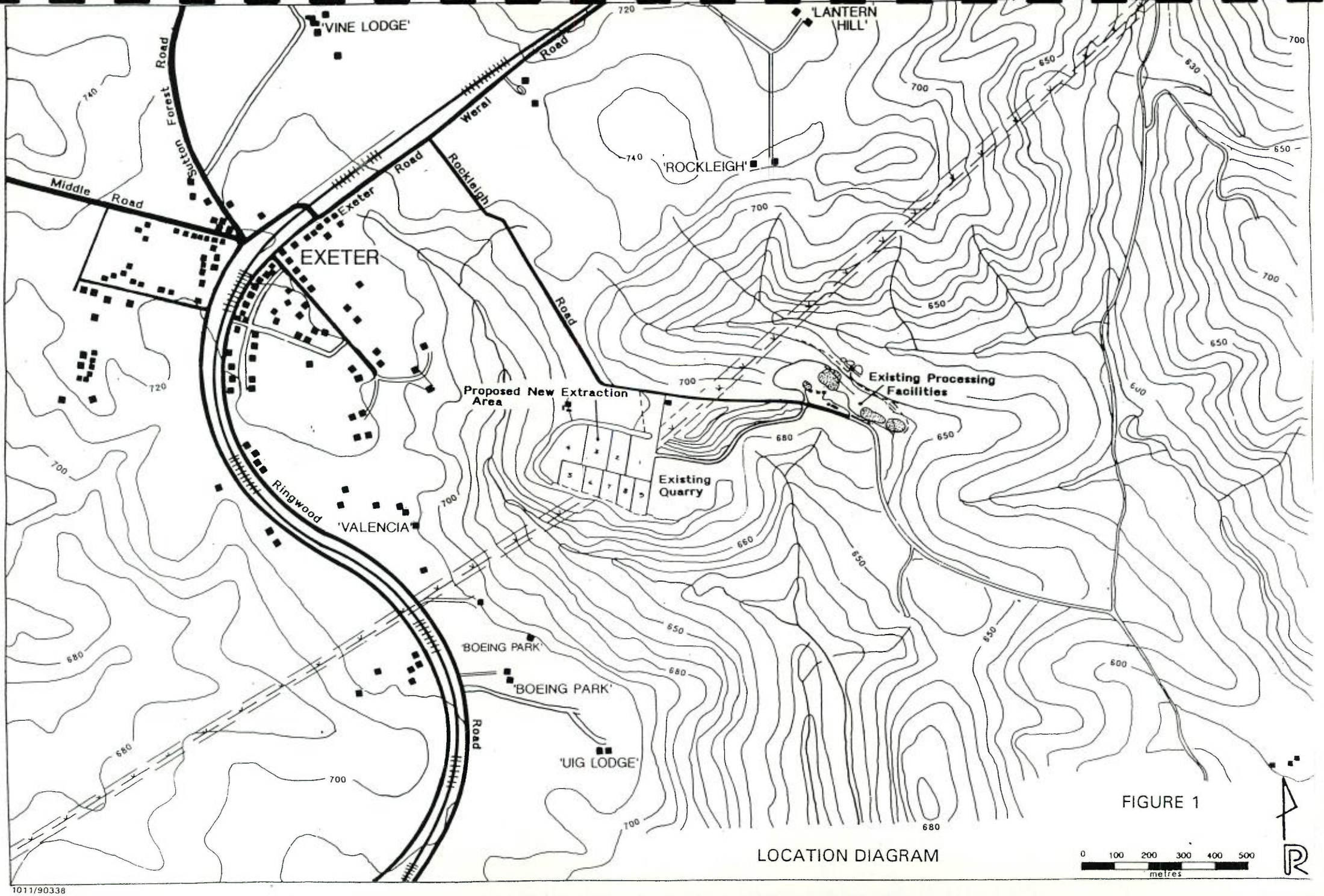
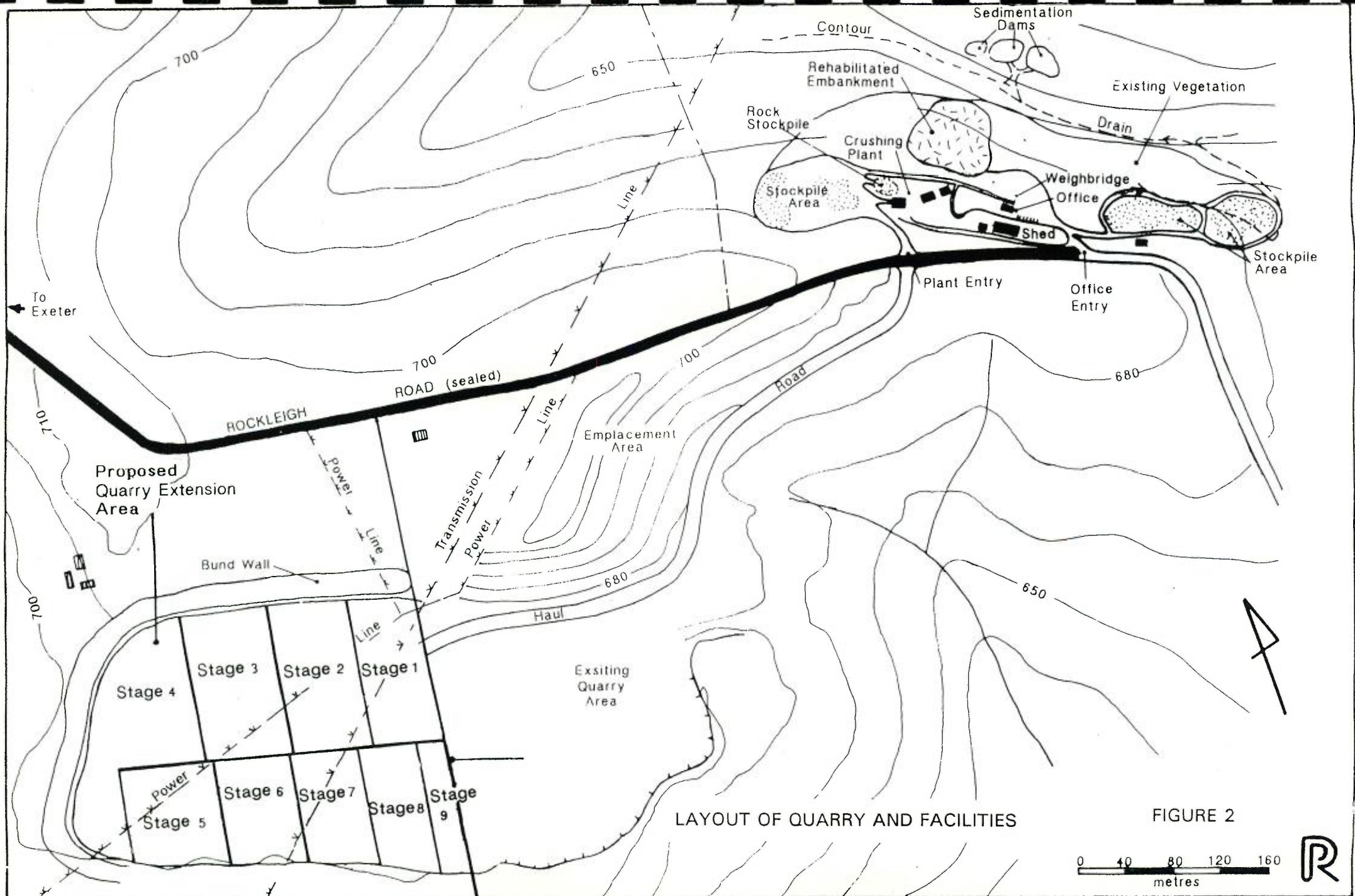


FIGURE 1

LOCATION DIAGRAM

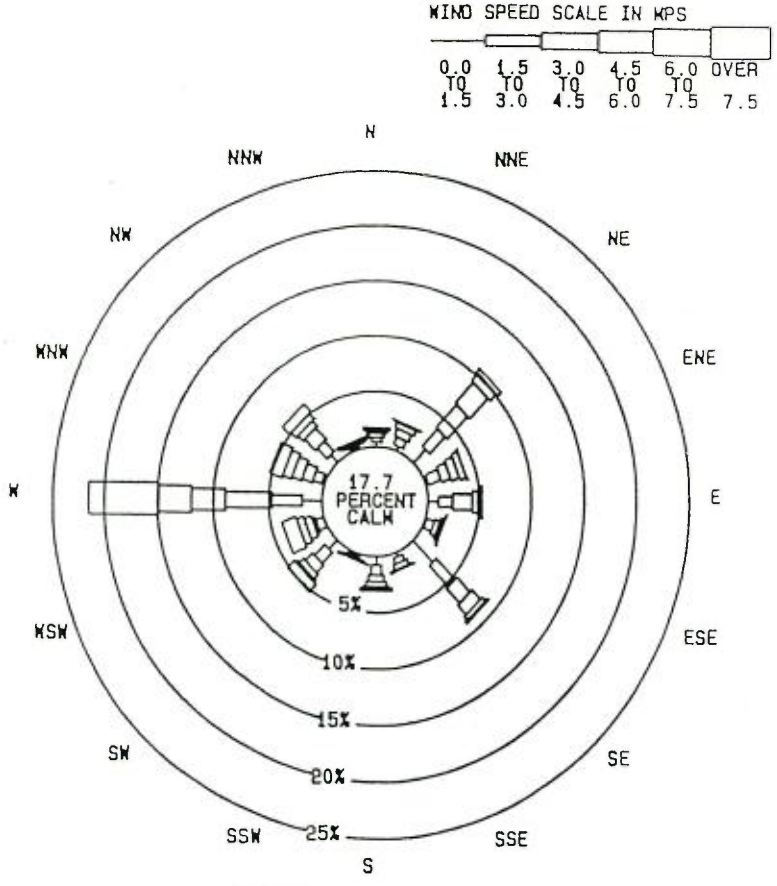
1011/90338



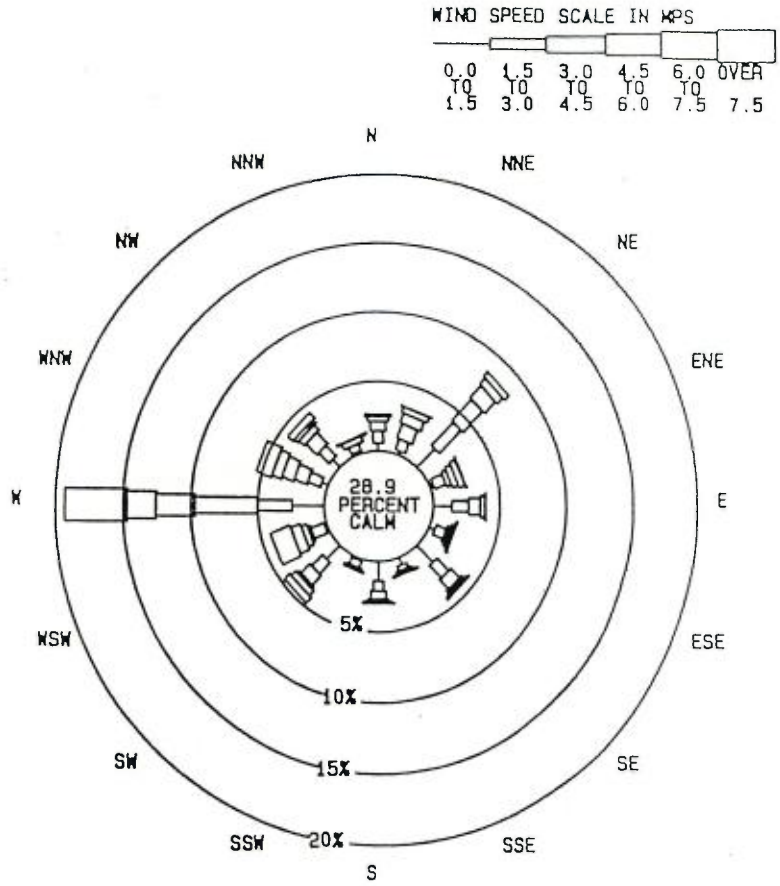
LAYOUT OF QUARRY AND FACILITIES

FIGURE 2

1011/90338

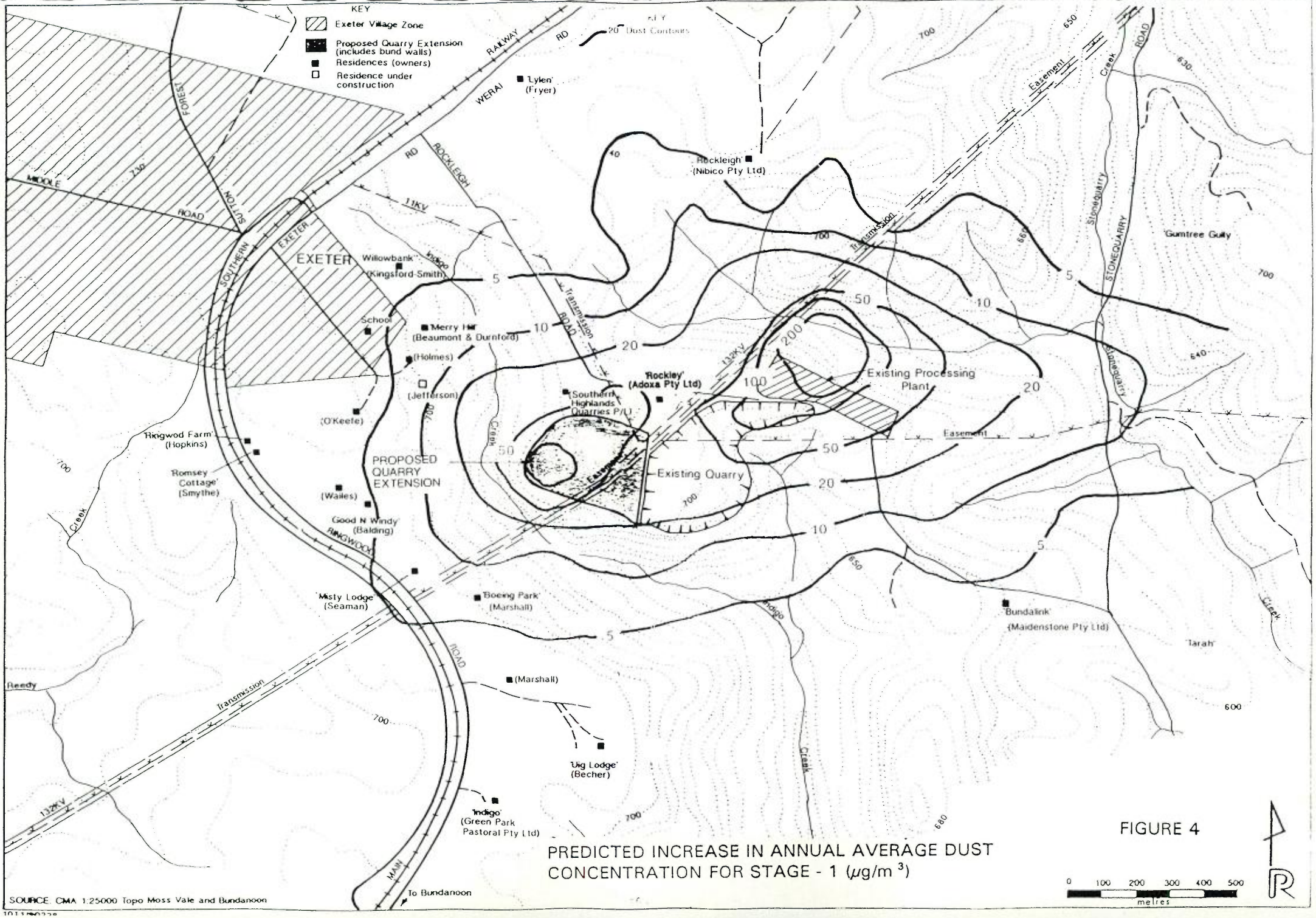


DISTRIBUTION OF WINDS
FREQUENCY OF OCCURRENCE IN PERCENT
BOWRAL 1967-1984 3PM



DISTRIBUTION OF WINDS
FREQUENCY OF OCCURRENCE IN PERCENT
BOWRAL 1967-1984 9AM

FIGURE 3


KEY
Exeter Village Zone
Proposed Quarry Extension (includes bund walls)
Residences (owners)
Residence under construction
20 Dust Contours
PROPOSED QUARRY EXTENSION
Existing Quarry
Existing Processing Plant
EXETER
Rockley (Adoxa Pty Ltd)
Southern Highlands Quarries P/L
Rockleigh (Nibico Pty Ltd)
Willowbank (Kingsford-Smith)
Merry Hill (Beaumont & Durnford)
School
(Holmes)
(Jefferson)
(O'Keefe)
Ringwood Farm (Hopkins)
Romsey Cottage (Smythe)
(Wailes)
Good N Windy (Balding)
Misty Lodge (Seaman)
Boeing Park (Marshall)
(Marshall)
Dig Lodge (Becher)
Indigo (Green Park Pastoral Pty Ltd)
Bundalink (Maidenstone Pty Ltd)
Tarah
Gumtree Gully
Lylen (Fryer)
Reedy
To Bundanoon
SOURCE: CMA 1:25000 Topo Moss Vale and Bundanoon
FIGURE 4
PREDICTED INCREASE IN ANNUAL AVERAGE DUST CONCENTRATION FOR STAGE - 1 (μg/m 3)
0 100 200 300 400 500
metres

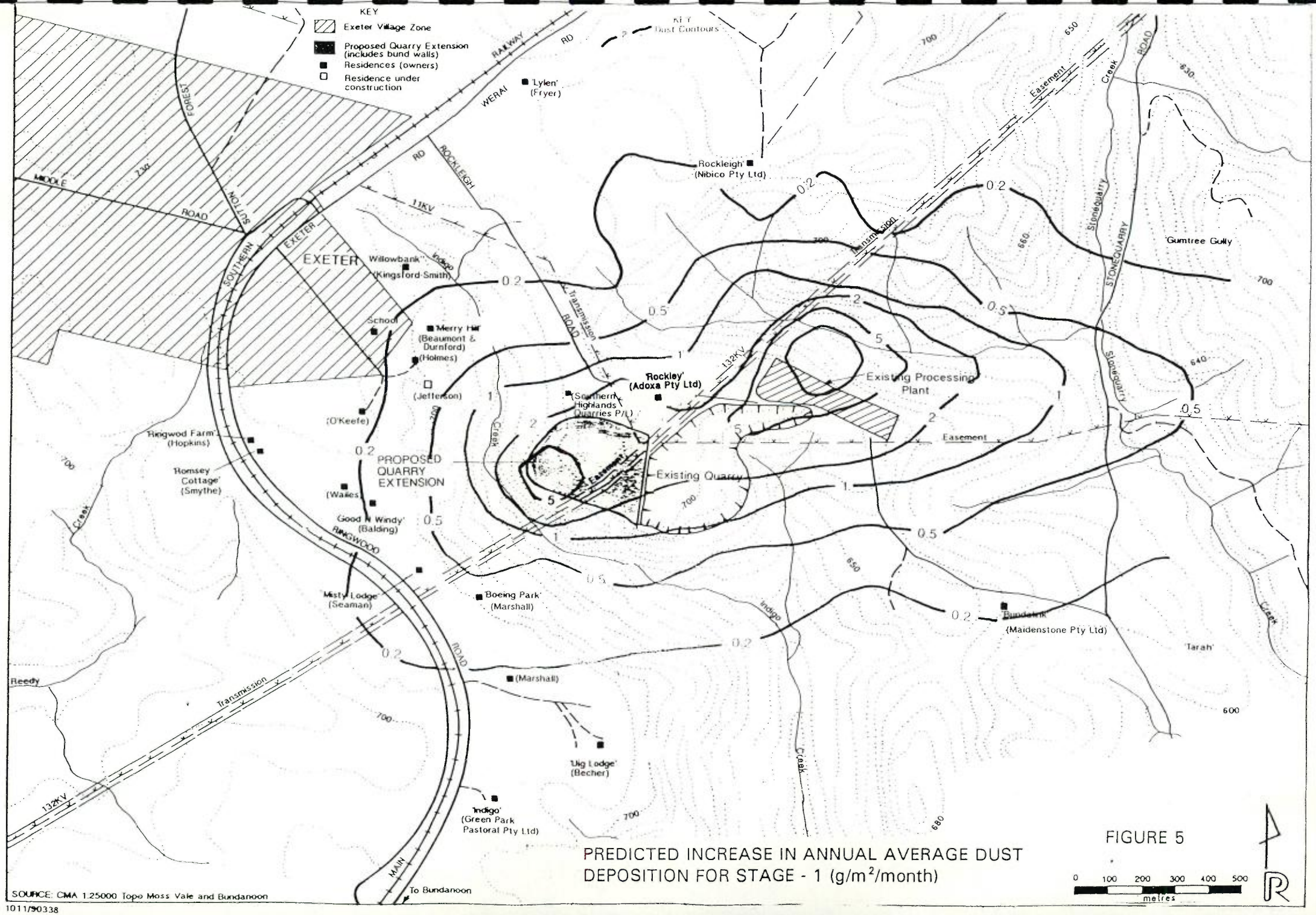
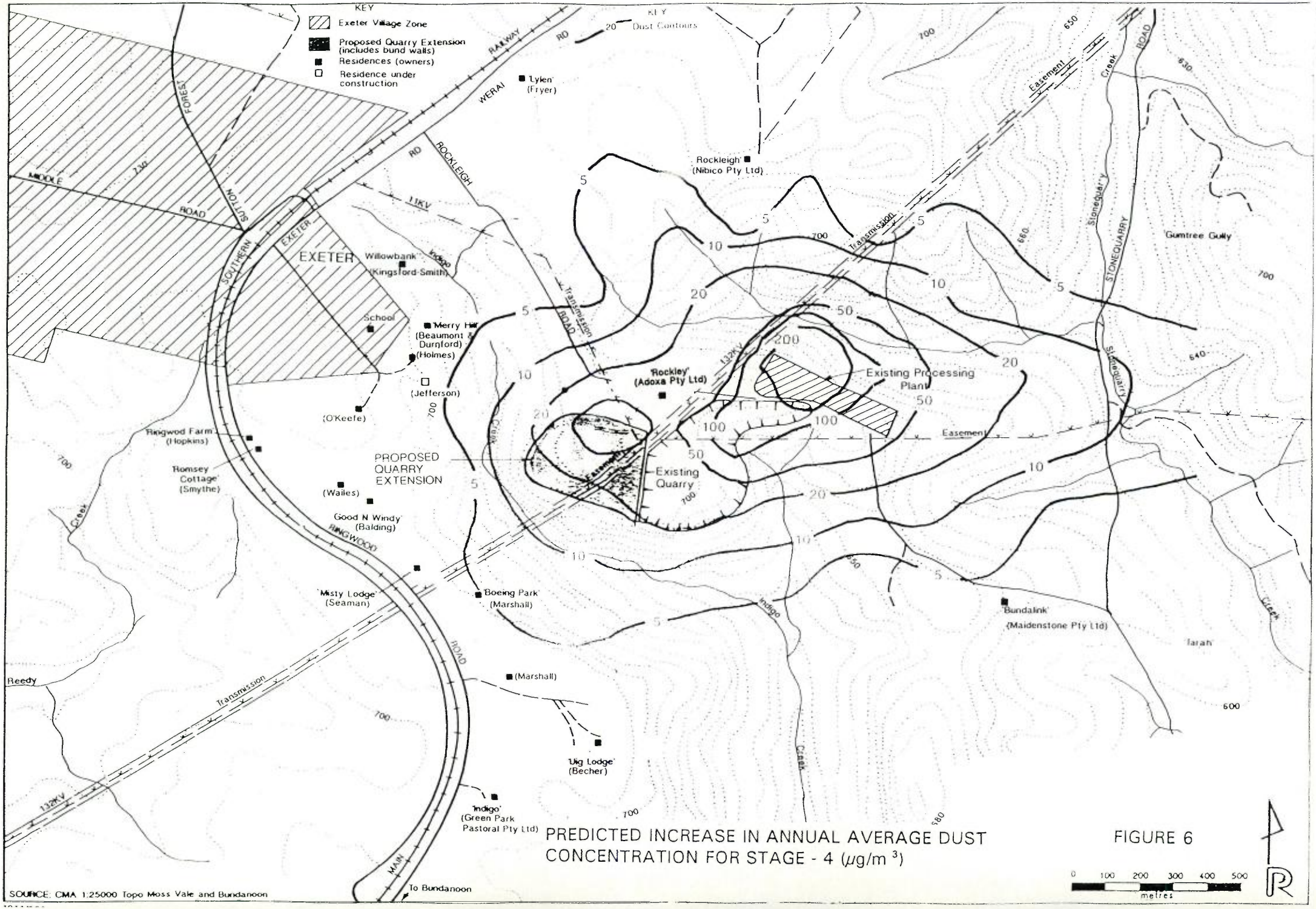


FIGURE 5

PREDICTED INCREASE IN ANNUAL AVERAGE DUST DEPOSITION FOR STAGE - 1 (g/m^2/month)

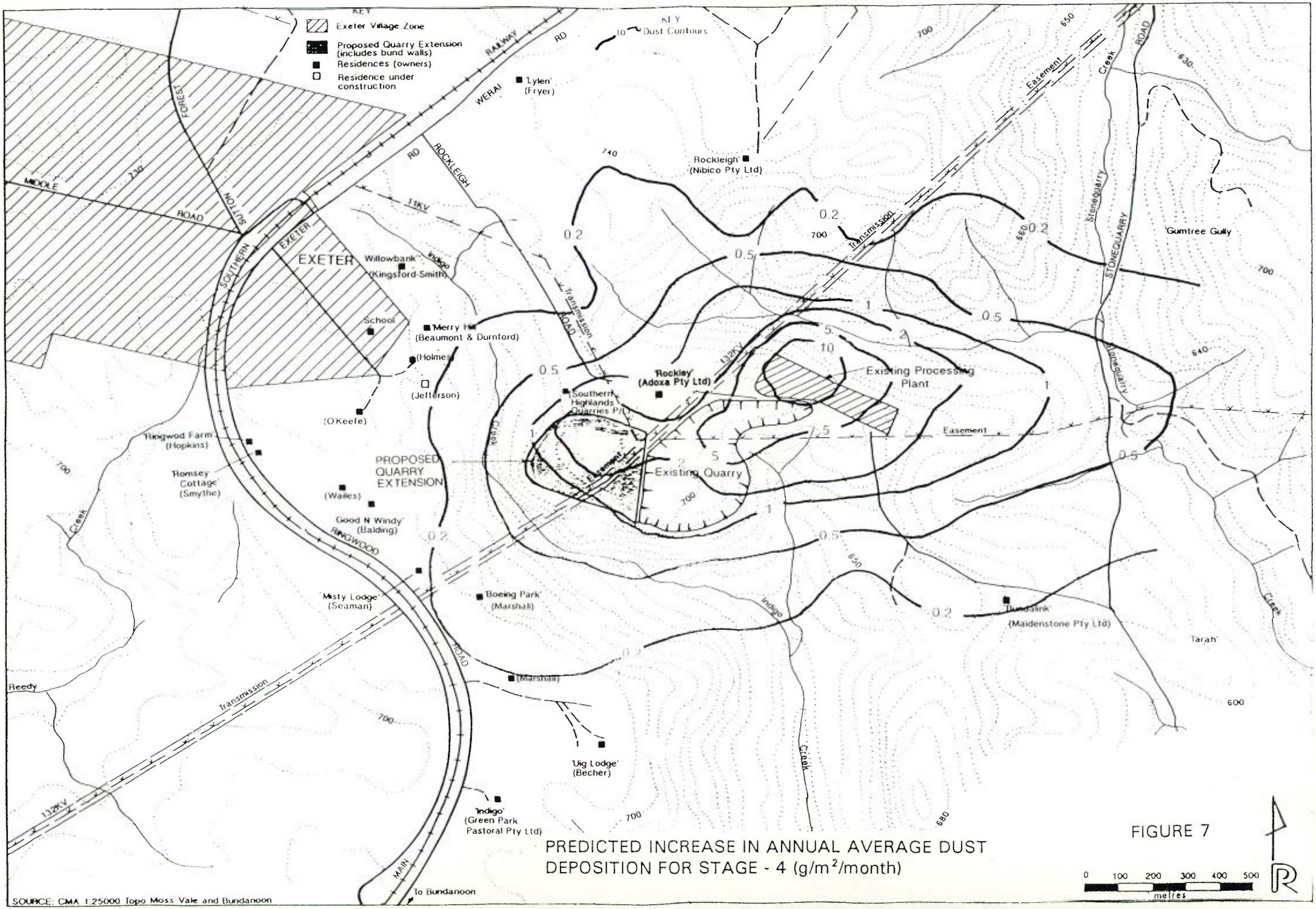
1011/90338



PREDICTED INCREASE IN ANNUAL AVERAGE DUST CONCENTRATION FOR STAGE - 4 ($\mu g/m^3$)

FIGURE 6

SOURCE: CMA 1:25000 Topo Moss Vale and Bundanoon


KEY
Exeter Village Zone
Proposed Quarry Extension (includes bund walls)
Residences (owners)
Residence under construction
KEY
10 Dust Contours
EXETER
PROPOSED QUARRY EXTENSION
Existing Quarry
Existing Processing Plant
Rockley (Adoxa Pty Ltd)
Southern Highlands Quarries P/L
Rockleigh (Nibico Pty Ltd)
Lylen (Fryer)
Willowbank (Kingsford-Smith)
Merry Hill (Beaumont & Durnford)
(Holmes)
(Jefferson)
(O'Keefe)
Ridgwood Farm (Hopkins)
Ramsey Cottage (Smythe)
(Wales)
Good N Windy (Balding)
Misty Lodge (Seaman)
Boeing Park (Marshall)
(Marshall)
Uig Lodge (Becher)
Indigo (Green Park Pastoral Pty Ltd)
Bundalink (Maidenstone Pty Ltd)
Tarah
Gumtree Gully
Reedy
To Bundanoon
SOURCE: CMA 1:25000 Topo Moss Vale and Bundanoon
FIGURE 7
PREDICTED INCREASE IN ANNUAL AVERAGE DUST DEPOSITION FOR STAGE - 4 (g/m²/month)
0 100 200 300 400 500
metres

APPENDIX 4

NOISE ASSESSMENT

Prepared By Wilkinson Murray Pty Limited

PROPOSED EXTENSION TO EXISTING HARD ROCK QUARRY AT EXETER

NOISE ASSESSMENT

Report No 91114

November 1992

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TABLE OF CONTENTS

1. INTRODUCTION

Southern Highlands Quarries Pty Ltd intends to extend the existing hard rock quarry at Rockleigh Road, Exeter where an estimated 2.3 million tonnes of rock material is to be obtained. The proposed quarry extension area is situated in a rural environment approximately 550 m from the edge of the village of Exeter. Extraction of rock is to take place in a number of stages with progressive land rehabilitation over approximately 9 years. The existing situation whereby the rock extracted is processed at an existing crushing/ screening plant across Rockleigh Road will continue.

Figure 1 shows a location plan of the area.

This report assesses the noise impact related to the proposed rock extraction operation at Exeter.

Ambient noise levels were measured from 2 January to 9 January 1992 at residential locations surrounding the subject site and also on 27 November 1992 at one location. Operational noise levels have been calculated for potentially affected residential locations and noise contours have been produced for three separate scenarios. The results of these calculations have been assessed against design goals, which are based on the measured ambient background levels. Noise control measures have also been considered where required.

2. DESCRIPTION OF THE PROPOSAL

The quarry operations involve topsoil stripping, overburden removal, extraction of pit rock, hauling of rock to the processing plant and the return of the surplus scalpings to the quarry. No changes are proposed to crushing and screening, stockpiling and loading and transportation to the market. In view of the type of rock to be extracted and the method of extraction, no rock blasting will be required.

This section describes the proposed quarry.

2.1 Quarrying Operations

To extract the hard rock resource, approximately 1 million tonnes of overburden and topsoil will be stripped and utilised for rehabilitation in areas that have been or will be quarried. Overburden stripping rates and rock production rates based on a 250,000 tonne per annum production rate are shown in Table 1. Noise assessment for the proposed development has been based on production rates of 300,000 tonnes per year.

The order of the proposed mining operations is shown in Figure 2. Generally quarrying will commence in the north-eastern corner and work counter clockwise around the site, ending in the south-eastern corner by Stage 9. Each stage of operation depicted is based on a production level ex-crushing plant of 250,000 tonnes per year. Actual yearly production may vary and as such the staging described is only indicative.

Overburden material is to be removed on a campaign basis with scrapers being used in the first year of operation and a combination of an hydraulic excavator and two dump trucks used in subsequent years. A bulldozer will be used in conjunction with scrapers and will subsequently be used to spread and shape overburden and topsoil.

Hard rock will be won from the quarry using an hydraulic excavator and 2 dump trucks. This operation will occur simultaneously with overburden removal and will continue throughout normal operations.

Based on our interpretation of the quarry plan, the following operational scenarios have been assessed in detail and these demonstrate the proposed operations.

* Scenario 1 : Stage 1 - Establish next Phase - construction of the bund and Material Extraction.

  During Scenario 1, a visual and acoustic bund wall 3 m high will be built around the northern and western perimeter of the subject site utilising overburden material from Year 1 extraction areas.

  After construction of the bund, the remaining overburden material will be used to rehabilitate the existing quarry area. However, the noise levels during this phase will be less since the scrapers will no longer be operating on top of the bunds. Therefore this phase has not been used for modelling purposes.

  For this Scenario, the following equipment will be used:

  - 2 Scrapers
  - 1 Bulldozer
  - 1 Hydraulic Excavator
  - 2 Dump trucks
  - 1 Watercart.

  This Scenario, involving overburden removal, construction of the bund and material extraction will only last for 2 to 3 weeks.

* Scenario 2 : Stage 1 - Material Extraction

During most of Year 1 the Scrapers and Bulldozer will not be required to remove overburden (see Scenario 1) and only extraction work will take place. Therefore, for this Scenario, the following equipment will be used:

- 1 Hydraulic Excavator
- 2 Dump trucks
- 1 Watercart.

* Scenario 3 : Stage 4 - Overburden removal and Material Extraction

During Scenario 3, the excavator will replace the scrapers and will operate in advance of the extraction face. The excavator will be used to remove overburden and the Bulldozer will be used to spread overburden material in the areas designated for rehabilitation. During this Scenario, which is expected to last less than 7 weeks in Stage 4, the following equipment will be used for overburden removal and extraction.

- 1 Bulldozer
- 2 Hydraulic Excavators
- 4 Dump trucks
- 1 Watercart.

* Scenario 4 : Stage 4 - Material Extraction

Since overburden will be removed during only a small percentage of the time during Stage 4, the bulk of the work in this stage will involve only material extraction. Therefore, for this Scenario, the following equipment will be used

- 1 Hydraulic Excavator
- 2 Dump trucks
- 1 Watercart.

* Scenario 5 : Stage 7 - Overburden Removal and Material Extraction

During Scenario 5, as in Scenario 3, an additional excavator and two dump trucks will be used to remove overburden and will operate in advance of the extraction face. The Bulldozer will be used to spread overburden material in the areas designated for rehabilitation.

During this Scenario, which is expected to last less than 4 weeks, the following equipment will be used:

- 1 Bulldozer
- 2 Hydraulic Excavators
- 4 Dump trucks
- 1 Watercart.

* Scenario 6 : Stage 7 - Material Extraction

Since overburden removal will occur for only a small percentage of the time during Stage 7, the bulk of the time the work will be limited to material extraction. Hence the additional Excavator, Dump Trucks and Bulldozer will not operate. Therefore, for this Scenario, the following equipment will be used

- 1 Hydraulic Excavator
- 2 Dump trucks
- 1 Watercart.

2.2 Hours of Operation

Work at the quarry, will occur between the hours of 7.00 am and 6.00 pm Monday to Friday and 7.00 am to 3.00 pm on Saturdays. No work will occur on Public Holidays and Sundays.

Plant maintenance is to be carried out between the hours of 6.00 am and 6.00 pm Saturday. Maintenance work will mainly involve checking machinery to ensure it is in proper working order.

2.3 Surrounding Areas

There are a number of residences along the western and southern sides of the quarry. The nearest residences are approximately 450 m from the proposed quarry.

The six nearby residential locations surrounding the quarry (as shown in Figure 1) are as follows:

* Location 1 "Bundalink" located south-east and at an approximate distance of 1200 m from the proposed quarry. This residence is the only one nearby in an easterly direction.

* Location 2 "Uig Lodge" located approximately 750 metres south-west of the quarry and overlooking the existing pit. This residence is generally representative of a number of residences to the south.

* Location 3 "Boeing Park" residence located to the south-west of the quarry at an approximate distance of 450 m from the proposed quarry. This residence is representative of a number of residences to the south-west of the quarry.

* Location 4 "Merry Hill" residence located approximately 550 m from the proposed quarry. This residence is one of the closest residences north-west of the quarry between Exeter and the quarry. However, the Jefferson residence is currently being constructed in the general vicinity of "Merry Hill" at a distance of approximately 450 m from the quarry.

* Location 5 "Rockleigh" residence located approximately 1000 m north of the proposed quarry. This residence is the nearest residence to the north of the quarry and the existing processing plant.

* Location 6 "Lylen" residence located over a kilometre to the north of the proposed quarry and set back approximately 35 m from Werai Road.

The edge of the Village of Exeter is approximately 550 m west north-west of the proposed quarry area, with the school located approximately 650 m away.

3. EXISTING NOISE ENVIRONMENT AND DESIGN GOALS

This section discusses the ambient noise level measurements and the results obtained. The assessment criteria for quarry operational noise and product transportation noise are also contained in this section.

3.1 Measurement Procedure

Measurements were made at a number of residential locations around the quarry. The existing quarry and processing plant ceased operations during the Christmas/New Year period and recommenced scaled down operations on 6 January 1992. Hence, ambient noise levels were measured in the area surrounding the quarry from January 2 1992 to January 9 1992, to measure the ambient levels with and without the present quarry and processing operations. Further measurements were later carried out at "Rockleigh" on 27 November 1992, after noise control measures had been implemented at the processing plant.

Ambient noise measurements were made using Environmental Noise Loggers which analyse the time varying noise environment to record the L_{A1}, L_{A10}, L_{A90} and L_{Aeq} noise levels. The L_{A1}, L_{A10} and L_{A90} are those which are exceeded for 1%, 10% and 90% respectively of the sample time, which in this instance has been set at 15 minutes. The L_{Aeq} level is the Equivalent Continuous Noise Level and is an energy based average. The L_{A90} is normally taken as the ambient background, which is used for the assessment of intruding noise.

3.2 Measurement Locations

Noise measurements were made at four residential locations (as shown in Figure 1) to determine the background noise levels prior to the proposed extension of the existing quarry. The locations chosen are Locations 1, 4, 5 and 6 as described in Section 2.3.

3.3 Meteorological Conditions

Due to frequent bouts of heavy rain and winds greater than 1.5 m/s during the measurement period (2 to 9 January 1992) limited data was suitable for setting noise criteria. Only measurements performed on Friday 3, Tuesday 7 and Wednesday 8 January 1992 were during still conditions, and hence were acceptable to set background levels.

Measurements taken on Friday 3 January 1992 are used to assess background levels without the current quarry and processing plant operating. Measurements taken on Tuesday 7 and Wednesday 8 January 1992 are used to indicate noise levels with the current operations. However, measurements made on 27 November 1992 at "Rockleigh" were used to indicate noise levels with the current operations at this location.

3.4 Measurement Results

The results of this survey, shown in Figures 3 to 35, display the ambient noise environment in graphical form. In summary, the results during the quarry hours are as follows:

3.4.1 No Quarry Operations

* Location 1 - "Bundalink" residence. The results used for calculation purposes are shown in Figure 4. From the 15 minute samples the average minimum 15 minute L_{A90} (or ambient background) was estimated to be 26 dBA.

* Location 4 - "Merry Hill" residence. The results used for calculation purposes are shown in Figure 12. From the 15 minute samples the average minimum 15

minute L_{A90} (or ambient background) was estimated to be 25 dBA.

* Location 5 - "Rockleigh" residence. The results used for calculation purposes are shown in Figure 20. From the 15 minute samples the average minimum 15 minute L_{A90} (or ambient background) was estimated to be 24 dBA.

* Location 6 - "Lylen" residence. The results used for calculation purposes are shown in Figure 28. From the 15 minute samples the average minimum 15 minute L_{A90} (or ambient background) was estimated to be 30 dBA.

3.4.2 Quarry Operational

* Location 1 - "Bundalink" residence. The results used for calculation purposes are shown in Figures 8 and 9. From the 15 minute samples the average minimum 15 minute L_{A90} (or ambient background) was estimated to be 26 dBA. This location is well shielded from the existing quarry and the quarry did not appear to have an effect upon the existing background noise level.

* Location 4 - "Merry Hill" residence. The results used for calculation purposes are shown in Figures 16 and 17. From the 15 minute samples the average minimum 15 minute L_{A90} (or ambient background) was estimated to be 24 dBA. Again, this location is shielded from the existing quarry operations and those operations appeared to have no effect upon the ambient background noise level.

* Location 5 - "Rockleigh" residence. The results used for calculation purposes are shown in Figure 35. From the 15 minute samples the average minimum 15 minute L_{A90} (or ambient background) was estimated to be 43 dBA. This level resulted after noise control measures were implemented on the processing plant. In view of the significant influence at this location by passing trains and trucks on Rockleigh Road upon the L_{A10} level, spot check measurements were carried out of the processing plant alone. These confirm that the L_{A10} levels from the processing plant also varied around 43 dBA.

* Location 6 - "Lylen" residence. The results used for calculation purposes are shown in Figures 32 and 33. From the 15 minute samples the average minimum 15 minute L_{A90} (or ambient background) was estimated to be 28 dBA.

In some cases, the background noise levels measured with the quarry and processing plant operational were lower than those measured without the operations. These results therefore indicate that quarry operations have little or no effect upon the ambient noise environment in these areas and that the lower levels were due to fluctuations in ambient background noise levels.

The results indicated here are indicative of the whole area surrounding the quarry. The background noise levels measured at "Merry Hill" can be taken as applying to the Jefferson residence currently under construction and the nearby school.

3.5 Noise Level Design Goals

Noise from quarry operations of the type proposed is generally continuous, but slowly varying in nature. However, this continuous noise is often punctuated by intermittent impact noise associated with dumping of rock into trucks and the crusher. Accordingly, the overall noise environment may be broken into continuous noise and intermittent noise.

3.5.1 Continuous Operational Noise Level Design Goal

It is considered for this area that, where the background noise level is below 30 dBA, it is appropriate to adopt a background level of 30 dBA for assessment purposes.

In determining the "true" background noise level at each location in the area, it should be noted that ambient measurements were carried out when the quarry and processing plant were not operating as well as when they were operating. However, it was found that, in general, the background noise levels during operation were similar to those without operation indicating that the quarry is currently having a very limited effect upon noise levels in the surrounding area. The exception to this is at Rockleigh where noise levels from the concurrent operation of the processing plant and quarry are audible.

The "true" background noise level at all locations has been chosen as the level obtained when the quarry is not operational. Since it is less than 30 dBA, a background level of 30 dBA has been adopted. This approach is consistent with the Environment Protection Authority (EPA) "Environmental Noise Control Manual".

* Scenario 1

Construction of the bund will occur in Scenario 1. Since construction noise is temporary in nature, experience has shown that residents will accept higher noise levels for this type of noise. The EPA Construction Noise Guidelines set environmental limits as follows:

Short term - 4 weeks or less.
The L_{A10} level must not exceed the background by more than 20 dBA.

Medium term - greater than 4 weeks and less than 26 weeks.
The L_{A10} level must not exceed the background by more than 10 dBA.

Long term - greater than 26 weeks.
The L_{A10} level must not exceed the background by more than 5 dBA.

We consider that this approach is appropriate for residences and the school. For Scenario 1, the two or three weeks construction period estimated indicates an operational noise criterion of 20 dBA above the background, that is 50 dBA.

* Scenarios 2 to 6

It is generally accepted that noise from continuous quarrying operations will not cause residential annoyance providing it does not exceed the background noise level by more than 5 dBA. Hence, for Scenarios 2 to 6, an operational noise criterion of 35 dBA has been adopted at the nearby residences, as well as at the school.

This procedure is consistent with the Environment Protection Authority "Environmental Noise Control Manual".

3.5.2 Intermittent Operational Noise Design Goal

Apart from the steady noise levels resulting from the continuous quarrying operation, intermittent noise levels of an impulsive nature will also occur when rocks are dumped into haul trucks. Usually this noise occurs only when the first bucket load is dumped into the truck and, since it is anticipated that a truck would normally be loaded approximately every 12 minutes, the impulsive noise would occur in the vicinity of once every 12 minutes. When overburden is being removed, the impulsive noise is expected to occur in the vicinity of once every 5 minutes.

On this basis, it is considered that a criterion higher than the continuous noise criterion would be appropriate. Based on the frequency of occurrence of such noise, it is considered that a criterion of background noise level plus 15 dBA is appropriate to avoid annoyance to nearby residents.

4. DEVELOPMENT OF ENVIRONMENTAL NOISE MODEL

The calculations of noise levels associated with the quarry operation have been carried out using an Environmental Noise Model (ENM). This section describes the Environmental Noise Model and gives the noise levels of the equipment and the scenarios used for noise calculations. It also discusses the noise calculation procedure including all assumptions made.

4.1 Environmental Noise Model

Calculations of quarry operational noise have been carried out using ENM, a computerised Environmental Noise Model. This widely accepted model calculates noise levels in octave bands and allows for the following factors:

* Sound Power Levels and location including relative height of equipment.

* Attenuation with distance including hemispherical spreading, air absorption (90% relative humidity, 5^0C) and ground absorption. In addition, allowance is made for adverse meteorological conditions by modelling a moderate temperature inversion of 3^0C per 100m which gives similar characteristics to a stable atmosphere with a light breeze towards the receiver location.

* Shielding provided by natural topography.

4.2 Sound Power Levels of Noise Sources

Noise levels of operational equipment have been determined by reference to equipment suppliers and by undertaking measurements of the equipment currently in use at the quarry. From the levels derived (Sound

Pressure Level at a distance) Sound Power Levels have been calculated for some items and typical octave band shapes have been assumed.

The sound power levels assumed for each item of equipment are shown in Table 2. The sound power levels used in the calculations take into consideration the attenuation provided by proposed control measures as discussed in Section 5.1. From the Sound Power Levels, L_{A10} noise levels in the area surrounding the site have been calculated using ENM.

4.3 Scenarios Used for Noise Calculations

Noise resulting from quarry operations will vary over the life of the operation as the equipment moves through the proposed stages. It has therefore been necessary to calculate noise levels for a number of stages of operation. ENM cannot calculate overall noise levels for moving noise sources and it is necessary to derive a typical scenario for each stage of the operation to be calculated. A scenario is developed by freezing the operation at a point in time whereby the equipment is operating at a typically noisy position.

Single point calculations have been made for six operational scenarios, as described in Section 2.1, to five residential locations, Locations 1-5, as described in Section 2.3. The results from these calculations are regarded as accurate.

Contour calculations have also been made for the same six operational scenarios, to give a pictorial representation of the propagation of noise from quarry activities to the surrounding area. These results may contain slight inaccuracies and hence show slight variations from the single point calculations.

5. ASSESSMENT OF QUARRY NOISE AND PROPOSED CONTROLS

This section gives a summary of the calculation results and assesses the impact of noise from the quarry.

5.1 Noise Control Measures

Preliminary calculations indicated that noise levels from the proposed quarry would exceed the design goal set unless a number of noise control measures were implemented. Accordingly, the following measures have been incorporated into the quarry plan and have been assumed in the calculations discussed in this report:

* Construction of a 3m high bund around the northern and western perimeter of the subject site.

* In the early stages of the proposed quarry, Stages 1-4, the knoll and the low ridge immediately to the north on the central part of the quarry will provide some shielding to the south. During stages 1 and 2 the low ridge will be removed eliminating that part of the shielding. To ameliorate this situation during overburden removal after the first year the Scrapers will be replaced by an Excavator, Dump Trucks and Bulldozer, since they operate at a lower level than the Scrapers.

* Dump trucks will be fitted with noise control kits containing

  - High performance exhaust silencer.

  - Additional enclosure, lined with sound absorbent foam, on the engine.

  - Acoustic louvre over radiator.

This measure is expected to reduce truck noise levels by approximately 6 dBA.

* Excavators will be fitted with a noise control kits containing

  - High performance exhaust silencer.

  - Additional enclosure, lined with sound absorbent foam, on the engine.

  - Air intake and discharge silencers/ acoustic louvres.

  This measure is expected to reduce excavator noise levels by approximately 10 dBA.

5.2 Calculation Results of Continuous Operational Noise

The steady noise levels likely to emanate from Exeter Quarry during temperature inversion conditions have been calculated to the five residential locations surrounding the quarry (Locations 1-5 as shown in Figure 1 and described in Section 2.3).

A summary of the results of these calculations is shown in Tables 3 and 4.

Noise contours are shown in Figures 36 to 38 inclusive, for the three scenarios calculated where no overburden is removed and only material extraction takes place.

Consideration has also been given to noise levels expected at the boundaries of the Southern Highlands premises. Because of the falloff of land to the west and south, the expected noise levels at the boundary in these directions are in the vicinity of 30 dBA. To the north, the level expected at the boundary on Rockleigh Road is approximately 36 dBA.

5.3 Assessment of Continuous Operational Noise

As can be seen from Tables 3 and 4, noise levels from the proposed quarry generally comply with the design goal set. However, there are some exceptions, as follows:

* The noise levels expected at "Rockleigh" from the quarry operation will marginally exceed the long term operational design goal of 35 dBA for the life of the quarry. A level of 36 dBA has been estimated at this location from the proposed extraction operation and 37 dBA when overburden is removed. However, these levels will be dominated by noise emanating from the dump trucks as they cross Rockleigh Road travelling to and from the processing plant, an event that would last for only a few seconds during each truck movement. This operation currently occurs as part of the existing quarry and processing plant operations and, consequently, the noise levels will reduce due to the fitting of noise control kits on the trucks. In fact, the quarry noise of 36-37 dBA will be less than the noise from the processing plant which will continue at approximately 43 dBA.

* The design goal during the construction stage (50 dBA) is expected to be marginally exceeded by 2 dBA at "Boeing Park" and exceeded by 3 dBA at "Merry Hill"

* Quarry noise levels at "Boeing Park" and "Merry Hill" are expected to marginally exceed the 35 dBA design goal during overburden removal towards the end of the life of the quarry around Stage 7. However, overburden removal around this stage of the quarry life is expected to last no more than one month in any one year.

* If the Jefferson residence, currently under construction, is ultimately completed and occupied, then the noise levels affecting this residence will become relevant. Levels approximately 1 dBA

higher than those estimated for "Merry Hill" will apply at this residence. On this basis, noise levels associated with overburden removal and material extraction may exceed the design goal during the later stages of the quarry by up to 4 dBA.

* Noise levels at the school are expected to be approximately 1-2 dBA less than those at "Merry Hill" and therefore may slightly exceed the construction stage design goal for a short period and the overburden design goal during later stages.

5.4 Assessment of Intermittent Noise

Intermittent noise levels of an impulsive nature will be generated by loading haul trucks. From previous measurement of these activities, a typical noise level for this operation is 98 dBA at 7m (Sound Power Level of 123 dBA).

A summary of the results of the calculations is shown in Table 5. Generally, intermittent noise is expected to comply with the design goal set. However, slight exceedance of the goal has been calculated at "Merry Hill" in Stages 4 and 7. Equally the intermittent noise levels expected at the school and the Jefferson residence are expected to marginally exceed the goal during Stages 4 and 7.

5.5 Cumulative Impacts

There is potential for noise levels associated with the proposed quarry to add to other noise levels in the area, in particular noise levels generated by the existing processing plant. The only nearby receiver location where the processing plant is audible on a consistent basis is Rockleigh. Here, a plant noise level of 43 dBA has been measured.

The noise level anticipated from the quarry operations at Rockleigh is 36 dBA, occurring intermittently as dump trucks cross Rockleigh Road during most of the life of the quarry. When this level adds to the 43 dBA from the processing plant, the overall level which will result is 44 dBA. This level represents an insignificant change from the 43 dBA of the plant alone and a small reduction from that which is existing due to the plant and existing quarry.

6. CONCLUSION

Southern Highlands Quarries Pty Ltd intends to extend the existing hard rock quarry at Rockleigh Road, Exeter where an estimated 2.3 million tonnes of product is to be obtained. Extraction of rock is to take place over approximately 9 years.

Ambient noise levels were measured at 4 residential locations surrounding the subject site. From these measurements design goals for operational noise have been set based on EPA criteria. Noise levels have been calculated, incorporating proposed noise control measures, for potentially affected residential locations. The results of these calculations have been assessed against design goals.

During construction of the 3m bund around the northern and western perimeter of the subject site, noise levels will generally comply with the construction noise goal set, but the goal is likely to be exceeded by up to a marginal 2 dBA at "Boeing Park" and 3 dBA at "Merry Hill".

The continuous noise generated by the extraction of the proposed quarry, which will occur 90% of the time, will meet the 35 dBA goal set, excepting for the estimated level of 36 dBA at "Rockleigh" (which marginally exceeds this level). However, the level at "Rockleigh" will be dominated by haul trucks travelling to and from the crushing plant in the vicinity of Rockleigh Road. Due to the alignment of the haul road this elevated noise level occurs for periods of 20 seconds or less during each truck movement. In any event, the estimated 36 dBA for quarry operation will be less than noise levels which currently occur much of the time at "Rockleigh" as a result of operation of the crushing/screening plant.

During the periods when overburden is to be removed during the same time as rock is being extracted, noise levels are also expected to generally comply with the 35 dBA goal. However, towards the end of the quarry operation, in the vicinity of Stage 7, the goal is likely to be slightly exceeded at "Boeing Park" and "Merry Hill" by up to 2 dBA and 3 dBA

respectively. However, overburden removal is expected to be carried out only during one month in each year towards the end of the operation.

Apart from the continuous noise from the quarrying operations, intermittent noise is expected to be generated as the first load of rock is dumped by the excavator into a haul truck. Again, such intermittent noise levels will generally comply with the 45 dBA goal set. However, slight exceedances of the goal are to be expected at "Merry Hill" in Stages 4 and 7.

Noise levels at the school are expected to be 1-2 dBA less than at "Merry Hill" and at the Jefferson residence (currently under construction) 1 dBA higher.

Figures 36-38 show predicted noise contours for material extraction at the quarry.

91114 : TABLE 1

ROCK/ OVERBURDEN VOLUMES

Stage	Overburden (tonnes)	Production Volume (tonnes)	Overburden Duration Days	Overburden Destination
1	153,000	250,000	15*	Constructing Bund wall, existing quarry.
2	81,000	250,000	19	Stage 1
3	117,000	250,000	28	Stage 2
4	153,000	250,000	36	Stage 3 & 4
5	153,000	250,000	36	Stage 4
6	72,000	250,000	17	Stage 4 & 5
7	90,000	250,000	21	Stage 3 & 6
8	99,000	250,000	24	Stage 2 & 7
9	90,000	255,000	21	Stage 1,8 & 9

* Stage 1 assumes overburden removed by scrapers.

91114 : TABLE 2

SCHEDULE OF TYPICAL QUARRY EQUIPMENT AND SOUND POWER LEVELS (WITH NOISE CONTROL KITS).

Equipment	Sound Power Level (dBA)
Cat D7 Bulldozer	114
Cat 631 Scraper	117
Leibher 974 Hydraulic Excavators (ea)	103
Volvo A35 Dump Truck	103
Water Cart	104

91114 : TABLE 3

SUMMARY OF CONTINUOUS NOISE CALCULATION RESULTS - SCENARIOS 1 AND 2

	Scenario 1 Construction Noise		Scenario 2 Stage 1 Material Extraction	
Residential Location	**Design Goal**	**Calculated Continuous Noise Levels**	**Design Goal**	**Calculated Continuous Noise Levels**
1 Bundalink	50	37	35	28
2 Uig	50	48	35	28
3 Boeing	50	52	35	32
4 Merry Hill	50	53	35	22
5 Rockleigh	50	39	35	36

Note: All levels in dBA.

91114 : TABLE 4

SUMMARY OF CONTINUOUS NOISE CALCULATION RESULTS - SCENARIOS 3 - 6.

	Overburden Removal and Material Extraction			Material Extraction		
Residential Location	**Design Goal**	**Calculated Continuous Noise Levels**		**Design Goal**	**Calculated Continuous Noise Levels**	
		Stage 4	**Stage 7**		**Stage 4**	**Stage 7**
1 Bundalink	35	30	28	35	29	27
2 Uig	35	31	34	35	27	27
3 Boeing	35	34	37	35	32	32
4 Merry Hill	35	31	38	35	26	31
5 Rockleigh	35	37	37	35	36	36

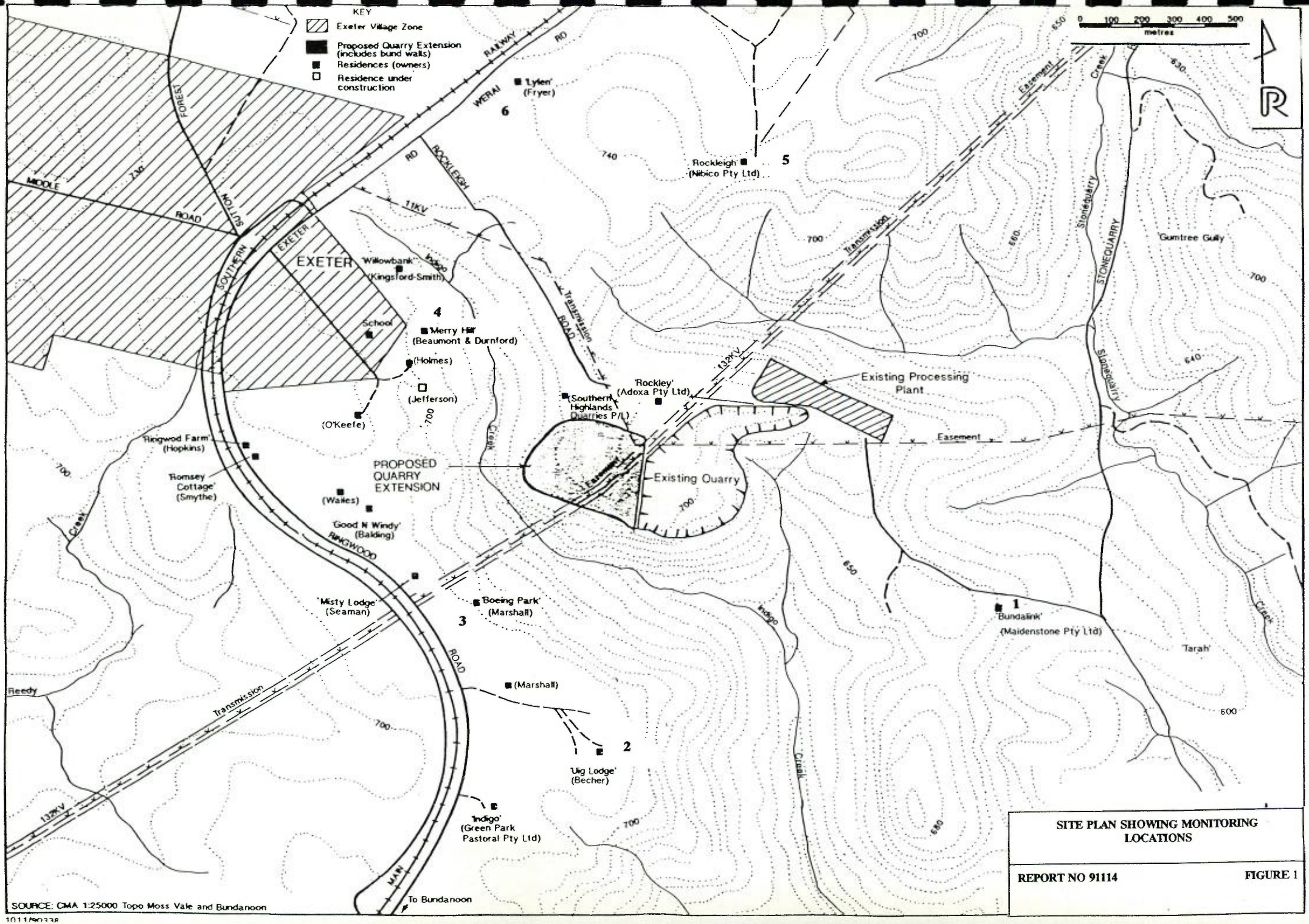
Note: All levels in dBA

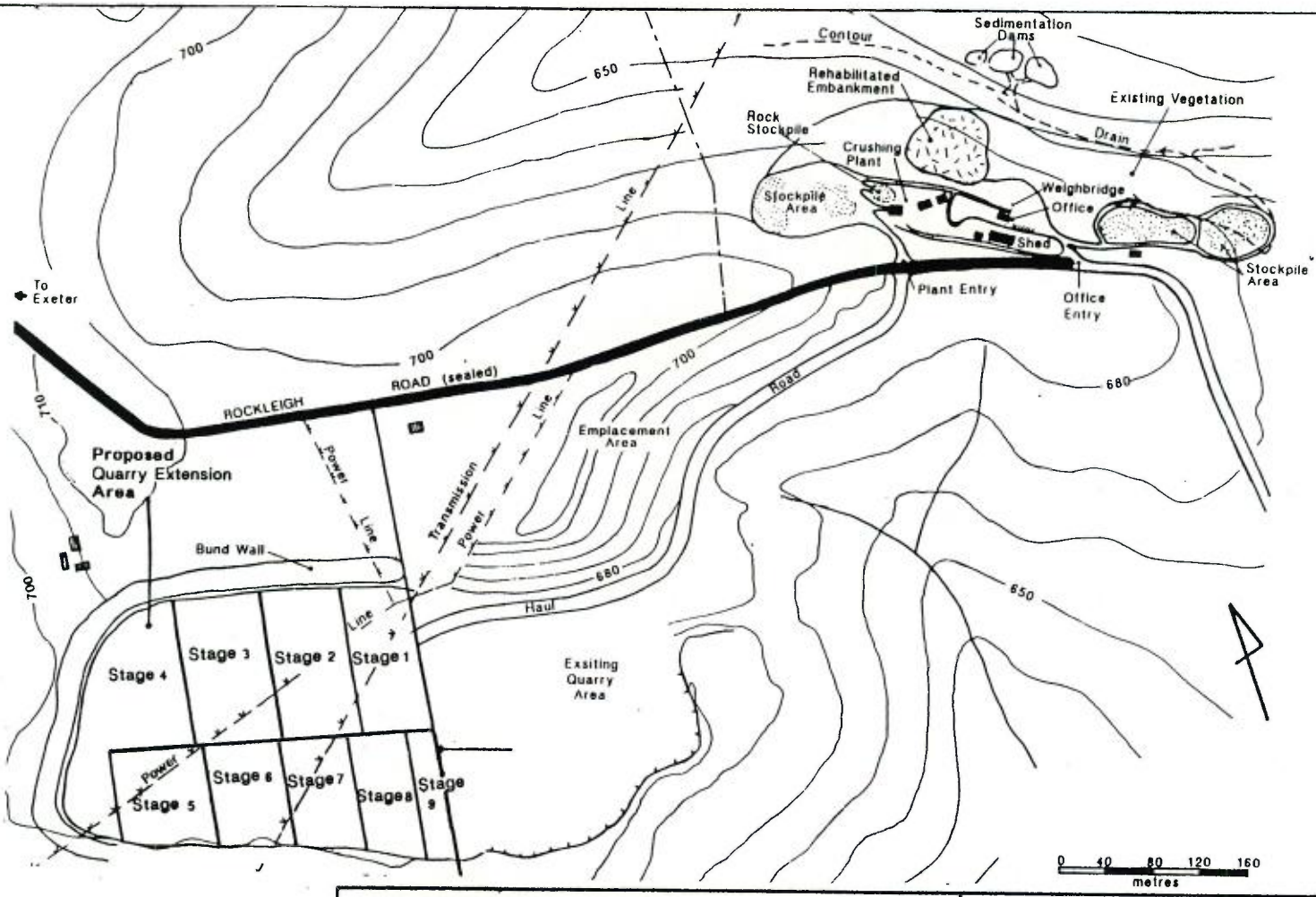
91114 : TABLE 5

SUMMARY OF INTERMITTENT NOISE CALCULATION RESULTS

Residential Location	Design Goal Stage 1 Material Extraction	Stage 1 Material Extraction	Design Goal Stage 4 Material Extraction	Stage 4 Material Extraction	Design Goal Stage 7 Material Extraction	Stage 7 Material Extraction
1. Bunderlink	45	40	45	36	45	26
2. Uig	45	44	45	44	45	36
3. Boeing	45	43	45	41	45	39
4. Merry Hill	45	40	45	46	45	48
5. Rockleigh	45	35	45	37	45	35

Note: Intermittent noise due to dumping of rocks into dump trucks (generally once every 12 minutes)


KEY
Exeter Village Zone
Proposed Quarry Extension (includes bund walls)
Residences (owners)
Residence under construction
0 100 200 300 400 500
metres
PROPOSED QUARRY EXTENSION
Existing Quarry
Existing Processing Plant
EXETER
Rockleigh' (Nibco Pty Ltd)
'Lylen' (Fryer)
'Willowbank' (Kingsford-Smith)
School
'Merry Hill' (Beaumont & Durnford)
(Holmes)
(Jefferson)
(O'Keefe)
'Rockley' (Adoxa Pty Ltd)
(Southern Highlands Quarries P/L)
'Ringwod Farm' (Hopkins)
'Romsey Cottage' (Smythe)
(Walles)
'Good N Windy' (Balding)
'Misty Lodge' (Seaman)
'Boeing Park' (Marshall)
(Marshall)
'Jig Lodge' (Becher)
'Indigo' (Green Park Pastoral Pty Ltd)
'Bundalink' (Maidenstone Pty Ltd)
'Gumtree Gully
Tarah'
To Bundanoon
SOURCE: CMA 1:25000 Topo Moss Vale and Bundanoon
SITE PLAN SHOWING MONITORING LOCATIONS
REPORT NO 91114
FIGURE 1



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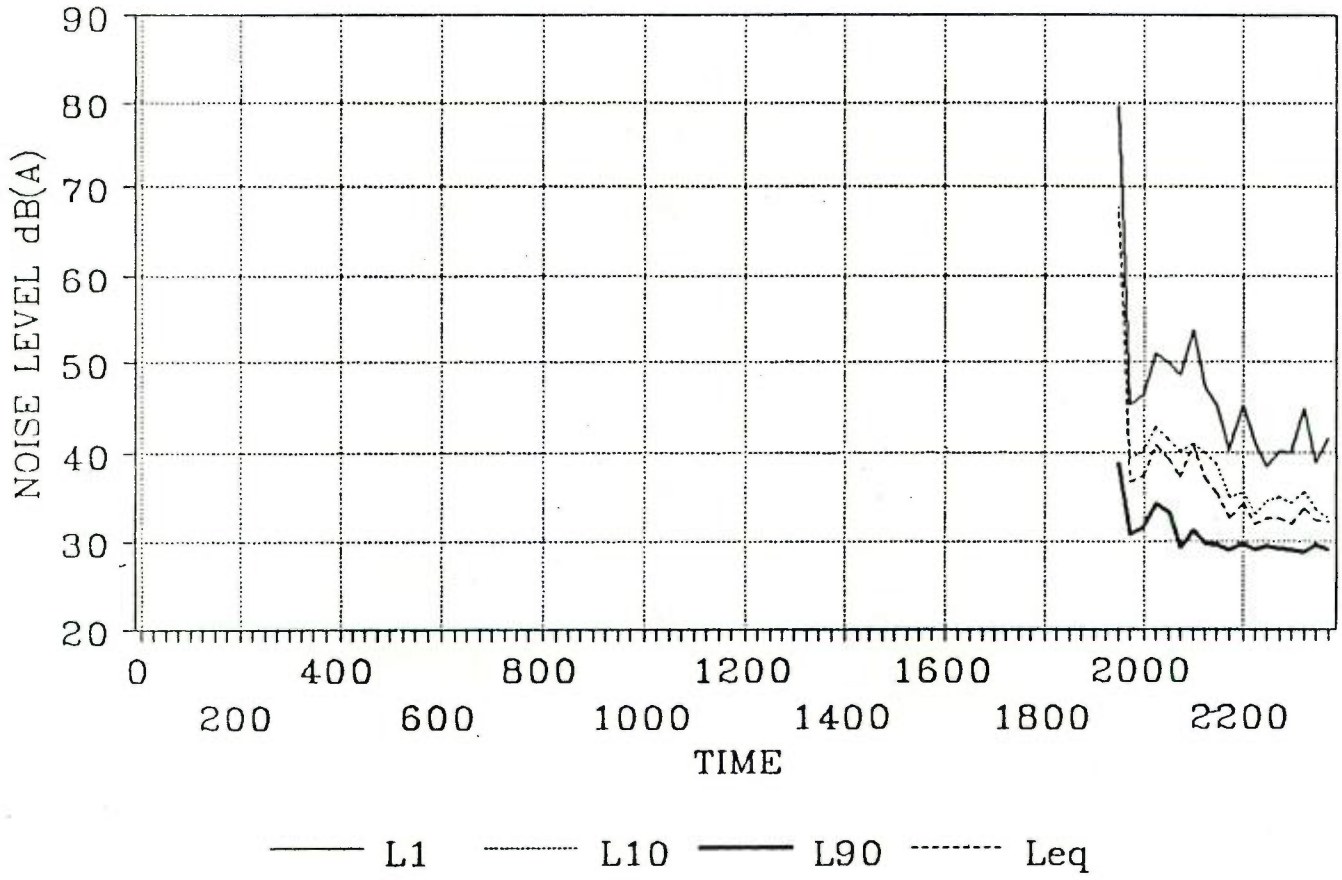
PLAN SHOWING DETAILS OF PROCESSING PLANT AND PROPOSED QUARRY

REPORT NO 91114 **FIGURE 2**



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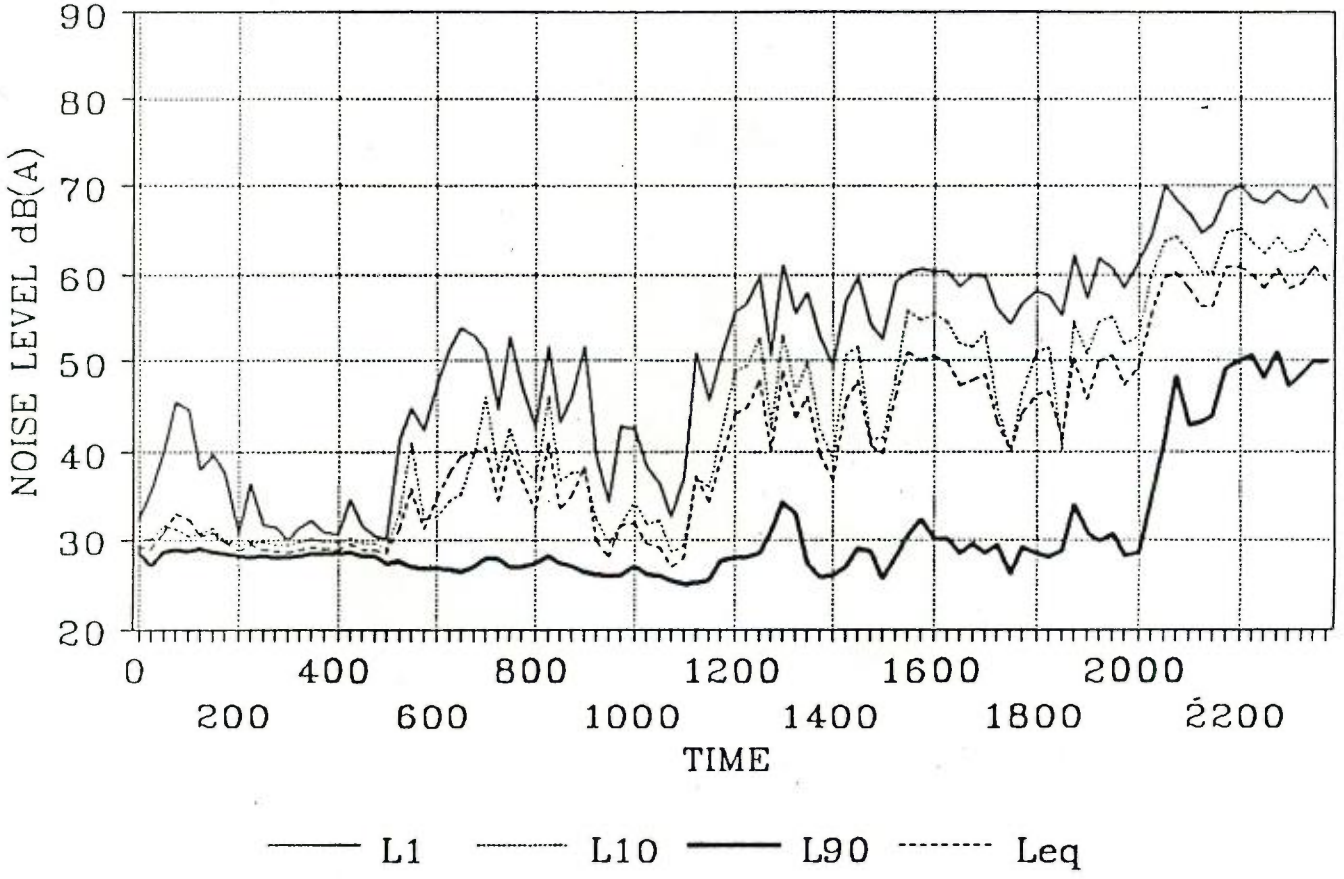
NOISE LEVELS AT "BUNDALINK" RESIDENCE 2 JANUARY ,1992

REPORT NO 91114 **FIGURE 3**



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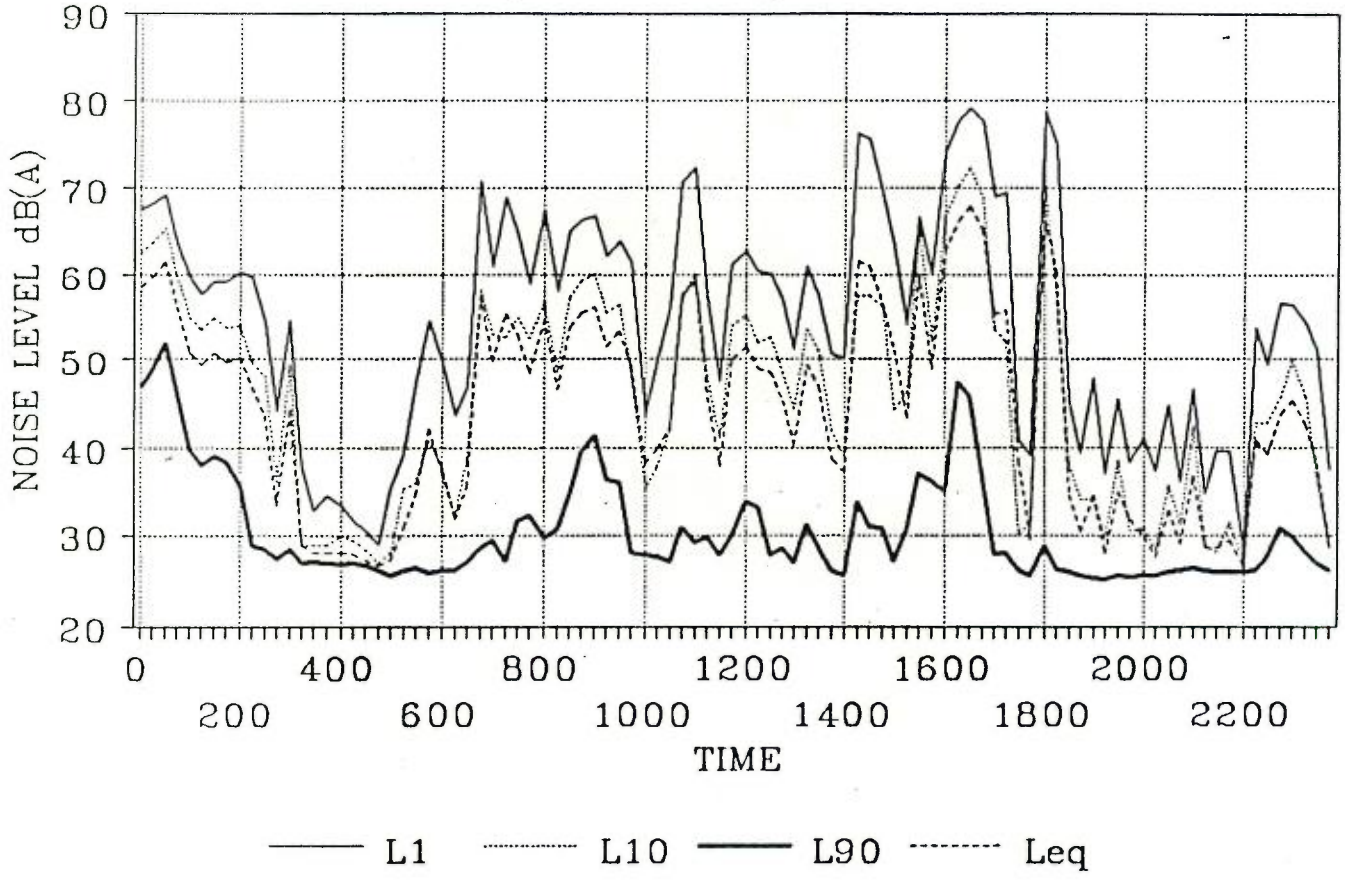
NOISE LEVELS AT "BUNDALINK" RESIDENCE 3 JANUARY ,1992

REPORT NO 91114 FIGURE 4



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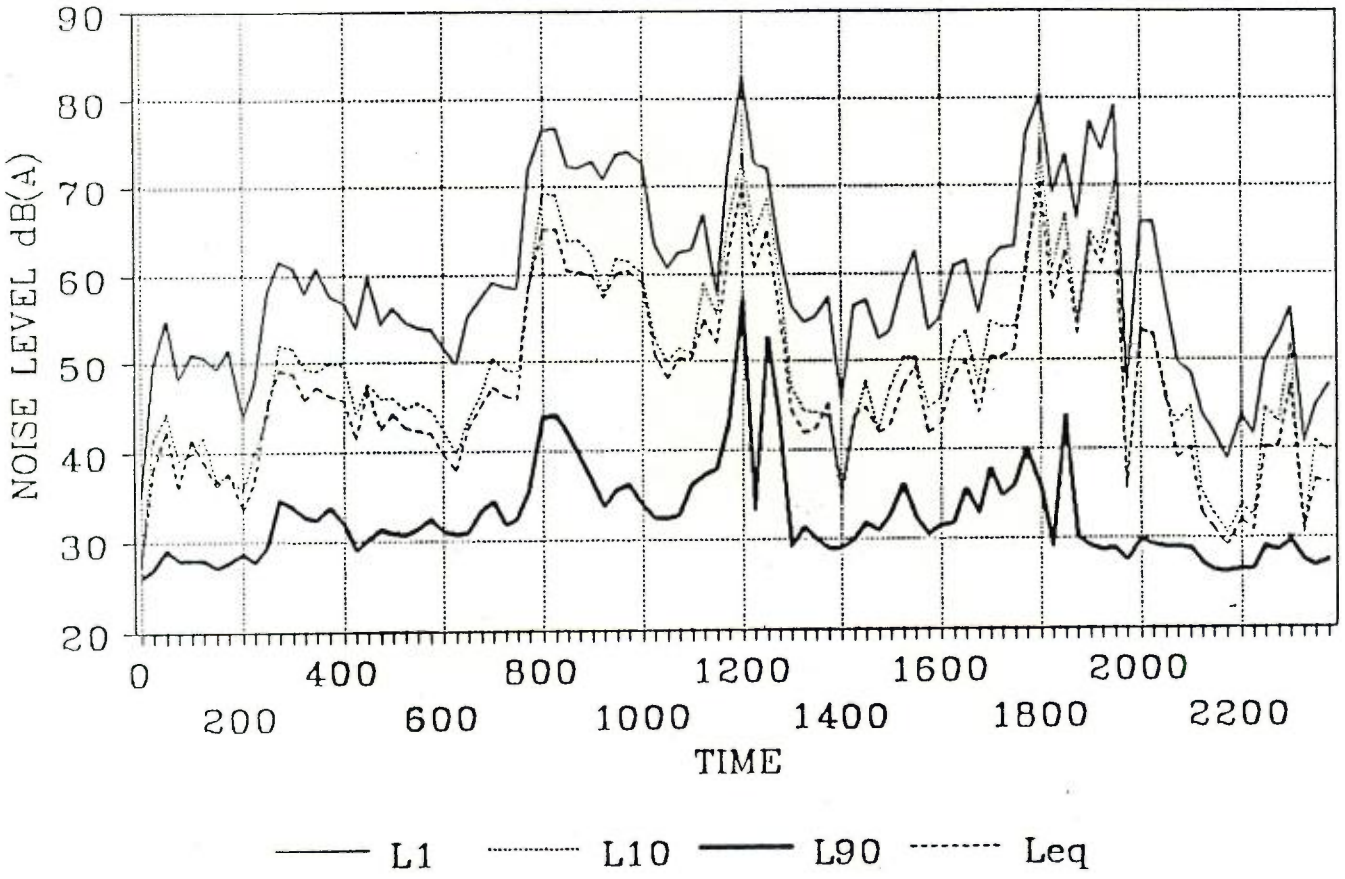
NOISE LEVELS AT
"BUNDALINK" RESIDENCE
4 JANUARY ,1992

REPORT NO 91114 FIGURE 5



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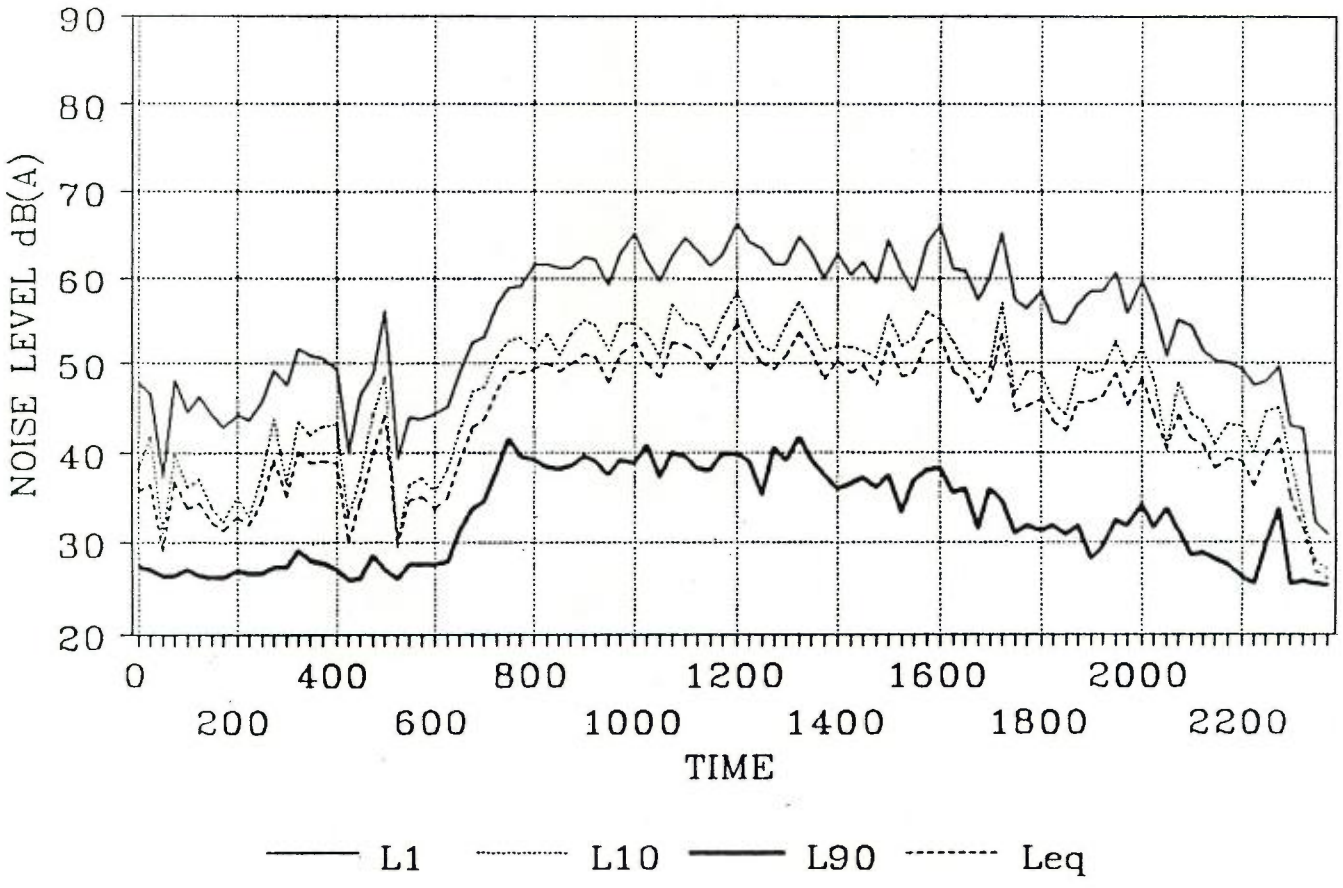
NOISE LEVELS AT
"BUNDALINK" RESIDENCE
5 JANUARY ,1992

REPORT NO 91114 FIGURE 6



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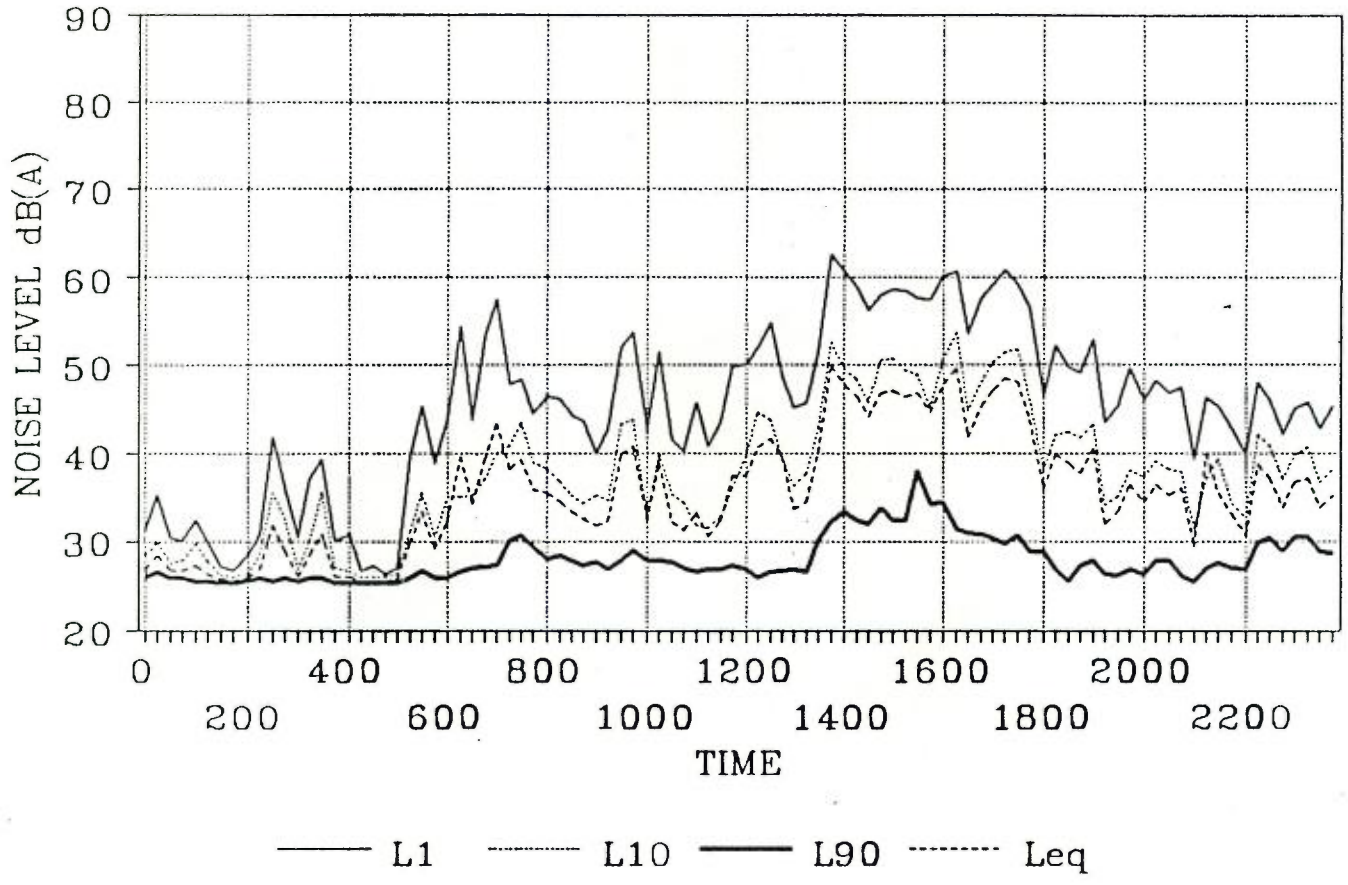
NOISE LEVELS AT
"BUNDALINK" RESIDENCE
6 JANUARY ,1992

REPORT NO 91114

FIGURE 7



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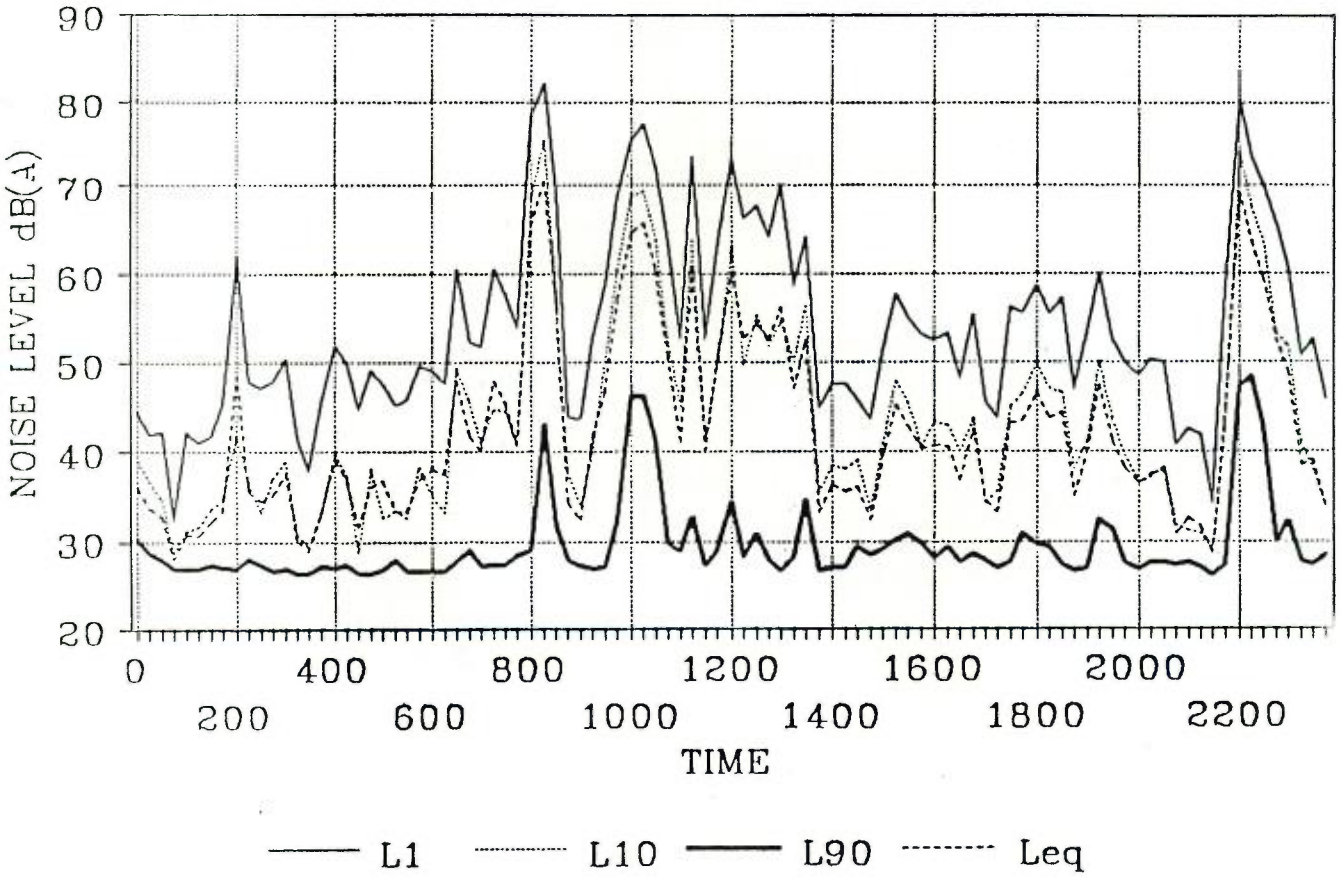
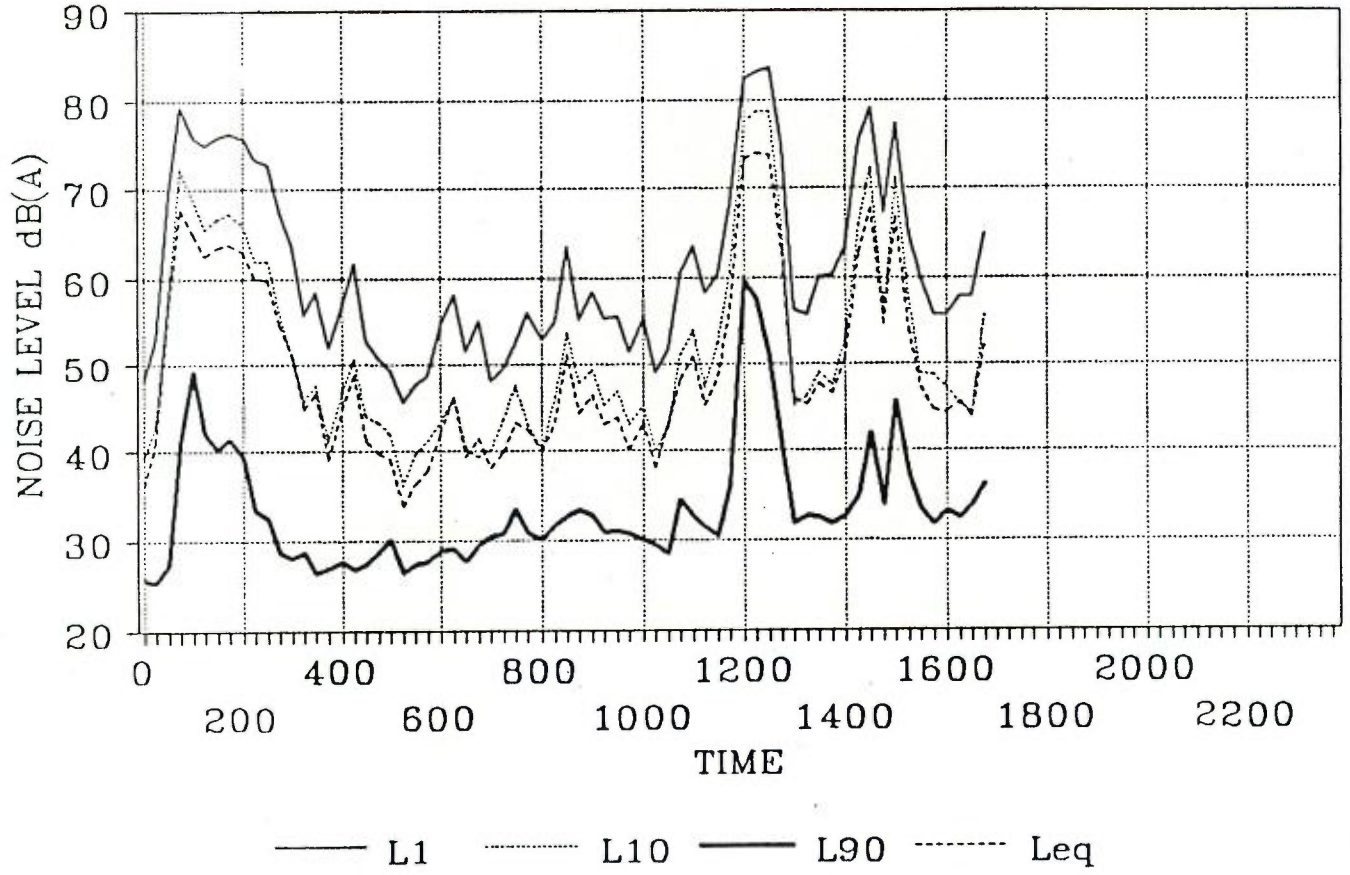
NOISE LEVELS AT
"BUNDALINK" RESIDENCE
7 JANUARY ,1992

REPORT NO 91114

FIGURE 8



WILKINSON MURRAY PTY LTD **Level 1, 123-125 Willoughby Road** **Crows Nest NSW 2065** **Telephone** **(02) 437 4611** **Facsimile** **(02) 439 4393**	**NOISE LEVELS AT** **"BUNDALINK" RESIDENCE** **8 JANUARY ,1992** **REPORT NO 91114** **FIGURE 9**



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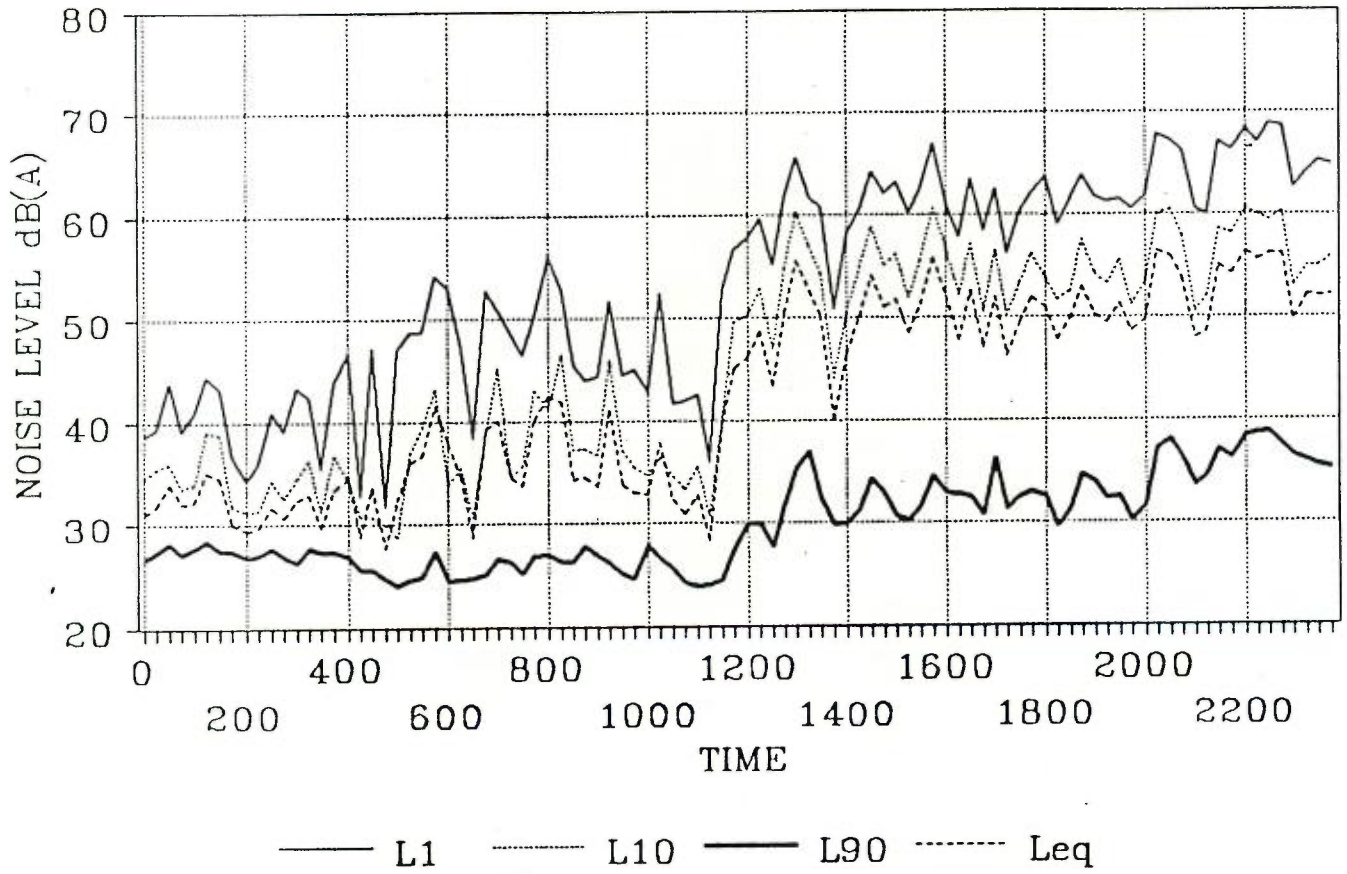
NOISE LEVELS AT
"BUNDALINK" RESIDENCE
9 JANUARY ,1992

REPORT NO 91114 FIGURE 10



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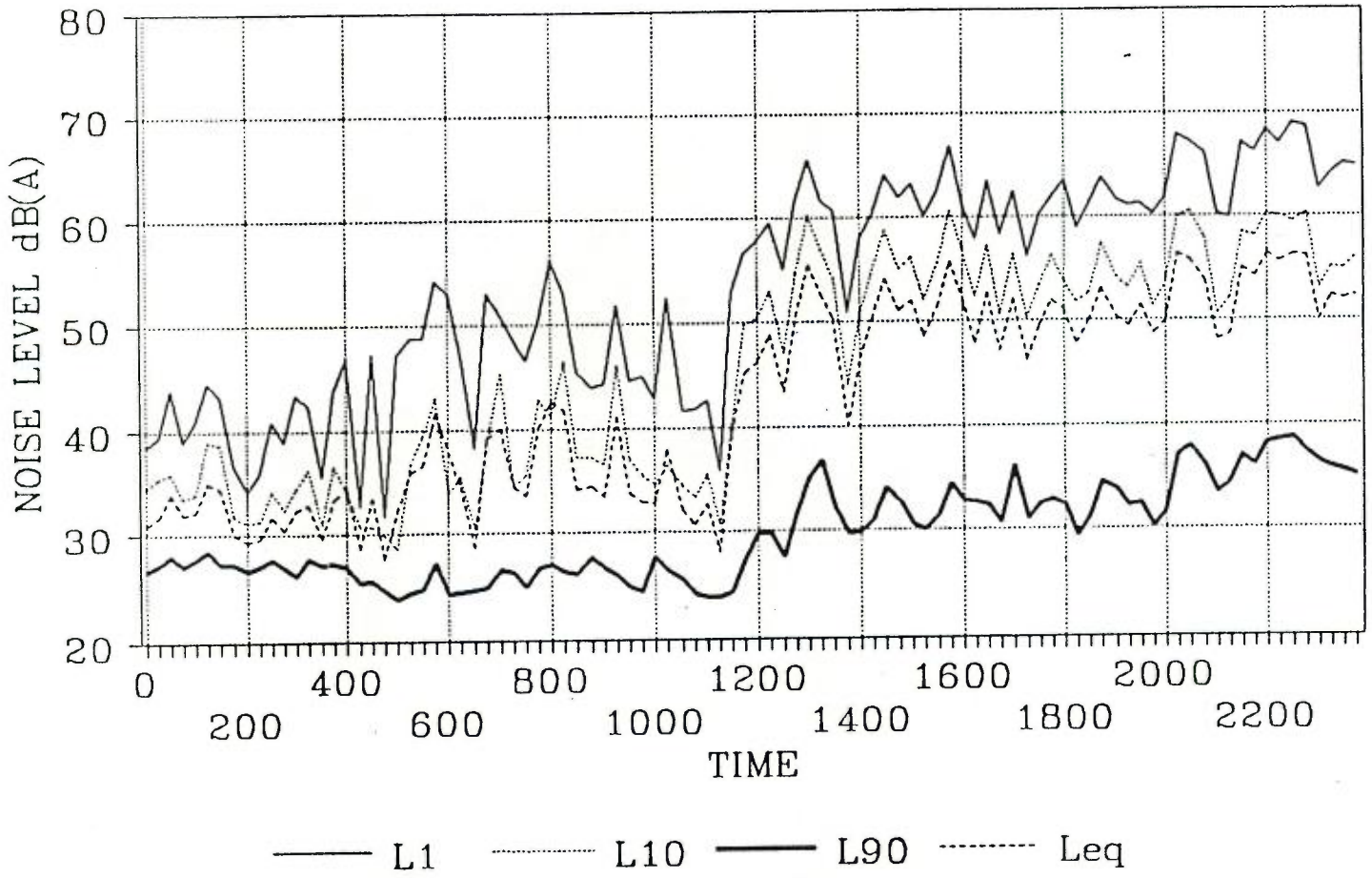
NOISE LEVELS AT
"MERRY HILL" RESIDENCE
2 JANUARY ,1992

REPORT NO 91114 **FIGURE 11**



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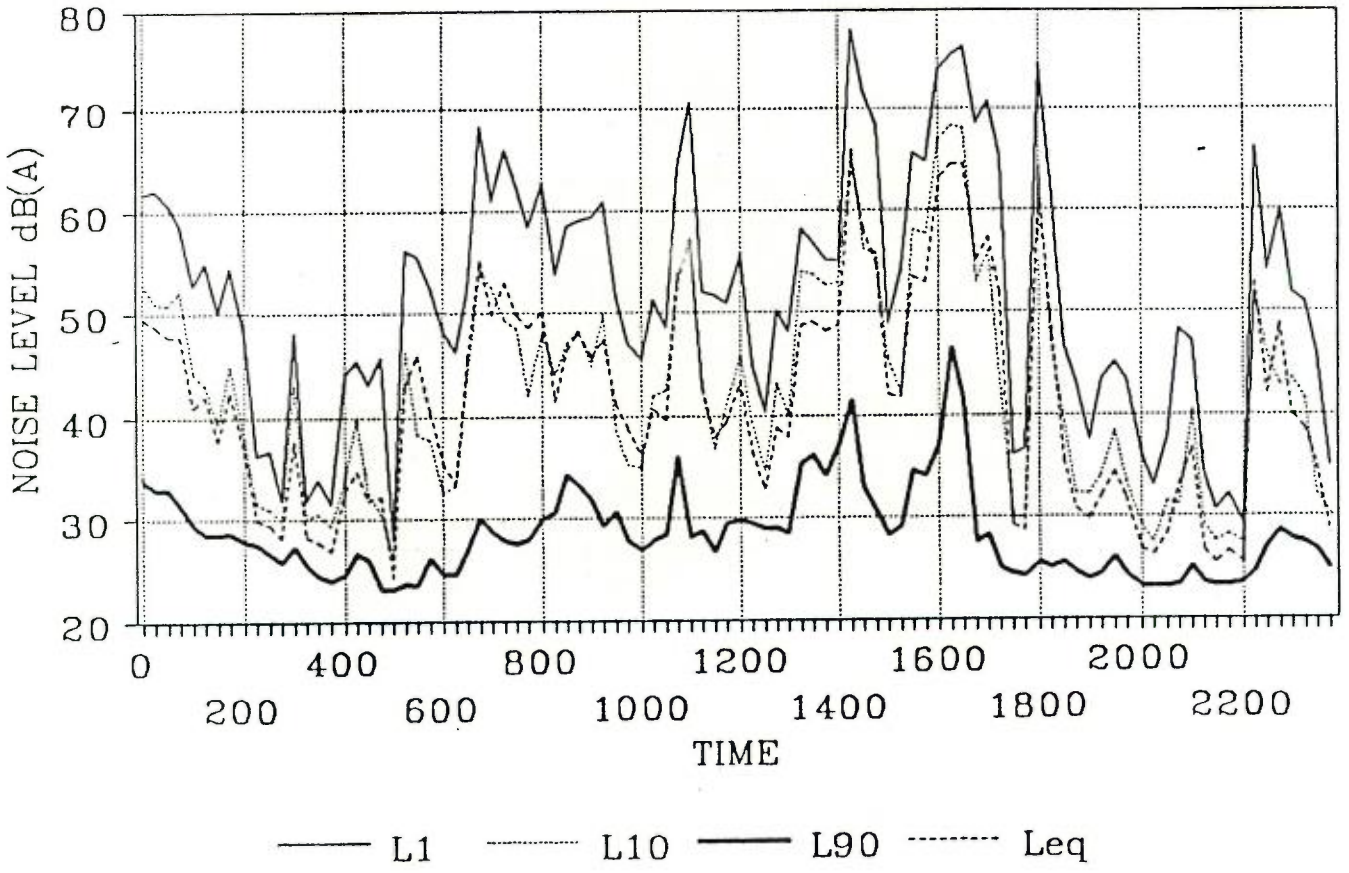
NOISE LEVELS AT
"MERRY HILL" RESIDENCE
3 JANUARY ,1992

REPORT NO 91114 **FIGURE 12**



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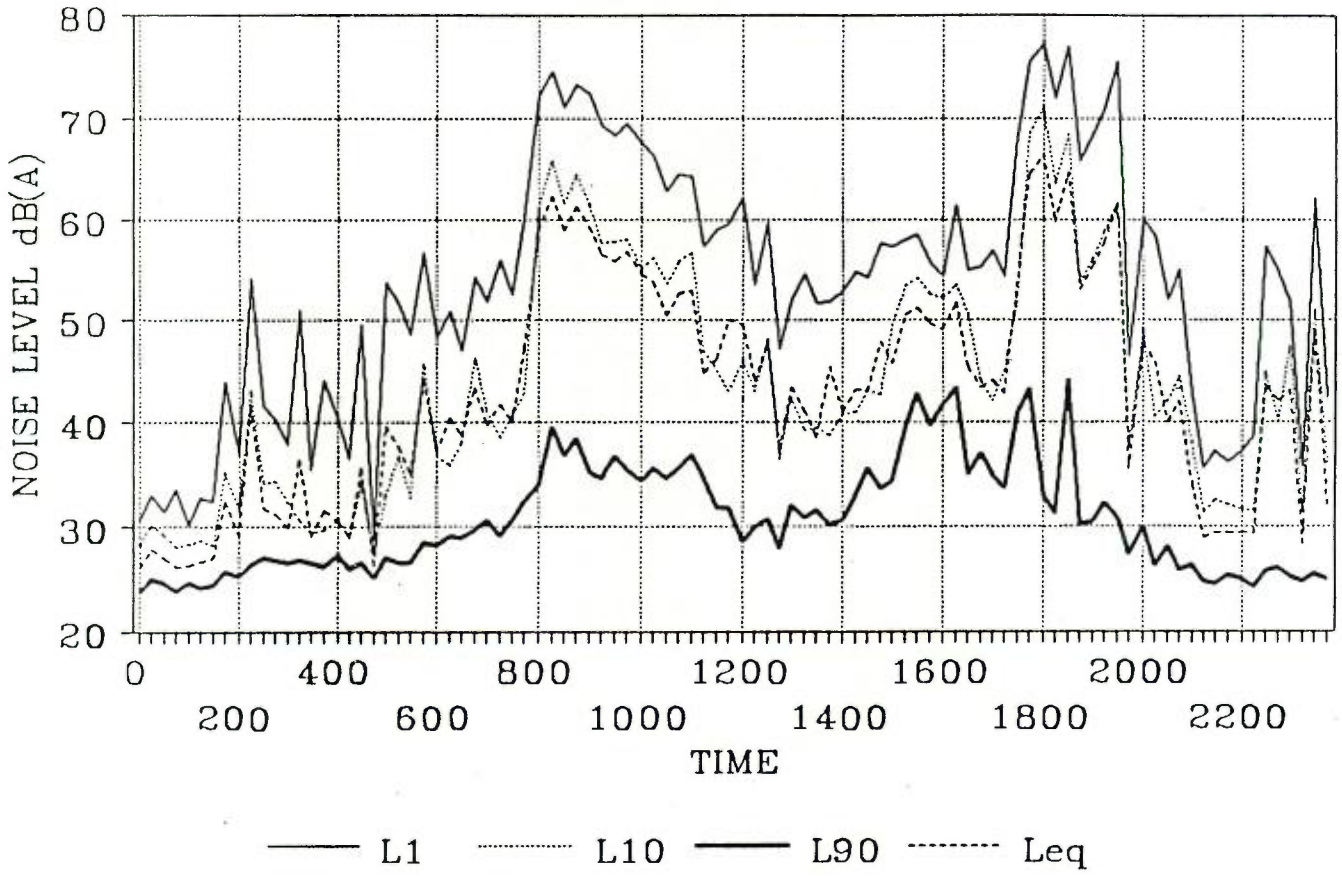
NOISE LEVELS AT "MERRY HILL" RESIDENCE 4 JANUARY ,1992

REPORT NO 91114

FIGURE 13



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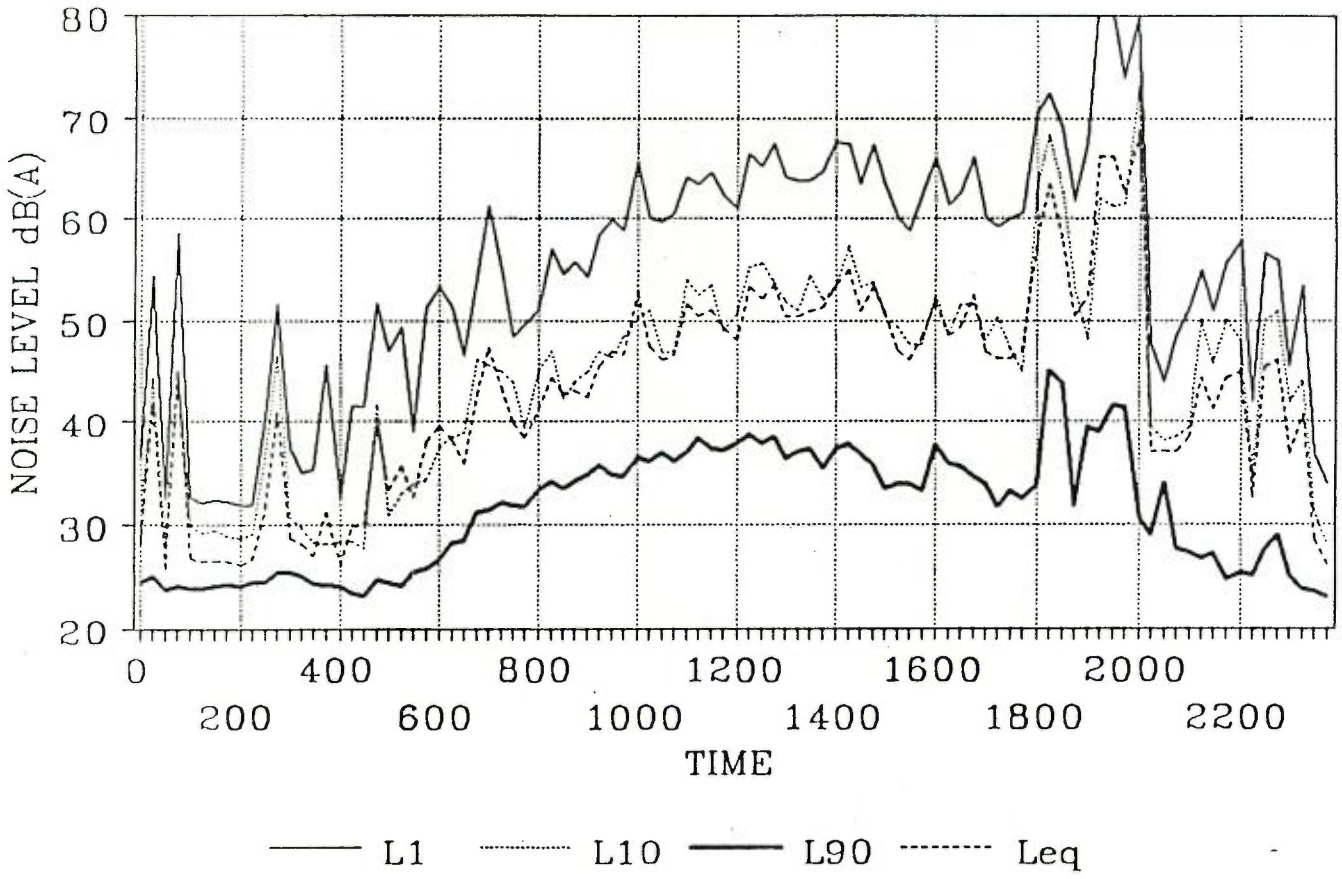
NOISE LEVELS AT
"MERRY HILL" RESIDENCE
5 JANUARY ,1992

REPORT NO 91114 FIGURE 14



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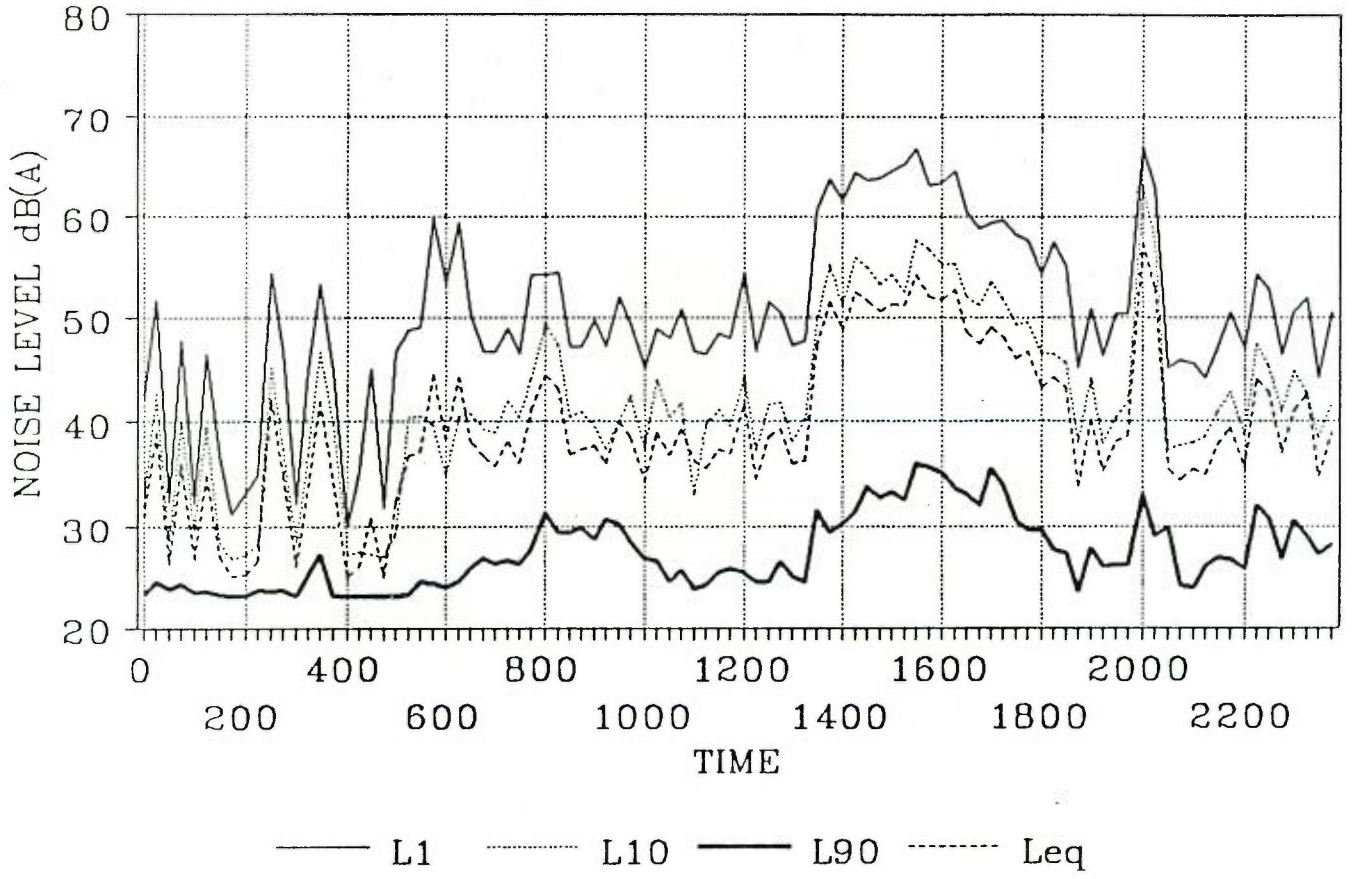
NOISE LEVELS AT
"MERRY HILL" RESIDENCE
6 JANUARY ,1992

REPORT NO 91114 **FIGURE 15**



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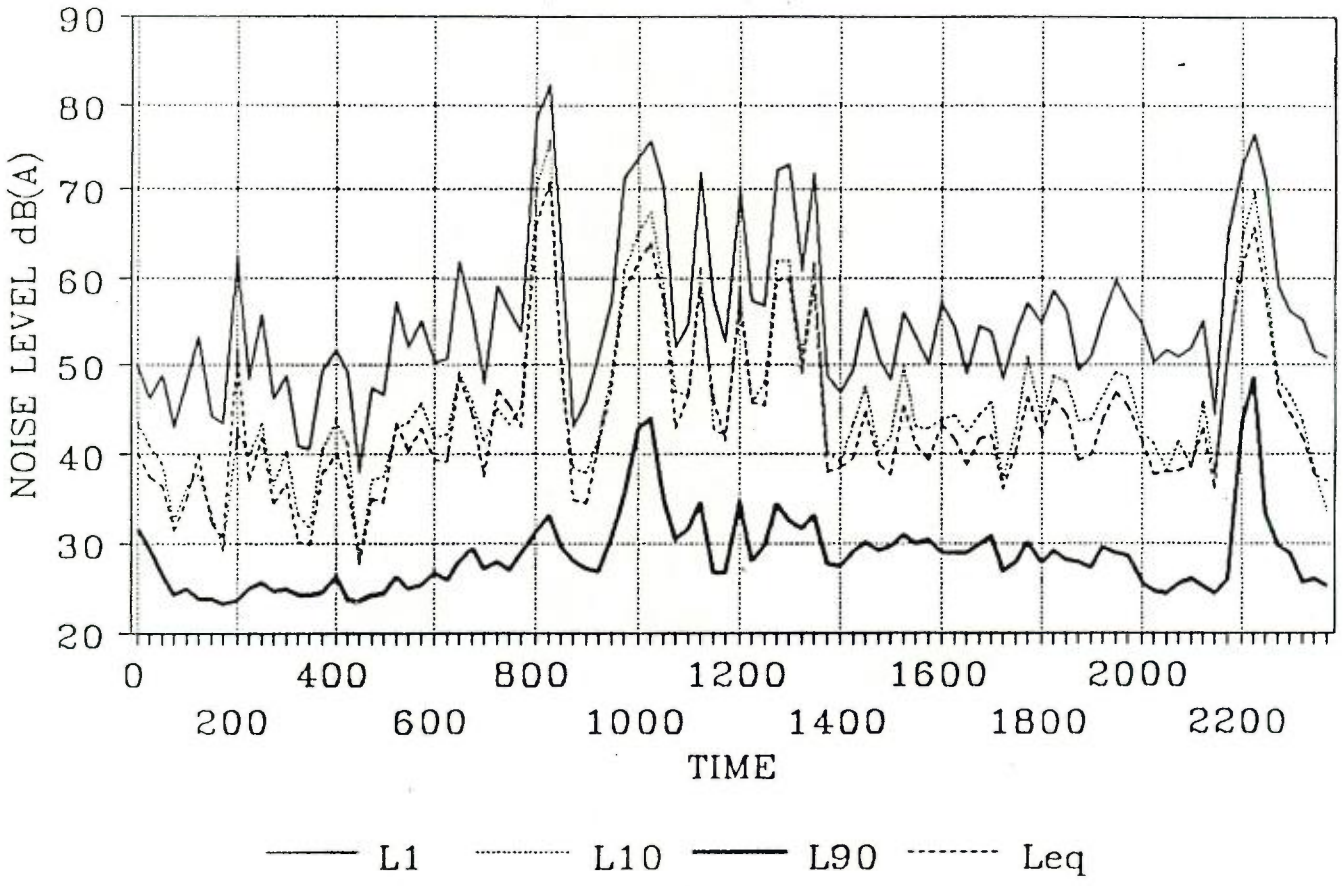
NOISE LEVELS AT
"MERRY HILL" RESIDENCE
7 JANUARY ,1992

REPORT NO 91114 **FIGURE 16**



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NOISE LEVELS AT
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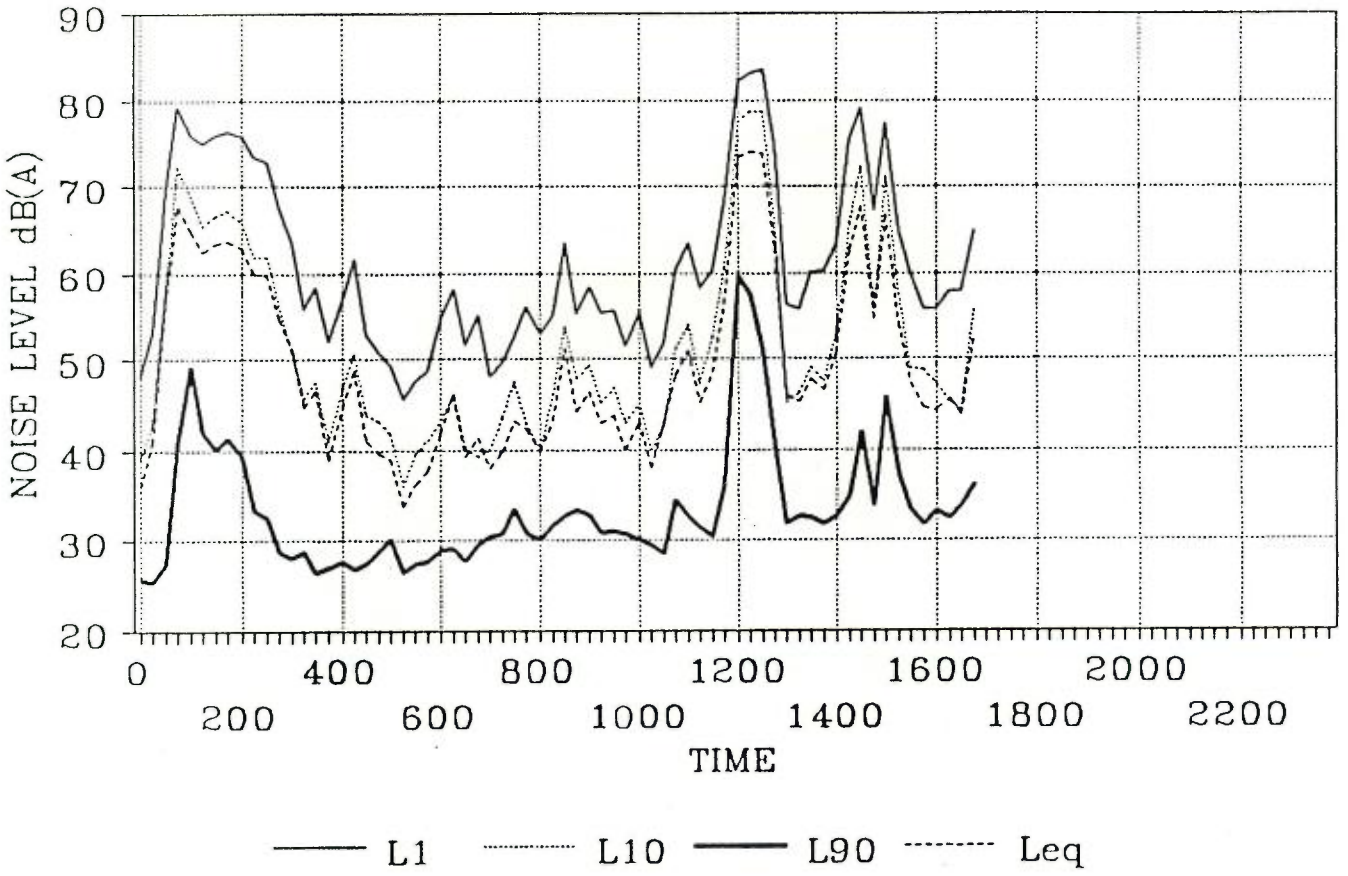
8 JANUARY, 1992

REPORT NO 91114 **FIGURE 17**



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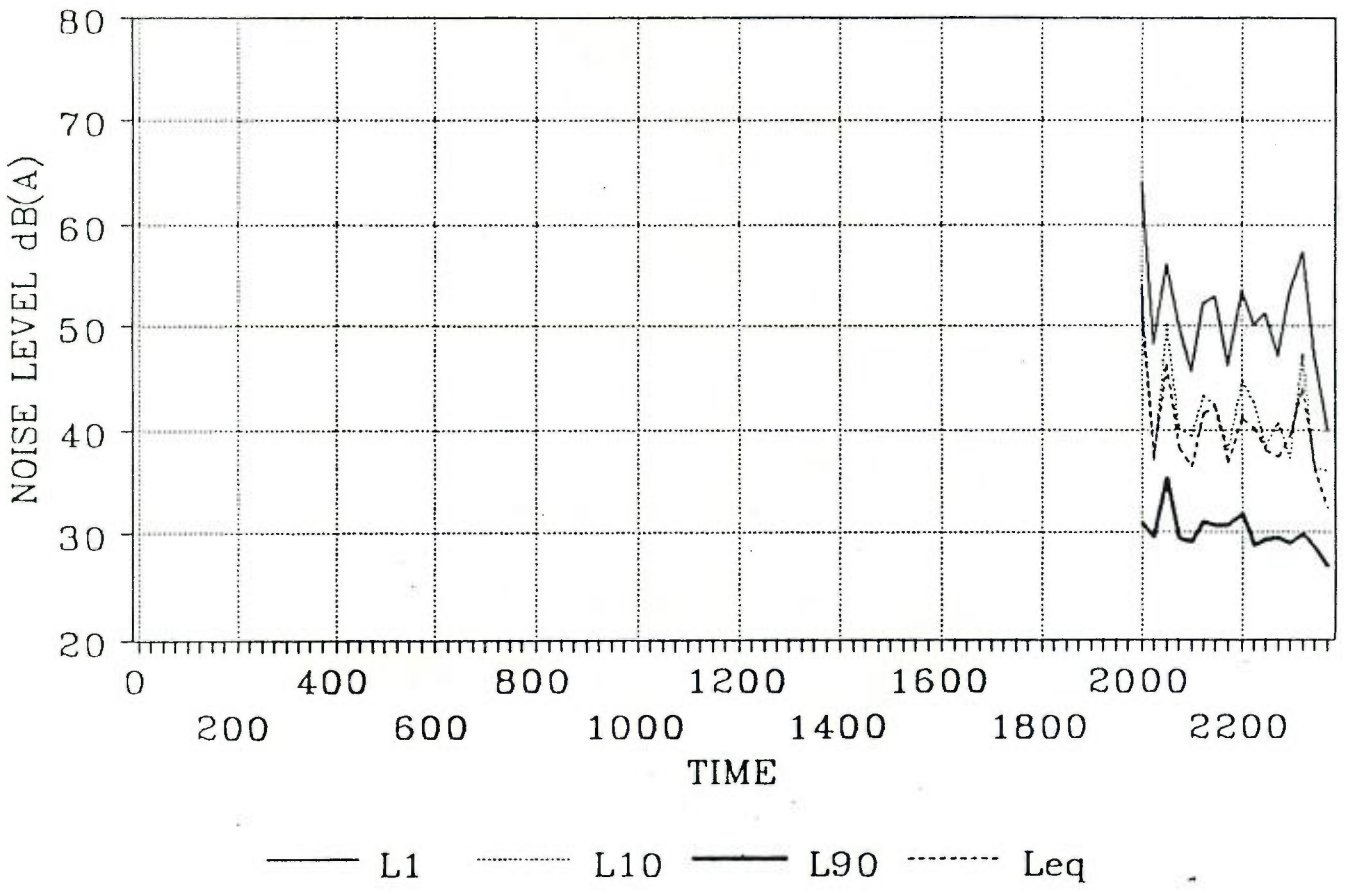
NOISE LEVELS AT "MERRY HILL" RESIDENCE 9 JANUARY, 1992

REPORT NO 91114 **FIGURE 18**



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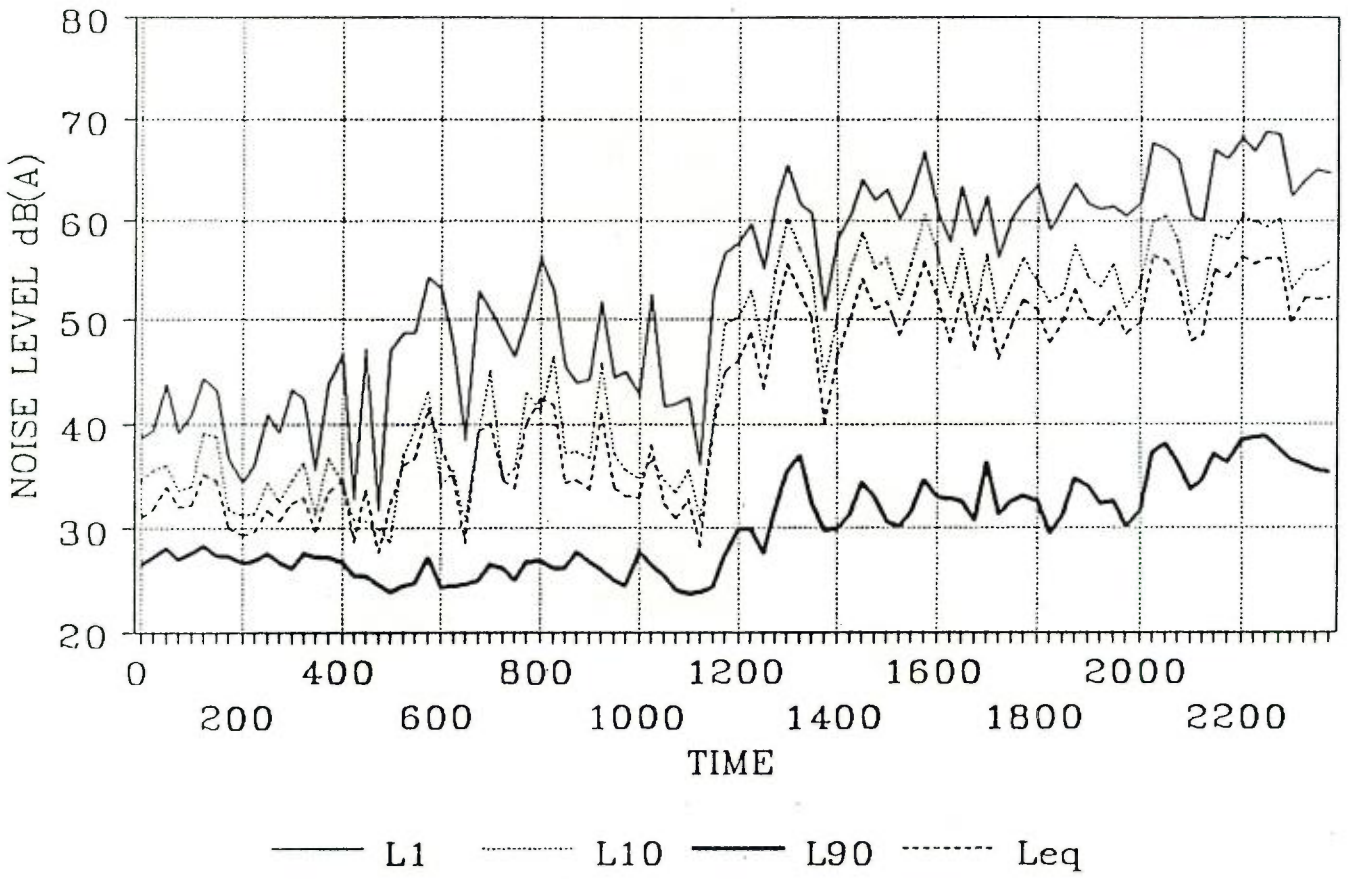
NOISE LEVELS AT
"ROCKLEIGH" RESIDENCE
2 JANUARY ,1992

REPORT NO 91114

FIGURE 19



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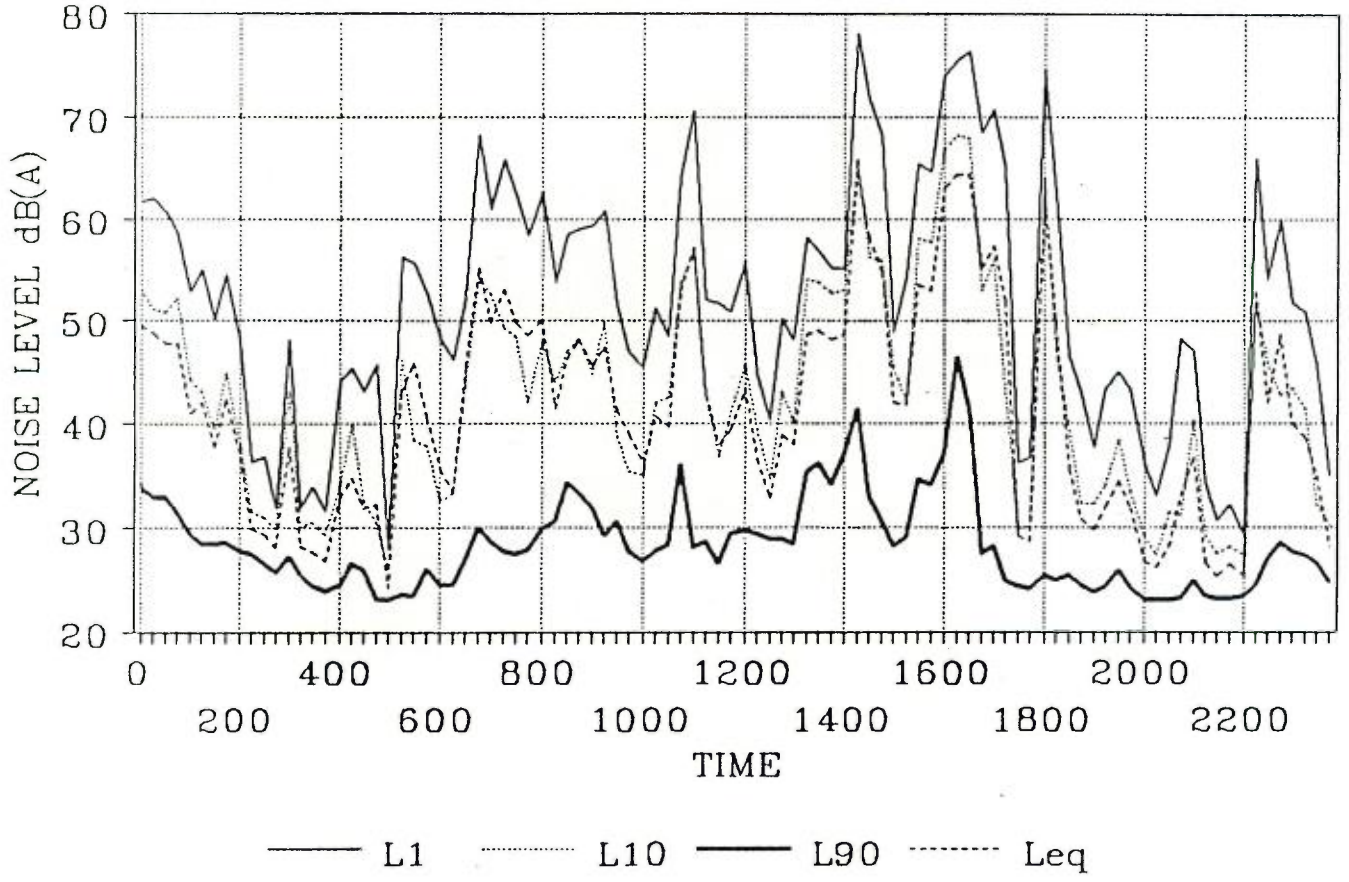
NOISE LEVELS AT
"ROCKLEIGH" RESIDENCE
3 JANUARY, 1992

REPORT NO 91114 **FIGURE 20**



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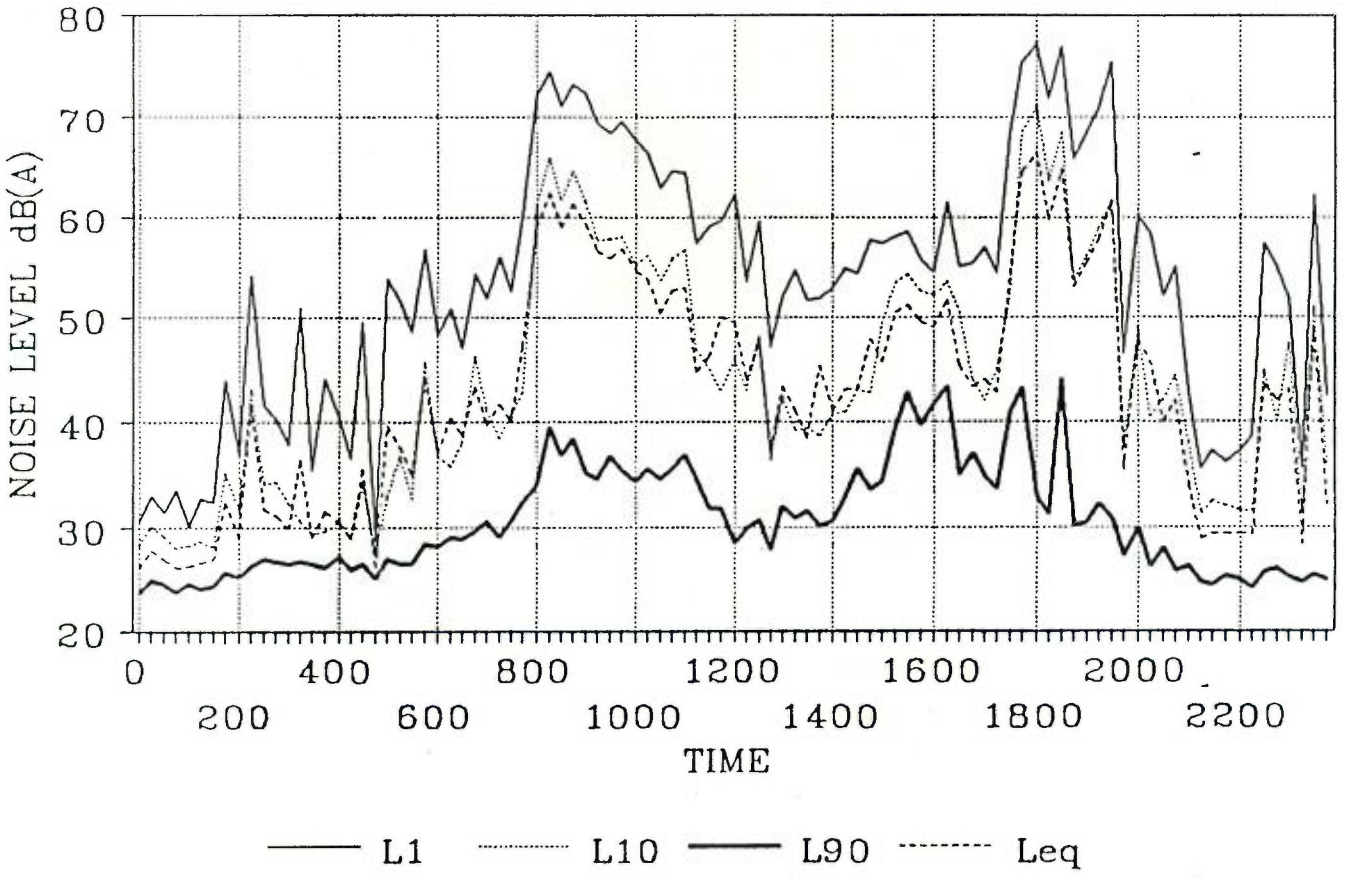
NOISE LEVELS AT
"ROCKLEIGH" RESIDENCE
4 JANUARY, 1992

REPORT NO 91114 **FIGURE 21**



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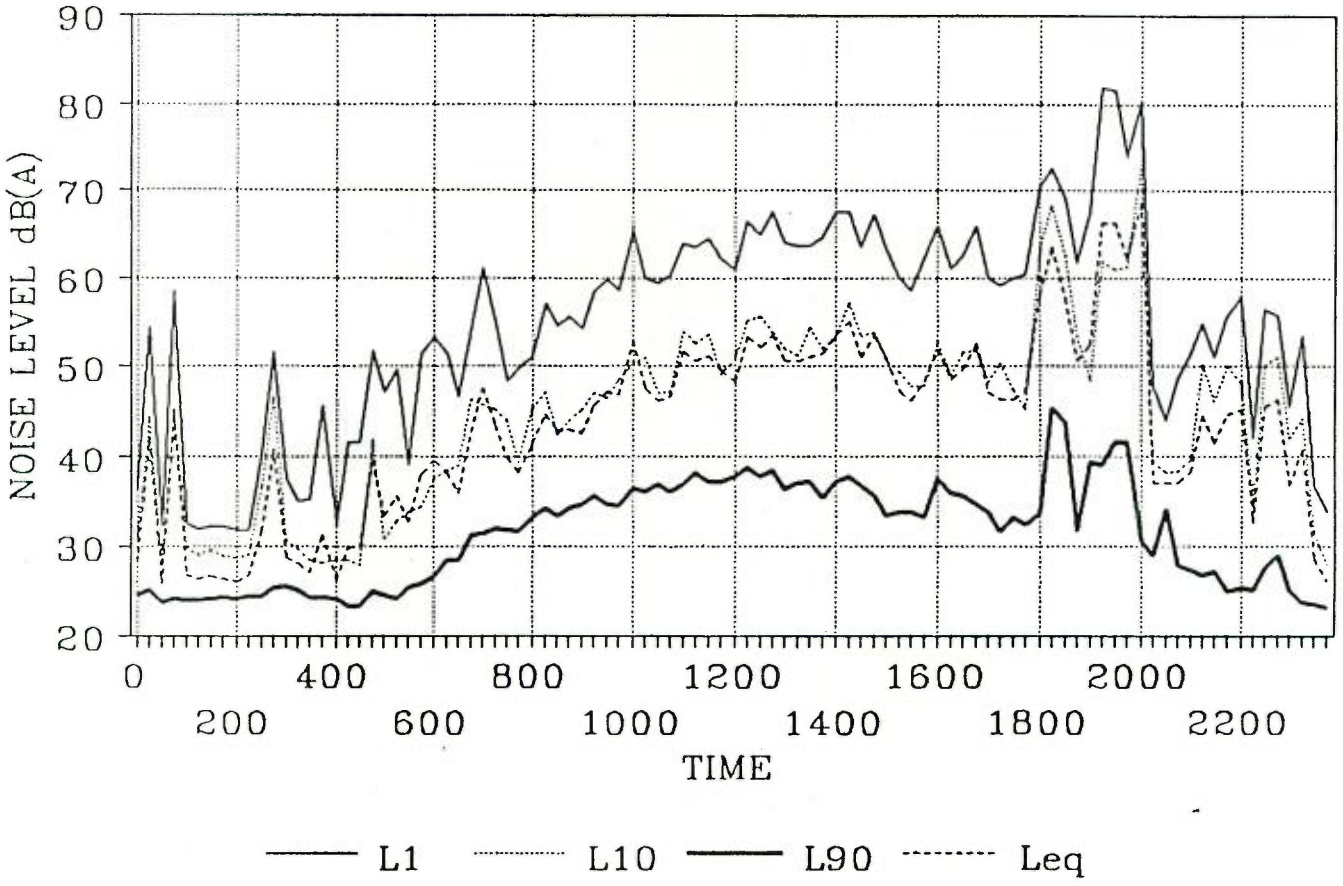
NOISE LEVELS AT
"ROCKLEIGH" RESIDENCE
5 JANUARY, 1992

REPORT NO 91114 FIGURE 22



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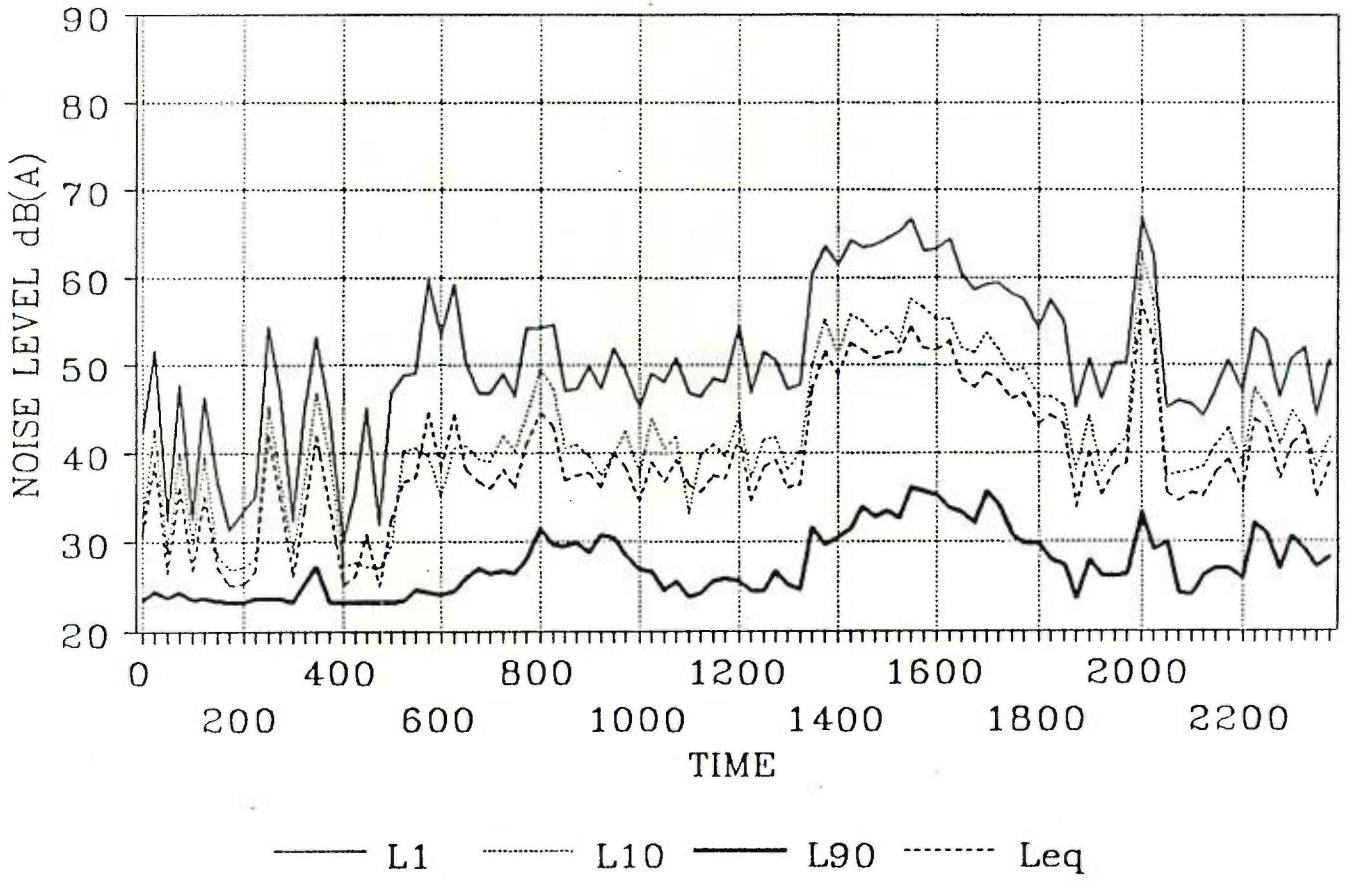
NOISE LEVELS AT "ROCKLEIGH" RESIDENCE 6 JANUARY, 1992

REPORT NO 91114 **FIGURE 23**



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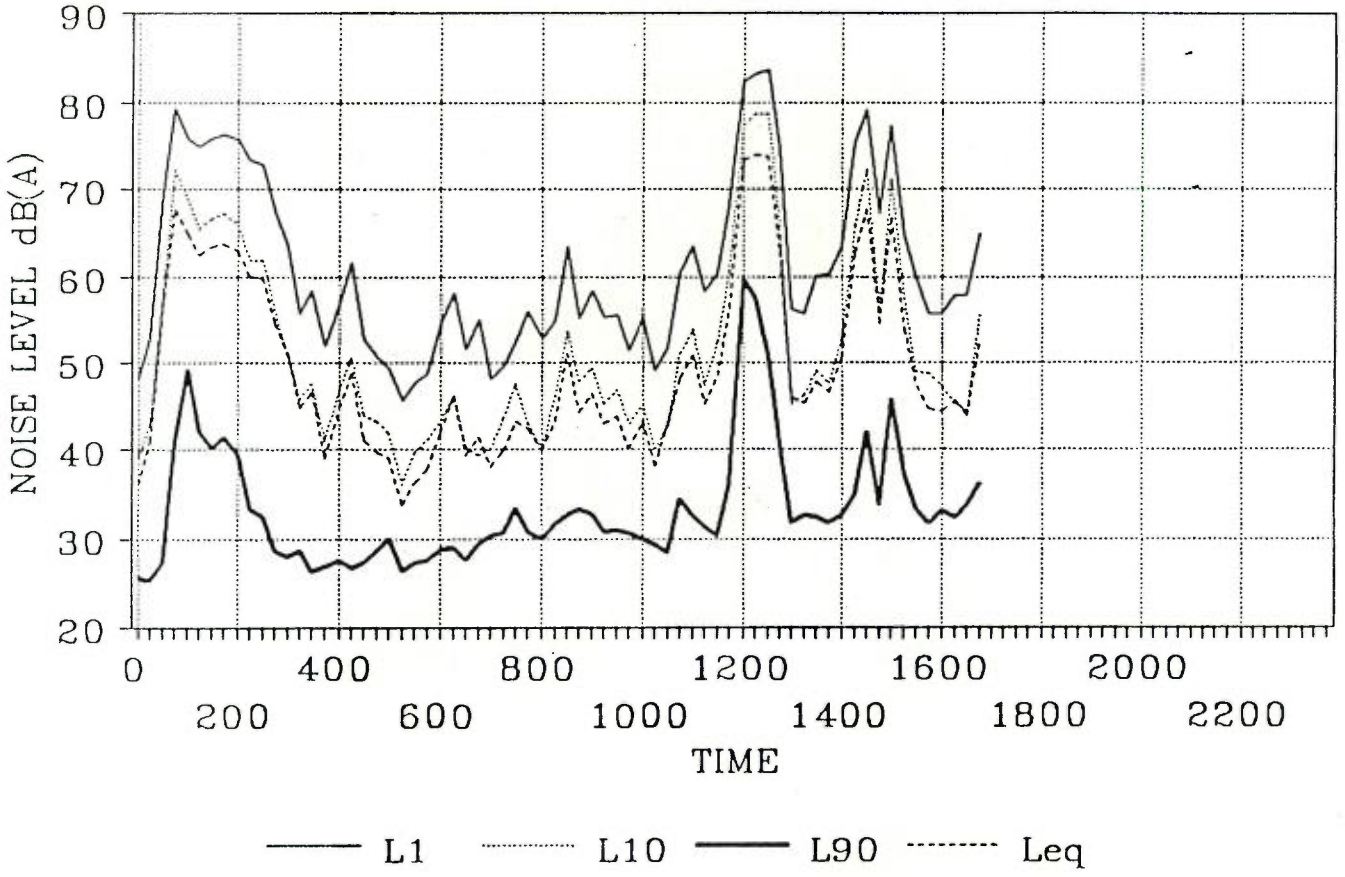
NOISE LEVELS AT
"ROCKLEIGH" RESIDENCE
7 JANUARY, 1992

REPORT NO 91114

FIGURE 24



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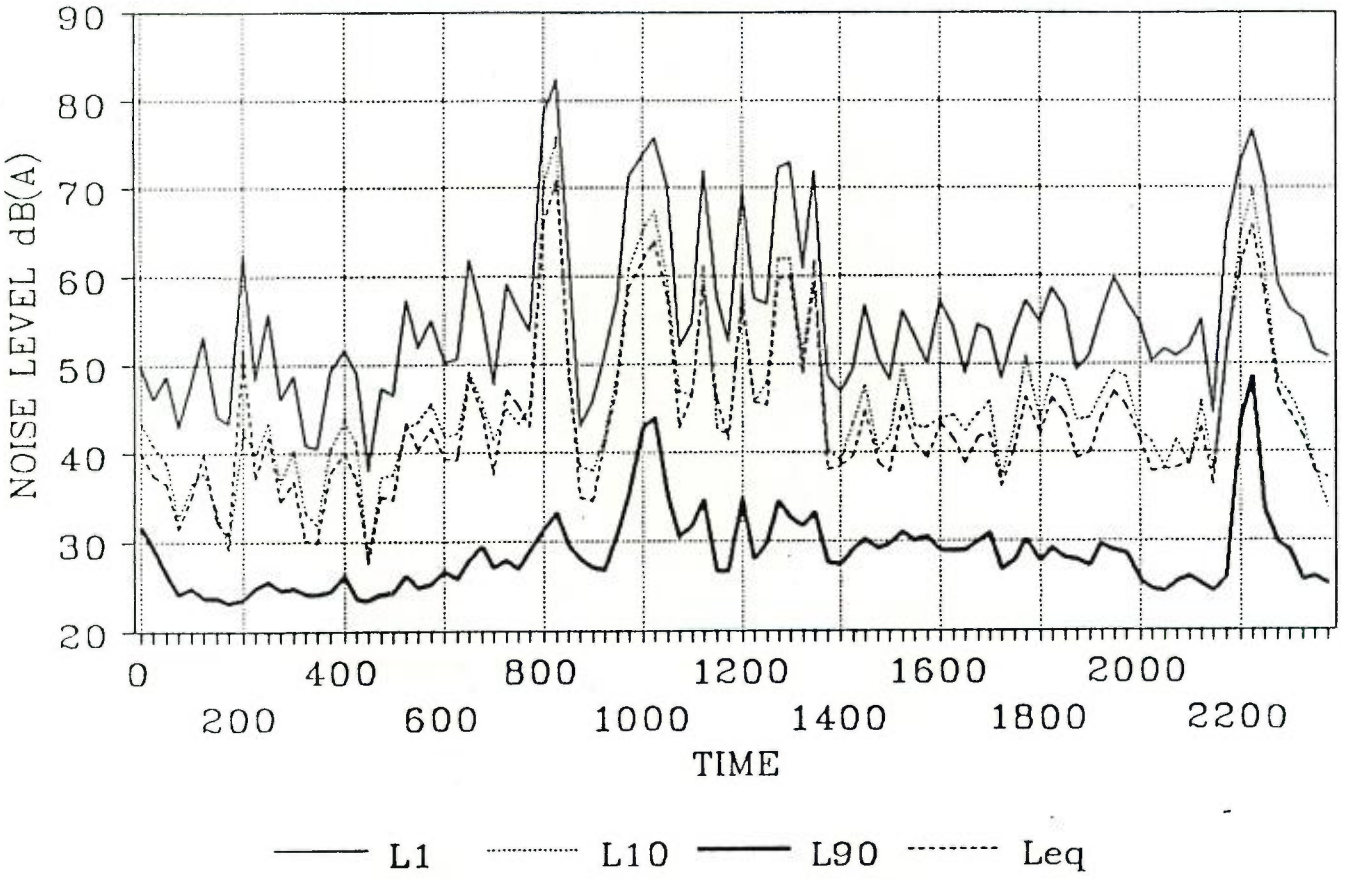
NOISE LEVELS AT
"ROCKLEIGH" RESIDENCE
9 JANUARY, 1992

REPORT NO 91114

FIGURE 26



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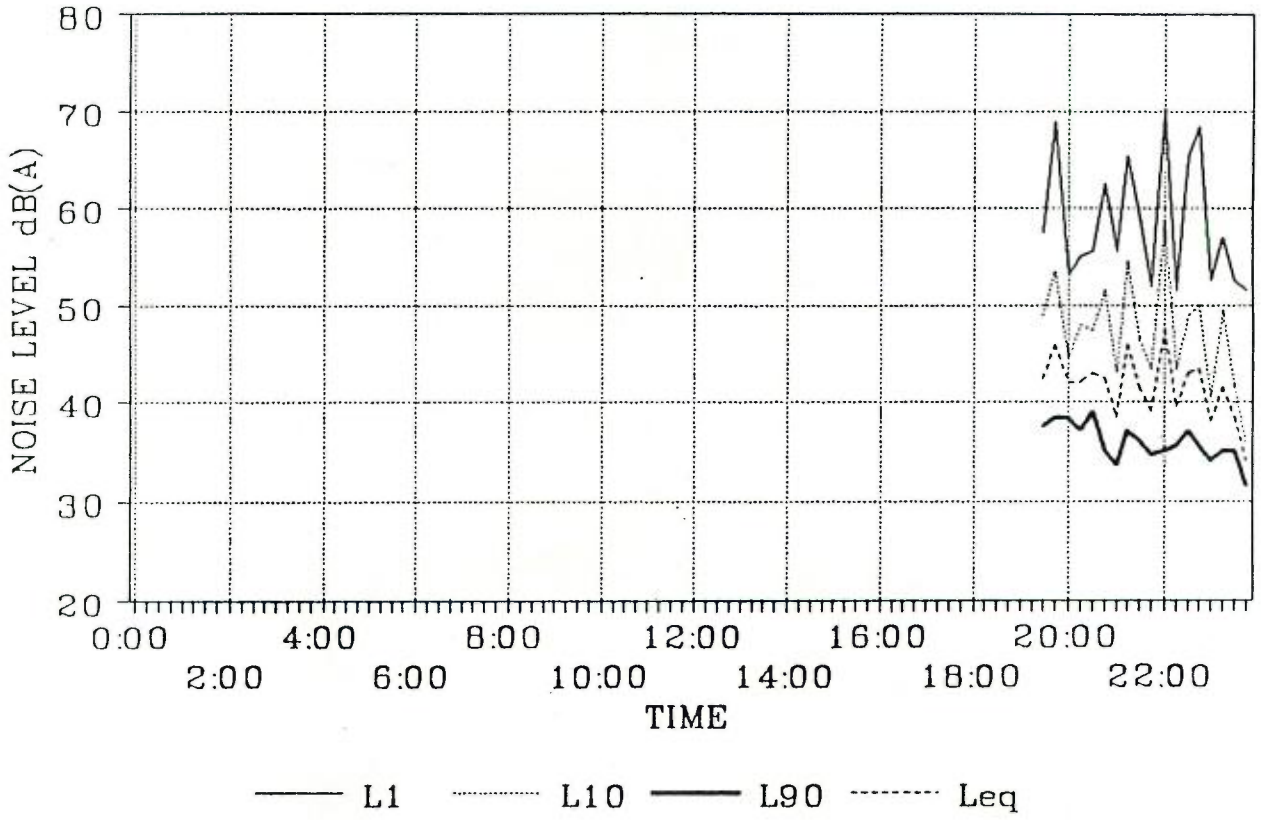
NOISE LEVELS AT
"ROCKLEIGH" RESIDENCE
8 JANUARY, 1992

REPORT NO 91114

FIGURE 25



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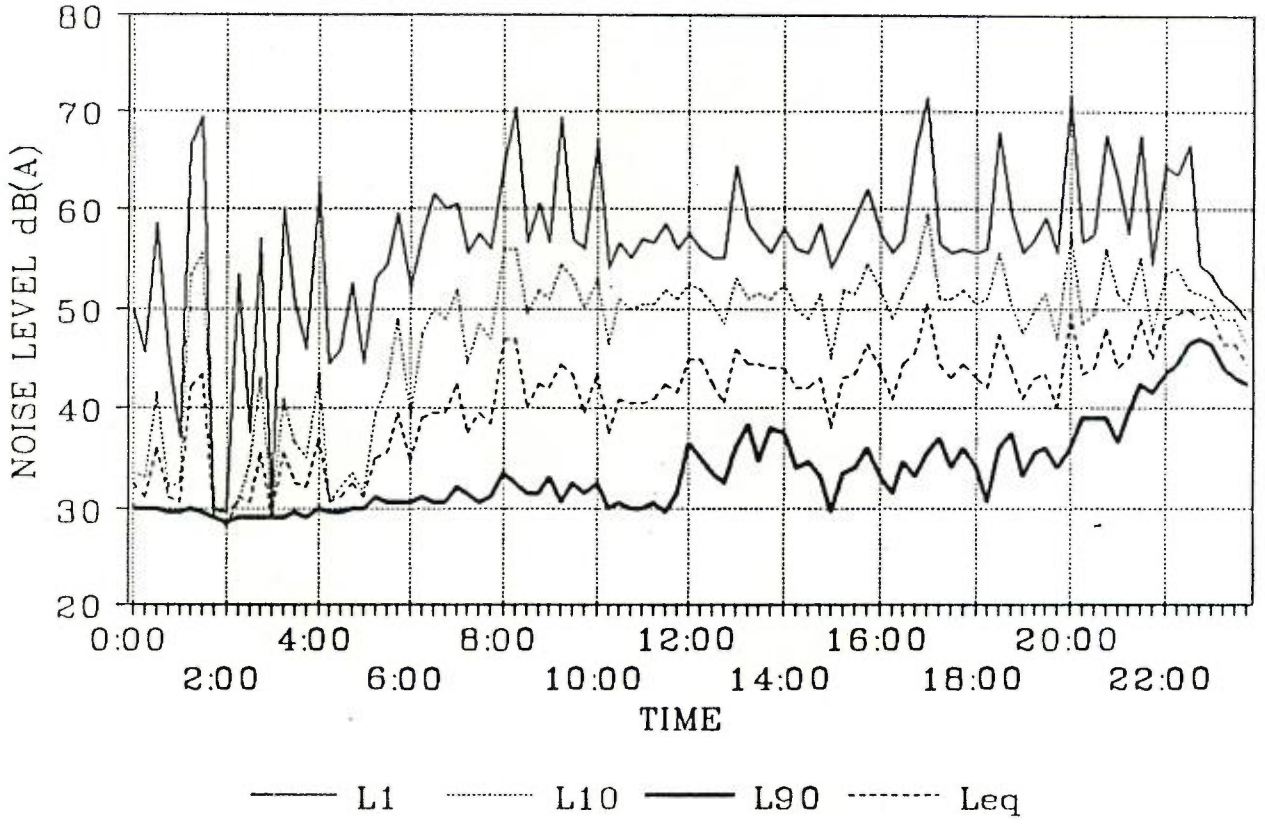
NOISE LEVELS AT "LYLEN" RESIDENCE 2 JANUARY, 1992

REPORT NO 91114 **FIGURE 27**



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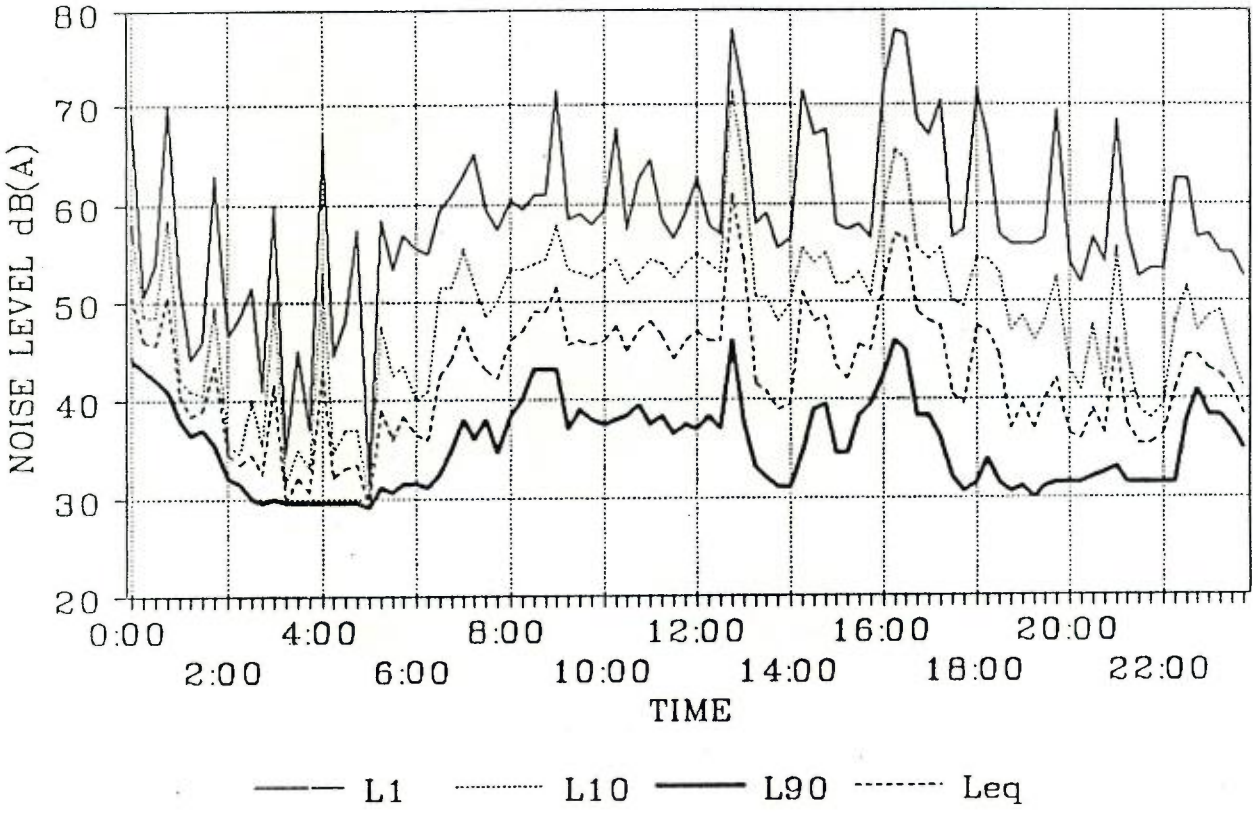
NOISE LEVELS AT "LYLEN" RESIDENCE 3 JANUARY, 1992

REPORT NO 91114 **FIGURE 28**



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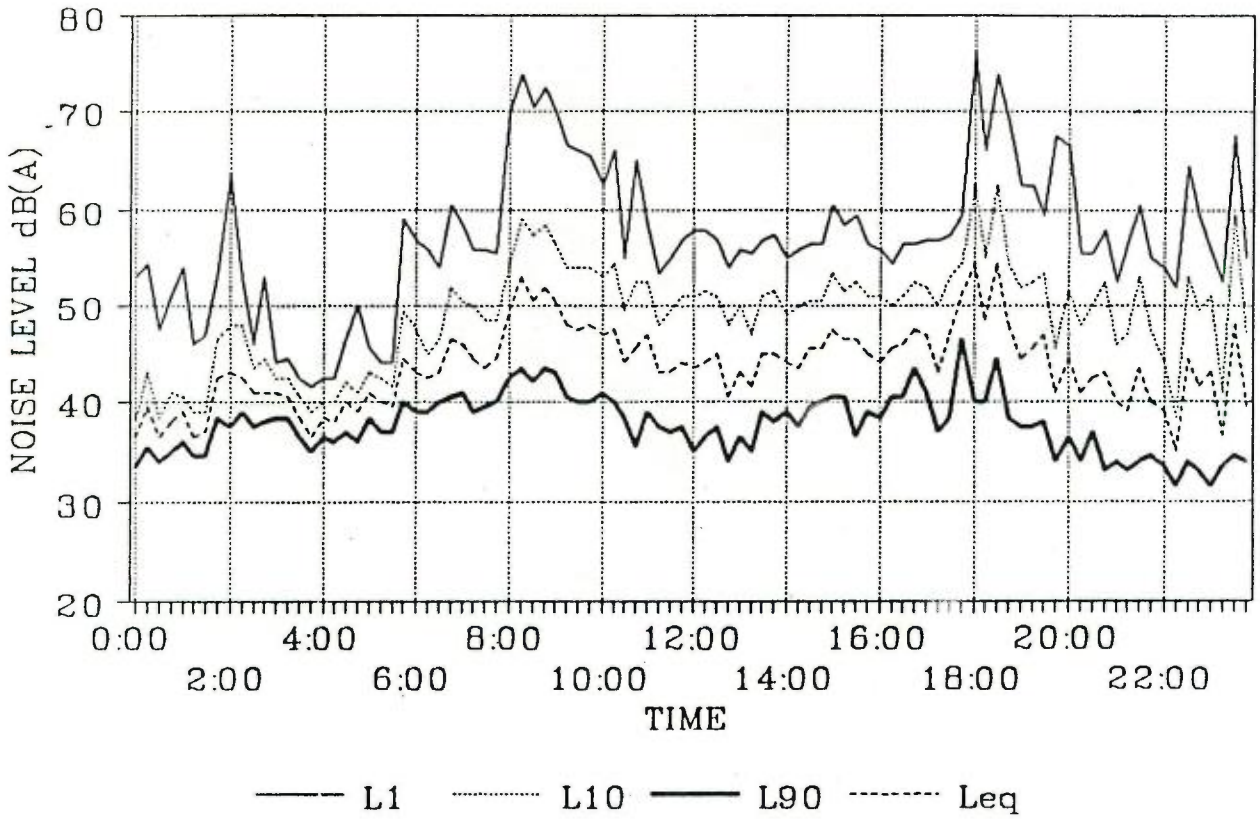
NOISE LEVELS AT
"LYLEN" RESIDENCE
4 JANUARY, 1992

REPORT NO 91114 FIGURE 29



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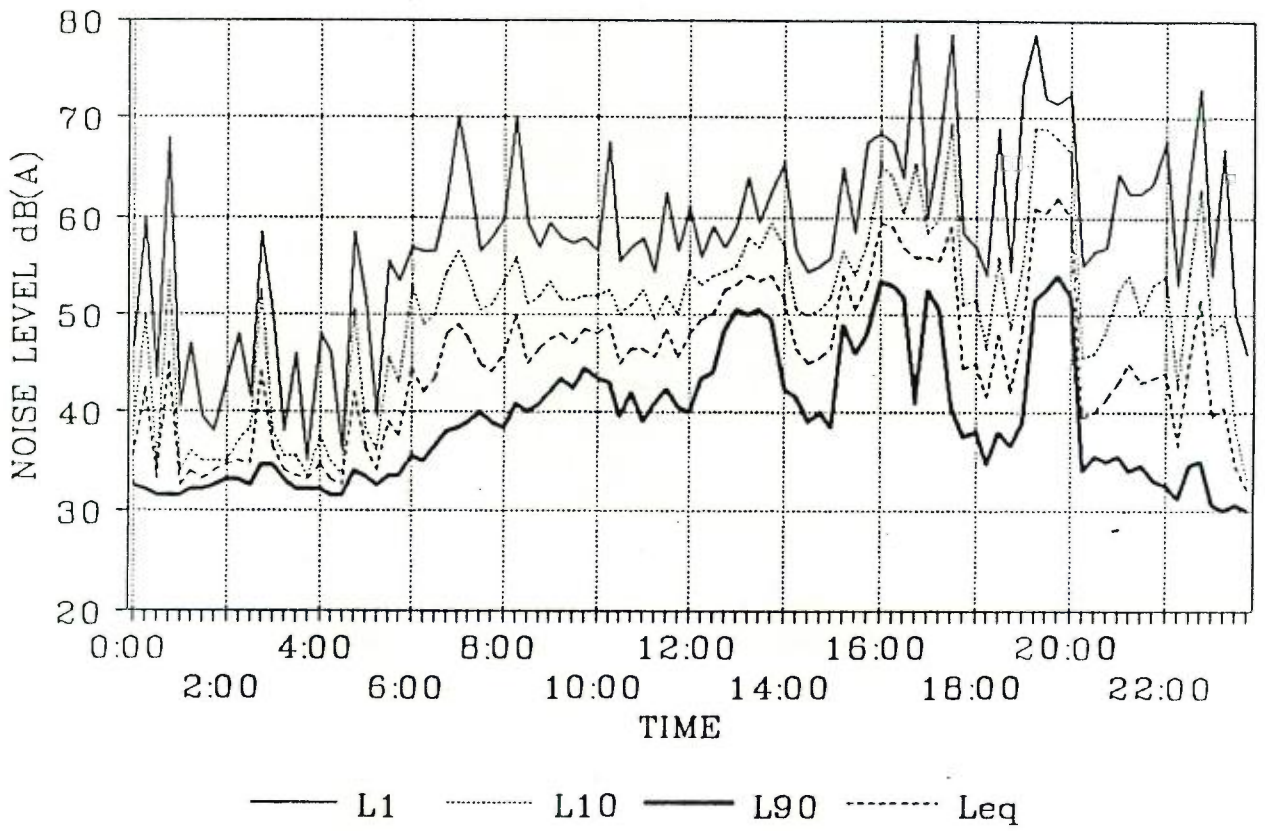
NOISE LEVELS AT "LYLEN" RESIDENCE 5 JANUARY, 1992

REPORT NO 91114 **FIGURE 30**



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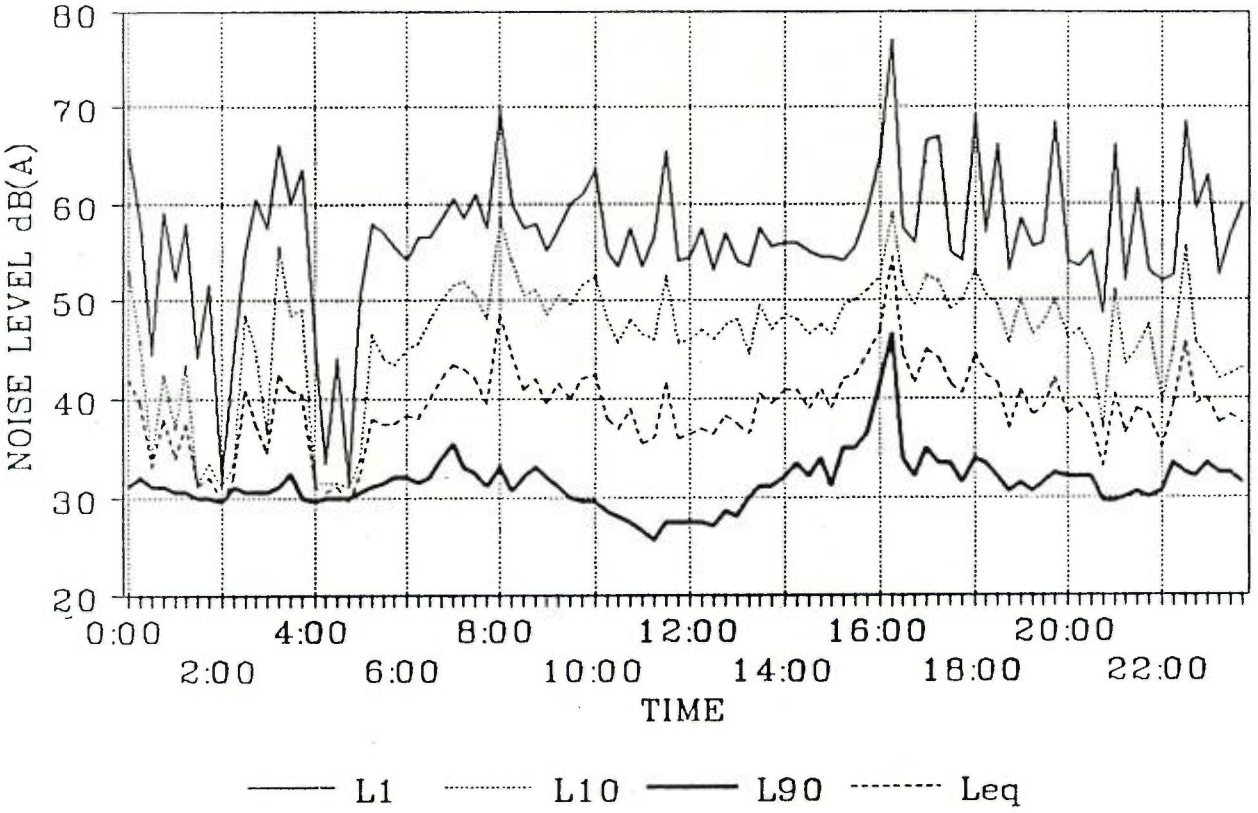
NOISE LEVELS AT
"LYLEN" RESIDENCE
6 JANUARY, 1992

REPORT NO 91114 **FIGURE 31**



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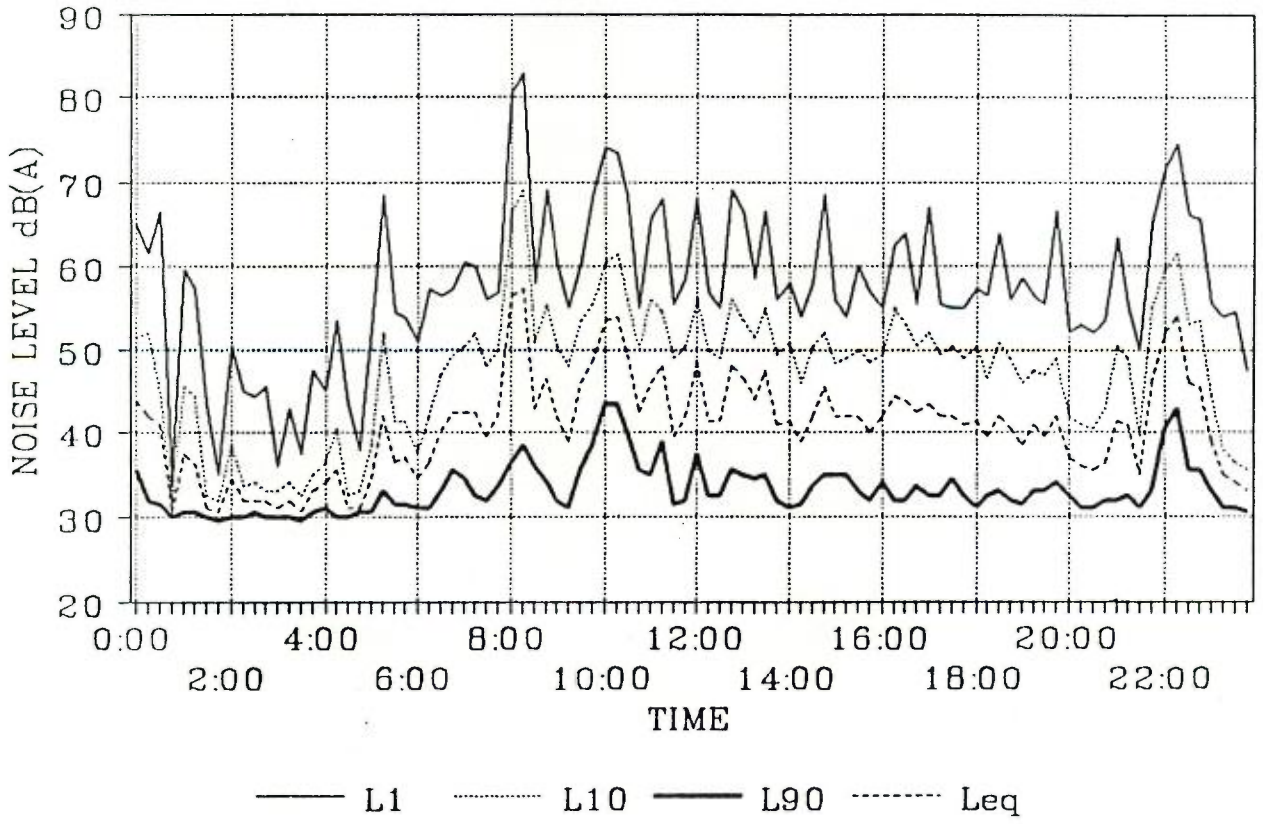
NOISE LEVELS AT
"LYLEN" RESIDENCE
7 JANUARY, 1992

REPORT NO 91114

FIGURE 32



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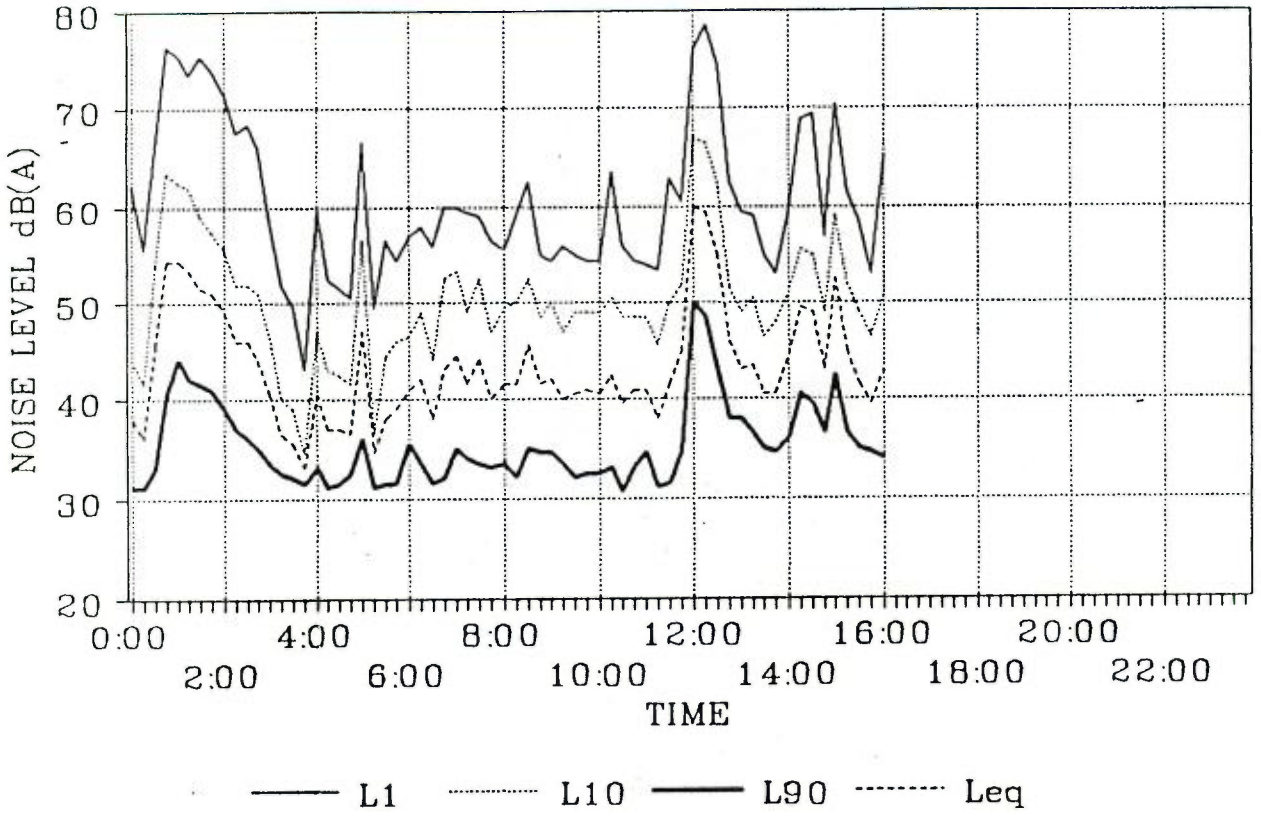
NOISE LEVELS AT
"LYLEN" RESIDENCE
8 JANUARY, 1992

REPORT NO 91114 **FIGURE 33**



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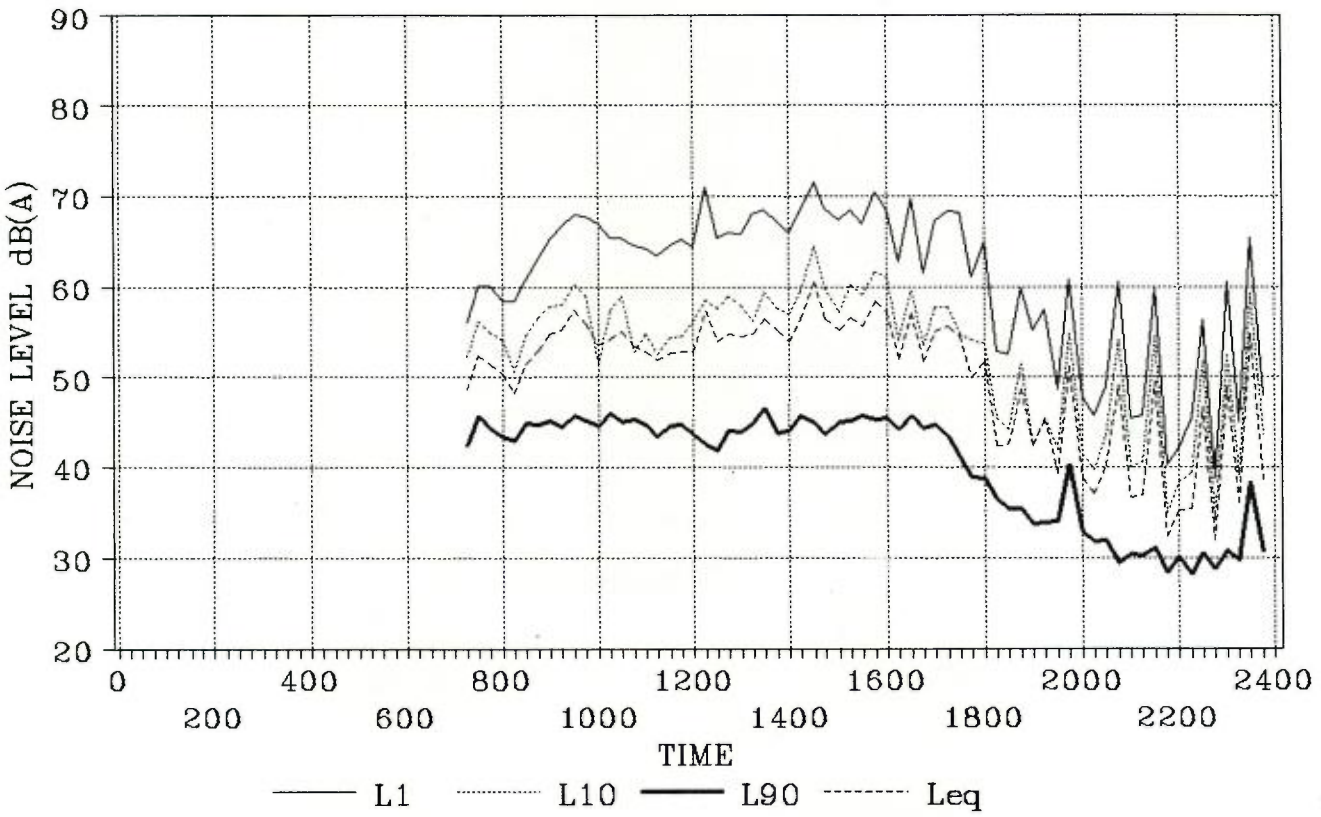
NOISE LEVELS AT
"LYLEN" RESIDENCE
9 JANUARY, 1992

REPORT NO 91114 FIGURE 34



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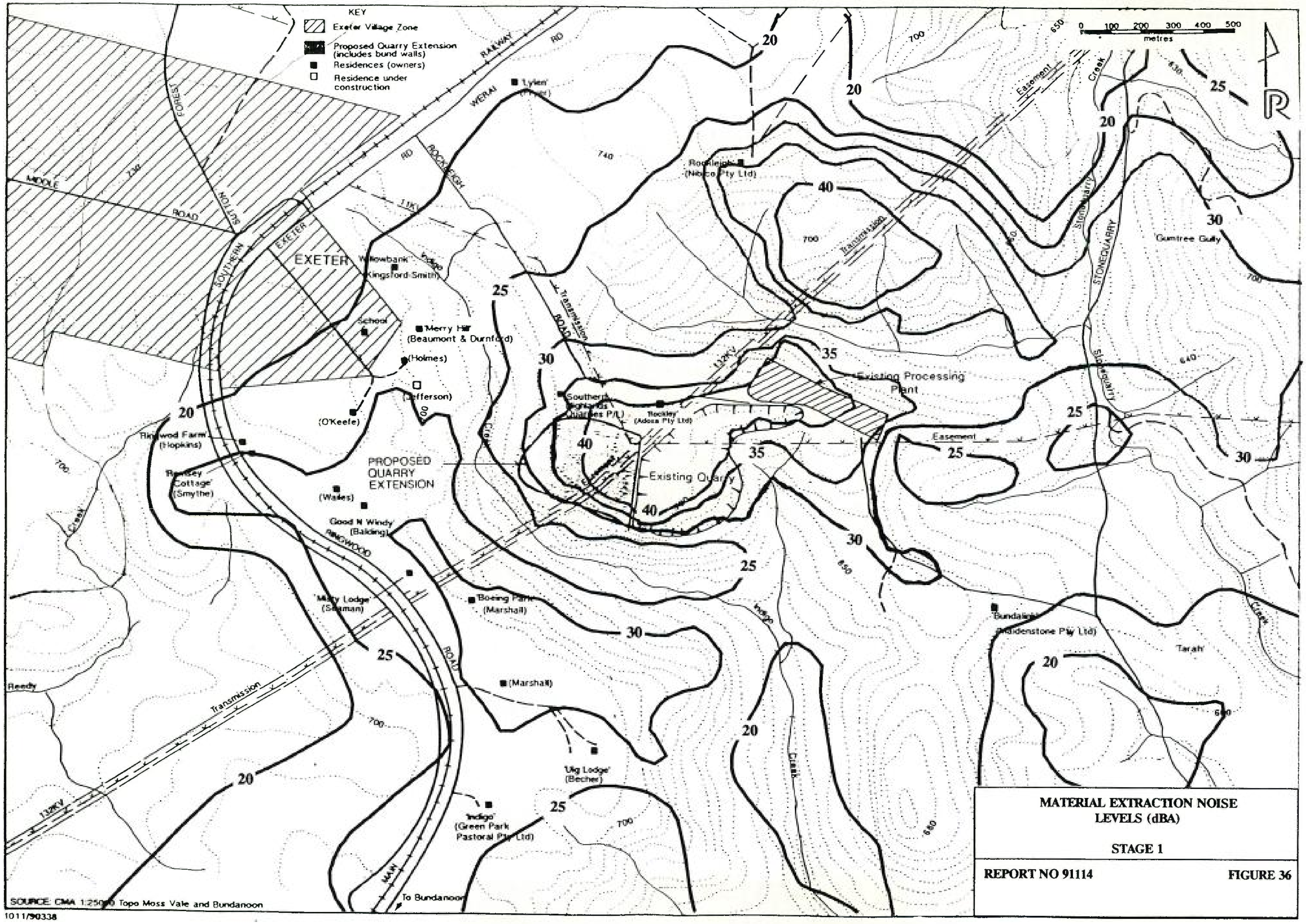
NOISE LEVELS AT "ROCKLEIGH"
27 NOVEMBER 1992

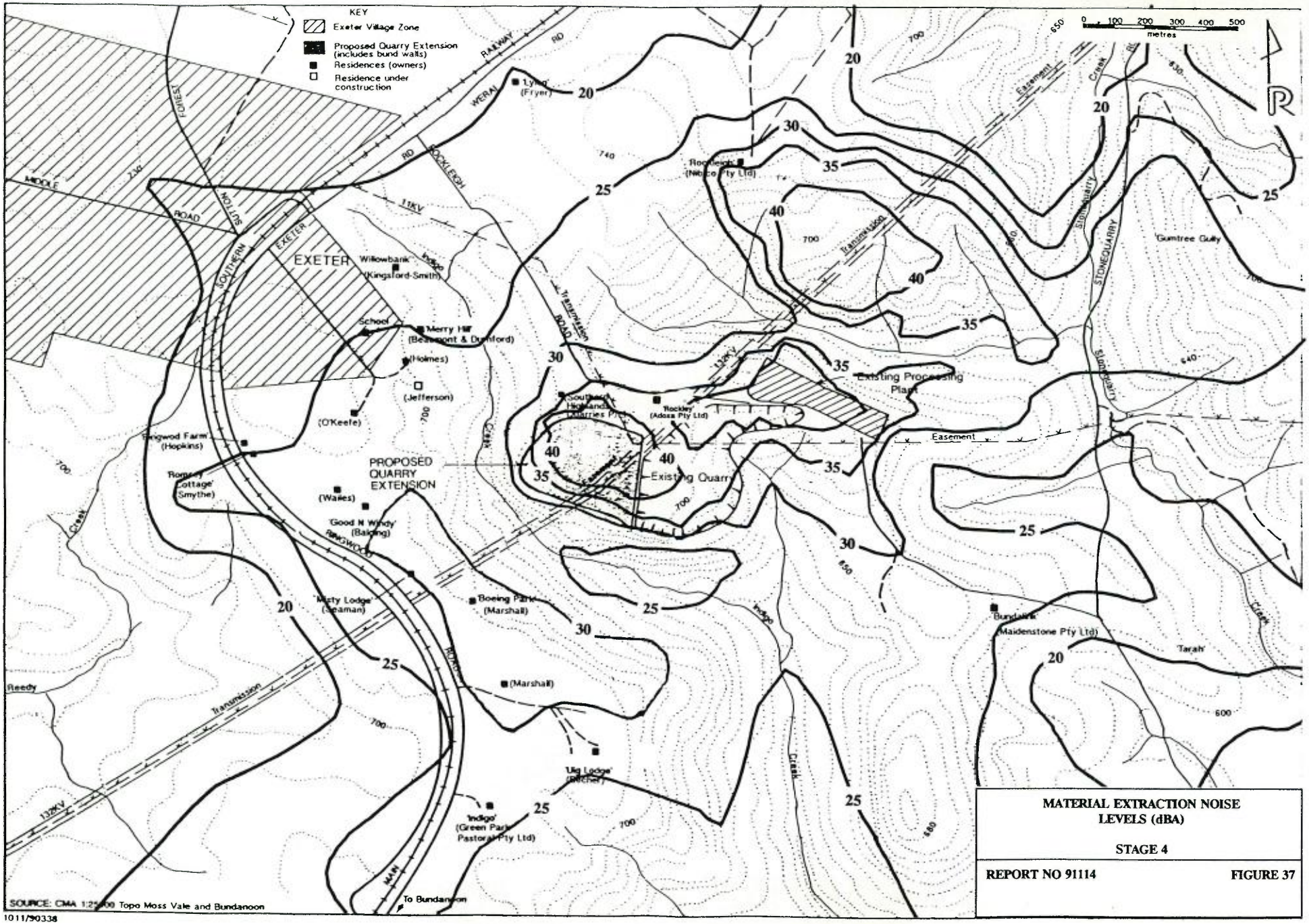
REPORT NO 91114 **FIGURE 35**



MATERIAL EXTRACTION NOISE LEVELS (dBA)

STAGE 1

REPORT NO 91114 **FIGURE 36**

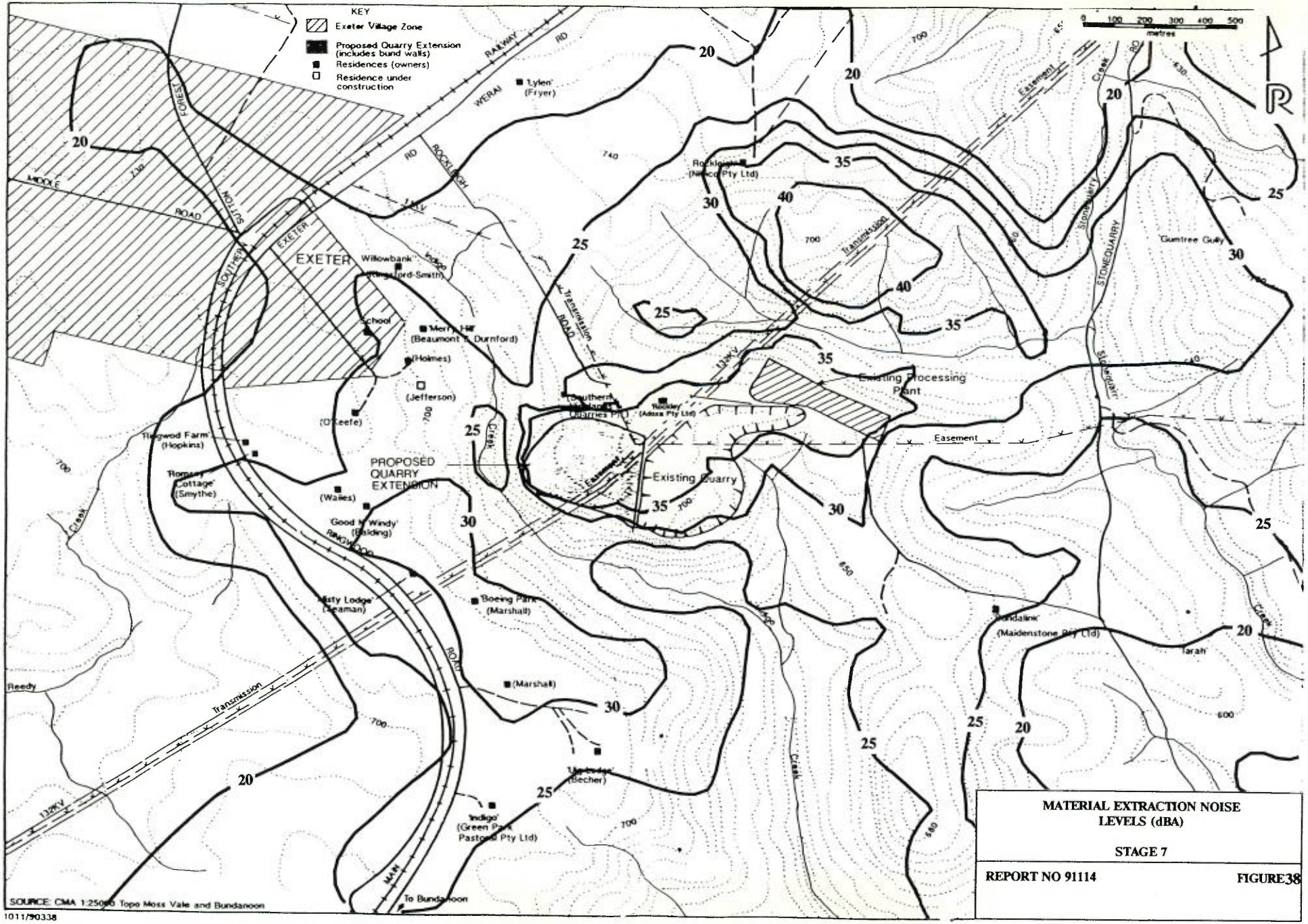


MATERIAL EXTRACTION NOISE LEVELS (dBA)

STAGE 4

REPORT NO 91114 **FIGURE 37**

1011/90338


KEY
Exeter Village Zone
Proposed Quarry Extension (includes bund walls)
Residences (owners)
Residence under construction
0 100 200 300 400 500
metres
EXETER
PROPOSED QUARRY EXTENSION
Existing Quarry
Existing Processing Plant
Easement
Transmission
Willowbank
Merry Hill
(Beaumont & Durnford)
(Holmes)
(Jefferson)
(O'Keefe)
Ringwood Farm
(Hopkins)
Cottage
(Smythe)
(Waites)
(Marshall)
Reedy
To Bundanoon
SOURCE: CMA 1:25000 Topo Moss Vale and Bundanoon
MATERIAL EXTRACTION NOISE LEVELS (dBA)
STAGE 7
REPORT NO 91114
FIGURE 38
1011/90338

Sound Pressure

Sound Pressure Level

μPa

140 dB Threshold of Pain

Jet Engine
(25 m distance)

100000000

130

Jet Take-Off
(100 m distance)

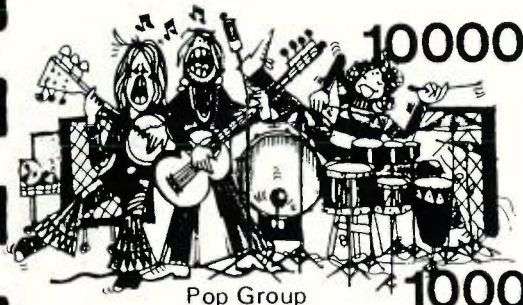
120

10000000

110

Pneumatic Chipper

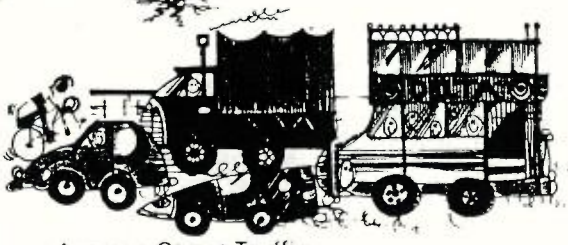
100



Pop Group

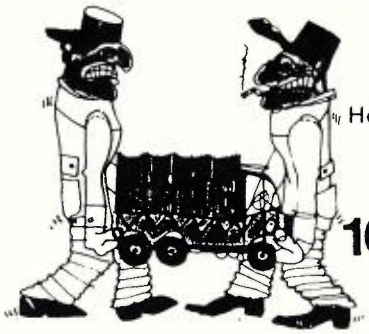
1000000

90



Average Street Traffic

80



Heavy Truck

100000

70

Business Office

60

Conversational
Speech

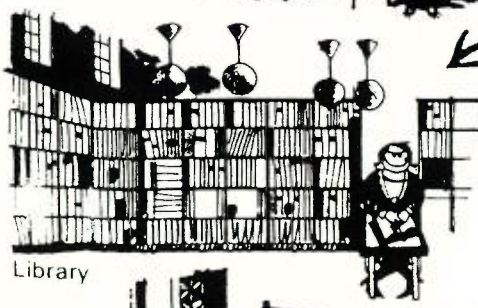
10000

50

Living Room

40

1000



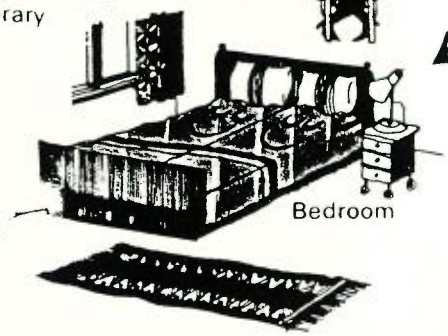
Library

30

Wood

20

100



Bedroom

10

20

0 Threshold of Hearing

Noise

Brüel & Kjær

DK-2850 Nærum · Denmark · Telephone: +45 2800 500 · Telex: 37316 bruka dk · Fax.: 02801405

APPENDIX 5

ARCHAEOLOGICAL SURVEY

Prepared By Matthew Barber, Archaeologist
- Resource Planning Pty Limited

ARCHAEOLOGICAL SURVEY
EXETER

1.0 INTRODUCTION

This report details the results of an archaeological survey that was undertaken as part of an Environmental Impact Statement into a proposed extension to an existing hard rock quarry onto Lot 2, DP 537292. The investigation was carried out by Matthew Barber of Resource Planning Pty Limited on behalf of Southern Highlands Quarries Pty Limited.

This report details the results of the field survey, and includes discussions on the survey methodology and the archaeological context of the area. The report also makes recommendations as to the management of Aboriginal sites.

1.1 STUDY AREA

The proposed quarry extension is approximately 550m east of Exeter Village on the New South Wales Southern Highlands (**Figure 1**). The lease area is bounded by Rockleigh Road on the north and the existing quarry on the eastern side. The southern and western boundaries of the property border Indigo Creek.

Not all of the property is proposed to be quarried. Six hectares of the plateau is the total area to be disturbed by the proposed quarry extension. The existing processing plant will continue to be used and the method of quarrying is excavator and truck.

2.0 LOCAL ENVIRONMENT

The proposed quarry extension is on a plateau 550m east of the Exeter village. The site comprises a basalt plateau which rises to 711m AHD on a knoll in the extension area. The existing quarry operation has been processing westerly with a working face approximately 20m deep.

The hard rock is a Tertiary basalt flow overlying Wianamatta shales of Triassic age. There are blocks of basalt scattered over the surface of the site. Soils of the area are red–brown and quite deep in some areas. Steep slopes on the western and southern sides of the plateau end at the creek. The western end has a terrace above the creek and above this terrace rises a steep slope to the top of the plateau.

The present land use is cattle grazing. The plateau has been cleared of most trees, with those remaining found on the slopes. The area has also been ploughed and a transmission line has been constructed across the area.

The present vegetation consists of improved pasture grasses with some blackberry and thistles and other noxious weeds.

3.0 ARCHAEOLOGICAL BACKGROUND

Although little archaeological work has been carried out in the Exeter region, Rich (1984) summarised some of the relevant information when she conducted the archaeological survey as part of the original Environmental Impact Assessment for the Exeter Quarry. Her summary is used here to put the present study into an archaeological context.

Rich (1984:3) noted that only four sites were known within an 8km radius of the development, one of which was an engraving site, one a set of axe grinding grooves and the remaining two carved trees with burials. Brayshaw found no sites in a survey at the Berrima Colliery, 15km to the northwest (1982).

Rich (1984:3–4) also noted that Koettig's survey for the F5 freeway located 24 sites, thirteen of which were open campsites. They were mainly found in the areas of Wianamatta Shale, while other site types including rock shelters and grinding grooves were located on a different geological unit, Hawkesbury Sandstone.

Koettig observed that the campsites generally occurred in close proximity to watercourses, on flats, elevated areas above creek confluences and on spurs and ridges above the creeks. This general site location prediction was further supported by Rich's own findings at Exeter.

Rich located one isolated find on the wall of a dam on the upper terrace of the hill. The artefact was a quartz blade with retouch on one side. Situated as it was on the dam wall, it was in a disturbed context (1984:5).

Rich also located and recorded an artefact scatter. It was located about 20m east of an unnamed creek close to the junction of Indigo Creek. It was elevated about 10m above the creek. Although it was not possible to find the extent of the site, the exposure in which the site was found was approximately 25m x 30m with a total of six artefacts. The artefacts included flaked pieces and a core of a range of materials such as quartz, silcrete and chert. Two of the flaked pieces and the core displayed evidence of retouch and usewear (1984:6).

In her discussion of the results, Rich suggests that the site she found fits with the general pattern of site locations identified by Koettig for the area. The isolated find may also suggest that the upper terrace was an area where sites could be situated but Rich points out that the area is heavily disturbed and there is little chance of any sites surviving.

4.0 ABORIGINAL CONSULTATION

Prior to the survey being undertaken, the Illawarra Local Aboriginal Land Council, in whose area Exeter lies, were contacted and informed of the project. Discussions were held with the interim secretary Geraldine Brown, and it was decided that in the event that a Land Council member could not attend the site survey, the archaeologist proceed and that the draft report be sent to the Land Council for their consideration.

5.0 SURVEY METHODOLOGY

The proposed quarry extension area had previously been surveyed for Aboriginal sites by Pam Dean-Jones. She surveyed both the plateau and also relocated the site recorded by Rich (1984) which was in a good state of preservation.

The present survey therefore concentrated on the plateau and the terrace on the western end.

The methodology employed was to walk over the area noting visibility restrictions and recording any sites that were found. Trees were checked for scarring and basalt outcrops were also examined for potential quarries.

6.0 SURVEY RESULTS

No evidence of Aboriginal occupation was found in the area surveyed.

In general terms, visibility over the area was 0%, with the thick grass preventing any reasonable view of the ground. The only areas that provided some visibility were stock tracks along fencelines, gateways and occasional disturbed areas.

The area to be quarried was examined, as was the terrace above the creek at the western end of the lease. The survey route is shown on **Figure 2**. Inspections of the dam where Rich (1984) located an isolated find was made but the artefact was not relocated.

7.0 CONCLUSION AND RECOMMENDATIONS

The results of the survey were to be expected considering the lack of material found on previous surveys and the severe visibility restrictions.

It is considered that even if sites were located on the top of the basalt plateau, modern land use practices would have destroyed them or at the very least severely disturbed them.

The terrace at the base of the plateau on the western end may have been a location for campsites but the thick grass cover prevented any from being found. This area will not be disturbed by the quarry operation.

In view of the results of this survey, the relocation of the artefact scatter by Dean–Jones that was originally recorded by Rich (1984) and the disturbed nature of the plateau it is considered that the archaeological record imposes no restrictions on the proposed quarry extension.

It is therefore recommended that:

* There be no objection to the quarry extension on archaeological grounds.

* The site located by Rich continue to be undisturbed.

* If any evidence of Aboriginal occupation is found during the topsoil stripping, work must cease and the National Parks and Wildlife Service notified immediately.

Southern Highlands Quarries Pty Limited are informed that it is illegal to disturb damage or destroy an Aboriginal relic without the permission of the Director the National Parks and Wildlife Service.

8.0 REFERENCES

Brayshaw, H., 1982. Berrima Colliery Archaeological Survey of Proposed Surface Facility Expansion.

Rich, E., 1984. Exeter Quarry Proposed Extension–Archaeological Survey for Aboriginal Sites.

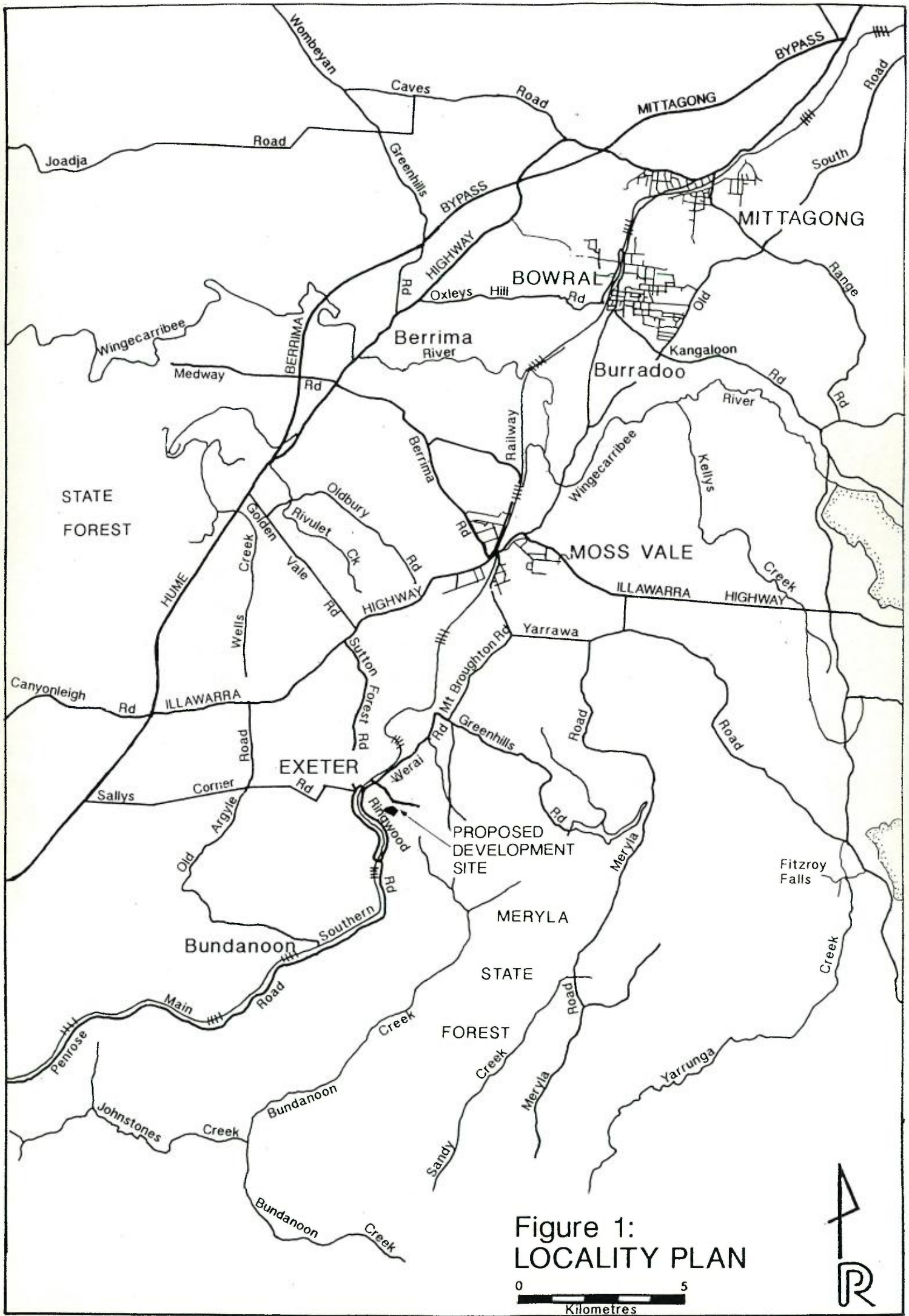


Figure 1: LOCALITY PLAN

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