POSSUM BRUSH QUARRY

ENVIRONMENTAL IMPACT STATEMENT

For:
PACIFIC BLUE METAL PTY LTD
As Trustee for Possum Brush Quarry Unit Trust

September, 97
36045RP5

ERM Mitchell McCotter Pty Ltd. A.C.N. 002 773 248. A member of the Environmental Resources Management Group.

Form 2

Submission of environmental impact statement (EIS)

prepared under the Environmental Planning and Assessment Act 1979 Section 77

EIS prepared by

name	ANTHONY J FISH
qualifications	BACHELOR OF APPLIED SCIENCE (ENVIRONMENTAL PLANNING)
address	6/221 VICTORIA STREET TAREE 2430
in respect of	

development application

applicant name	PACIFIC BLUE METAL PTY LTD as trustee for
applicant address	POSSUM BRUSH QUARRY UNIT TRUST PO BOX 258 PARRAMATTA 2124
land to be developed:address	POSSUM BRUSH QUARRY, POSSUM BRUSH ROAD, POSSUM BRUSH 2312
lot no, DP/MPS, vol/fol etc	LOT 109 DP753195, LOT 3 DP701903, LOT 66 DP608957
proposed development	PARISH OF TALAWAHL TO EXTEND QUARRY OPERATIONS INTO PART OF BLOCK B, TO ALLOW DEEPER EXTRACTION IN BLOCK A DOWN TO 40 METRES, TO ALLOW SECONDARY ROCK BREAKING ON THE RESULTANT NEW QUARRY FLOOR WHEN REQUIRED, TO PROCESS THE RESULTANT MATERIALS THROUGH THE EXISTING PROCESSING PLANT, AND TO TRANSPORT THE PRODUCT FROM THE SITE. or ❑ map(s) attached

environmental impact statement

❑ an environmental impact statement (EIS) is attached

certificate

I certify that I have prepared the contents of this Statement and to the best of my knowledge

- it is in accordance with clauses 51 and 52 of the Environmental Planning and Assessment Regulation 1994, and
- it is true in all material particulars and does not, by its presentation or omission of information, materially mislead.

signature	
name	ANTHONY JOHN FISH
date	12/9/97

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

Approved by:	ANTHONY JOHN FISH
Position:	Project Director
Signed:	
Date:	12/9/97

ERM Mitchell McCotter Quality System

TABLE OF CONTENTS

Page No.

EXECUTIVE SUMMARY

1. INTRODUCTION

1.1	INTRODUCTION	1.1
1.2	THE NEED FOR ADDITIONAL RESOURCE	1.2
1.3	PURPOSE OF THIS EIS	1.2
1.4	OBJECTIVES OF THE PROPOSAL	1.3
1.5	CONSULTATION WITH REGULATORY AUTHORITIES AND THE COMMUNITY	1.4
1.5.1	Consultation with Regulatory Authorities	1.4
1.5.2	Consultation with the Community	1.5
1.6	APPROVALS REQUIRED	1.6

2. THE PROPOSED DEVELOPMENT

2.1	GEOLOGY AND RESOURCE SIGNIFICANCE	2.1
2.1.1	Geological Investigations	2.1
2.1.2	Existing Quarry Reserves	2.2
2.1.3	The Need for Expansion	2.3
2.1.4	Quarry Extension Reserves	2.4
2.1.5	Resource Significance	2.5
2.2	QUARRY DEVELOPMENT	2.8
2.2.1	Site Development	2.8
2.2.2	Layout of Facilities	2.9
2.3	SITE PREPARATION	2.10
2.3.1	Site Drainage of Catchment	2.10
2.3.2	Clearing of Existing Vegetation	2.10
2.3.3	Removal and Stockpiling of Overburden	2.11
2.3.4	Hardstand Areas for Processing and Stockpiling of Quarry Products	2.11
2.4	QUARRY PLAN	2.12
2.4.1	Sequence of Extraction	2.12
2.4.2	Completion of Quarrying	2.14
2.5	QUARRY OPERATION	2.15
2.5.1	Method of Extraction	2.15
2.5.2	Loading and Haulage of Blasted Rock	2.19
2.5.3	Raw Materials Processing and Product Stockpiling	2.19
2.5.4	Plant and Equipment	2.20

TABLE OF CONTENTS

		Page No.
2.6	SITE FACILITIES, WORKFORCE AND OPERATING HOURS	2.21
2.6.1	Site Facilities	2.21
2.6.2	Workforce	2.21
2.6.3	Operating Hours	2.21
2.6.4	Waste Management	2.22
2.6.5	Services	2.22
2.7	TRANSPORT OF END PRODUCT	2.23
2.8	WATER MANAGEMENT	2.23
2.8.1	Water Management Controls	2.23
2.8.2	Erosion and Sediment Controls	2.24
2.9	LANDSCAPING AND REHABILITATION	2.28
2.9.2	Topsoil Management	2.30
2.9.3	Revegetation	2.30
2.9.4	End Landuse	2.31
3.	PLANNING CONTEXT	
3.1	STATE PLANNING	3.1
3.1.1	State Environmental Planning Policies	3.1
3.2	REGIONAL PLANNING	3.3
3.2.1	Hunter Regional Environmental Plan No. 1, 1989 (HREP)	3.3
3.2.2	Hunter Coastal Urban Settlement Strategy (HCUSS)	3.3
3.3	LOCAL PLANNING	3.4
3.3.1	Greater Taree Local Environmental Plan 1995	3.4
3.3.2	Greater Taree Development Control Plan 1995	3.4
3.3.3	Other Guidelines and Policies	3.5
4.	ENVIRONMENTAL PERFORMANCE OF EXISTING OPERATIONS	
4.1	EXISTING ENVIRONMENTAL PERFORMANCE	4.1
4.2	WATER QUALITY	4.1
4.3	LANDSCAPING AND REHABILITATION	4.2
4.4	AIR QUALITY	4.3
4.5	NOISE AND BLASTING	4.4
4.5.1	Quarry Noise	4.4
4.5.2	Blasting	4.7
4.6	VISUAL	4.9
4.7	TRANSPORT AND TRAFFIC	4.9

TABLE OF CONTENTS

Page No.

5. INTERACTIONS WITH THE PHYSICAL ENVIRONMENT

5.1 CLIMATE 5.1
5.1.1 Rainfall and Evaporation 5.1
5.1.2 Temperature 5.2
5.2 SOILS, LANDFORM AND EROSION 5.3
5.2.1 Topography and Landform 5.3
5.2.2 Soils 5.4
5.2.3 Contamination Potential 5.4
5.3 SURFACE AND GROUNDWATER 5.5
5.3.1 Surface Waters 5.5
5.3.2 Groundwater 5.5
5.3.3 Impacts and Mitigation 5.6
5.4 AIR QUALITY 5.7
5.4.1 Existing Air Quality 5.7
5.4.2 Emissions During Quarry Operations 5.7
5.4.3 Impacts and Mitigation 5.7
5.5 BUSHFIRE 5.8
5.5.1 Methodology 5.8
5.5.2 Risk Assessment 5.9
5.5.3 Bushfire Hazard and Mitigation Measures 5.10

6. INTERACTIONS WITH THE BIOLOGICAL ENVIRONMENT

6.1 EIGHT PART TEST 6.1
6.2 FLORA 6.2
6.2.1 Methodology 6.2
6.2.2 Vegetation Classification and Description 6.2
6.2.3 Likelihood of Rare or Threatened Plant Species 6.4
6.2.4 Assessment of Conservation Value 6.4
6.2.5 Impacts and Mitigation 6.7
6.3 FAUNA 6.7
6.3.1 Preliminary Studies 6.7
6.3.2 Fauna Survey 6.8
6.3.3 Likelihood of Threatened Species 6.10
6.3.4 Potential Impacts 6.11
6.3.5 Mitigation Measures 6.13

TABLE OF CONTENTS

Page No.

6.4 SEPP 44 - KOALA HABITAT PROTECTION 6.14
6.5 SEPP 46 - PROTECTION AND MANAGEMENT OF NATIVE VEGETATION 6.15

7. INTERACTIONS WITH THE HUMAN ENVIRONMENT

7.1 NOISE AND BLASTING 7.1
7.1.1 Noise Criteria For Proposed Quarry Extension 7.1
7.1.2 Blasting Criteria 7.5
7.1.3 Operational Noise Assessment Of Proposed Quarry Extension 7.6
7.1.4 Blasting Assessment 7.8
7.1.5 Haul Route Noise 7.10
7.2 VISUAL IMPACTS 7.10
7.2.1 Visual Assessment 7.10
7.2.2 Mitigation Measures 7.11
7.3 LANDUSE 7.11
7.4 SOCIO-ECONOMIC ISSUES 7.12
7.4.1 Population 7.12
7.4.2 Employment 7.14
7.5 HERITAGE AND CULTURAL ISSUES 7.14
7.5.1 Background 7.14
7.5.2 Previous Survey 7.15
7.5.3 Conclusions 7.15
7.6 TRAFFIC AND TRANSPORT 7.16

8. ENVIRONMENTAL PROTECTION AND MITIGATION MEASURES

8.1 SUMMARY OF MITIGATION MEASURES 8.1
8.1.1 The Physical Environment 8.1
8.1.2 The Biological Environment 8.2
8.1.3 The Human Environment 8.3
8.2 ENVIRONMENTAL MANAGEMENT AND SITE REHABILITATION PLAN 8.4

9. PROJECT JUSTIFICATION

9.1 ALTERNATIVES TO THE PROPOSAL 9.1
9.2 CONSEQUENCES OF NOT PROCEEDING 9.1
9.3 CUMULATIVE IMPACTS 9.2
9.4 PROJECT JUSTIFICATION 9.2

TABLE OF CONTENTS

Page No.

9.4.1	Biophysical Considerations	9.2
9.4.2	Economic Considerations	9.2
9.4.3	Social Considerations	9.3
9.4.4	Principles of Ecologically Sustainable Development	9.3

REFERENCES

APPENDICES

A. DIRECTOR GENERAL'S REQUIREMENTS

B. GOVERNMENT AUTHORITY RESPONSES

C. MINUTES OF COMMUNITY CONSULTATION MEETING

D. DEPOSIT GEOLOGY, QUARRY DESIGN AND RESERVES

E. EIGHT PART TEST

F. TRAFFIC AND TRANSPORT ASSESSMENT

LIST OF TABLES

		Page No.
Table 1.1	DIRECTOR-GENERAL'S ADDITIONAL REQUIREMENTS	1.4
Table 2.1	QUARRY EXTENSION RESERVES	2.4
Table 2.2	REGIONAL QUARRY PRODUCTION ANALYSIS	2.5
Table 2.3	BLAST SIZE, SCHEDULE AND FREQUENCY	2.16
Table 2.4	DESIGN CHARACTERISTICS OF SEDIMENTATION PONDS	2.27
Table 4.1	MEASURED BLAST VIBRATION (MILLIMETRES PER SECOND) AND OVERPRESSURE (dB(LIN))	4.7
Table 6.1	VEGETATION CONSERVATION VALUES	6.6
Table 6.2	FAUNA SURVEYS	6.8
Table 6.3	SPECIES OCCURRING OR POSSIBLY OCCURRING	6.10
Table 7.1	TABLE 20-1 OF ENCM	7.2
Table 7.2	SUMMARY OF LOGGED NOISE LEVELS	7.4
Table 7.3	DERIVED QUARRY OPERATION NOISE LEVEL LIMITS	7.5
Table 7.4	SOUND POWER LEVELS	7.7
Table 7.5	PREDICTED L_{10} NOISE LEVELS, dB(A), BLOCK B NORTH STAGE INITIAL OPERATIONS	7.7
Table 7.6	PREDICTED L_{10} NOISE LEVELS, dB(A), BLOCK B NORTH STAGE PIT FLOOR TO RL 120	7.8
Table 7.7	PREDICTED L_{10} NOISE LEVELS, dB(A), BLOCK B SOUTH STAGE INITIAL OPERATIONS	7.8

LIST OF TABLES

		Page No.
Table 7.8	PREDICTED L_{10} NOISE LEVELS, dB(A), BLOCK A AND B AFTER 20 YEARS, PIT FLOOR RL 80	7.8
Table 7.9	CALCULATED BLAST OVERPRESSURE AND VIBRATION	7.10
Table 7.10	POPULATION PROJECTIONS FOR THE COASTAL AREA	7.13

LIST OF FIGURES

		Follows Page No.
Figure 1.1	LOCATION OF STUDY AREA	1.2
Figure 2.1	EXISTING QUARRY OPERATION	2.9
Figure 2.2	OPTIMUM QUARRY DESIGN	2.13
Figure 5.1	ANNUAL RAINFALL DISTRIBUTION	5.1
Figure 5.2	MEAN DAILY TEMPERATURE	5.2
Figure 6.1	VEGETATION COMMUNITIES	6.2
Figure 6.2	FAUNA HABITATS	6.9
Figure 7.1	NOISE MONITORING LOCATIONS	7.3

EXECUTIVE SUMMARY

On 23 May 1986, Greater Taree Council granted development consent for the establishment of a hard rock quarry and crushing plant on Portion 109 and Lot 3 DP 701903 and Lot 66 DP 608957, Possum Brush. The development application proposed to extract material from the quarry in three stages referred to as Area A, Area B and Area C. The quarry was approved initially for only Area A and has since operated to provide material to markets on the mid North Coast of NSW.

This Environmental Impact Statement has been prepared to accompany a development application to Greater Taree City Council to extend quarry operations into part of Block B, to allow deeper extraction in Block A down to 40 metres AHD, to allow secondary rock breaking on the resultant new quarry pit floor when required, to process the resultant materials through the existing processing plant, and to transport the product from the site. Extension into Block B will not result in any change to operating procedures or outputs of the existing operation.

The extraction of material from Block B, which is located to the west of Block A, is necessary to enable Pacific Blue Metal Quarries Pty Ltd to provide high grade road materials to markets extending from Raymond Terrace to Johns River while at the same time minimising environmental impacts resulting from quarry operations and addressing the concerns of local residents.

Quarrying in the new area will occur between 6.00 am and 6.00 pm Monday to Friday and 6.00 am to 1.00 pm Saturdays. Whenever possible blasting will be restricted to between 9.00 am and 3.00 pm Monday to Friday and 9.00 am to 1.00 pm Saturday. Ancillary operations such as refuelling, servicing and maintaining plant and maintenance of the access road may be undertaken at any time. In order to supply specific contracts, operations outside normal hours may be required from time to time. In such circumstances agreement in writing from Council will be obtained prior to proceeding with such operations.

The Operation of the quarry will have the potential to impact on the surrounding environment. Careful management and control of the quarry operations will allow the development to operate with acceptable levels of impact. The potential impacts of the quarry extension and proposed mitigation measures are summarised below.

i. Surface and Groundwater

Water quality in downstream watercourses will be maintained by runoff from disturbed areas being directed to existing sedimentation ponds.

There will be no significant effects on regional groundwater as a result of the extended quarry operations.

ii. Air Quality

Dust generation and air quality are not expected to significantly change from the current levels. Emission of dust will be controlled by use of a water cart during dry periods, fitting industrial exhaust extraction and control systems to rock drills, avoiding drilling and blasting during high winds and prompt vegetation of exposed areas, bunds and stockpiles.

iii. Bushfire Protection

The dams located on the property will provide a source of water to fight bushfire and dust suppression watering systems would aid in controling the spread of any fire originating from quarry work areas.

iv. Flora and Fauna

Comprehensive details of proposed mitigation measures necessary to reduce the impact of the proposed development upon flora and fauna are outlined in the Species Impact Statement (SIS) accompanying the EIS. Such measures include progressive revegetation, imposition of speed limits, timed clearing, habitat enhancement and annual monitoring of procedures and techniques.

v. Noise and Blasting

Noise levels were assessed at three local residences. The quarry extension can operate within the specified noise and blasting criteria and no specific mitigation measures are required to reduce noise and overpressure levels.

vi. Visual Impact

Visual impacts will be mitigated by the retention of the northern face of the small knoll located along the northern boundary of Block B, the retention of dense vegetation between the boundary of Block B and the northern boundary of Portion 109 and the vegetation of the benches in Block B along the northern edge of the access road.

vii. Traffic and Transport

Road safety on Possum Brush Road will be improved by maintenance of design sight distances at the entrance of the quarry property and the provision of material to Council for ongoing maintenance of Possum Brush Road. Residents concerns with traffic and transport issues will be addressed by providing material to GTCC for the construction of a school bus stop and set down area, construction of an arrestor bed at the bottom of the access road and continual advice to contractors to comply with traffic safety requirements.

Only a limited number of other quarries in the region are able to produce high quality premium grade aggregates to meet current RTA specifications. Collectively they will be unable to supply the quantities of demand expected to be required by the Pacific Highway upgrading and local market demands.

The demand for high quality material will exceed supply at least in the short to medium term. Quality assured products are essential for high quality construction of the Pacific Highway and if they are not available locally, they must be imported using costly road transportation.

An alternative to the proposal would be to continue the extraction sequence in accordance with the existing development consent. This approach would not allow the quarry to supply the high quality material required for Pacific Highway upgrading in the short term.

The consequences of the extension of Possum Brush quarry not proceeding will be a potential short to medium term shortage of premium aggregate material for use as quality assured aggregates and road pavement material for upgrading the Pacific Highway within the region between Johns River and Bulahdelah.

The existing development consent contains numerous conditions to ensure the impacts of operations are kept to acceptable levels. This extended proposal has taken into account the impacts anticipated and mitigation measures in place for Block A, together with anticipated impacts of the proposed extension. The results of this environmental impact assessment has determined that provided the nominated mitigation measures are implemented the impacts of deepening Block A and extending into Block B will meet all relevant environmental criteria.

Chapter 1

INTRODUCTION

1.1 INTRODUCTION

On 23 May 1986, Greater Taree City Council granted development consent for the establishment of a hard rock quarry and crushing plant on Portion 109 and Lot 3 DP 701903 and Lot 66 DP 608957, Parish of Talawahl. The development application proposed to extract material from the quarry in three stages referred to as Area A, Area B and Area C.

On 10 June 1986 two objectors appealed to the Land and Environment Court, against the decision of Council, pursuant to the provisions of Section 98 of the Environmental Planning and Assessment Act 1979.

On 2 December 1986 a new development application was lodged with Council (DA 431/86) which modified the sequence of extraction of the original proposal. On 25 March 1987 Council granted development consent to this new application subject to numerous conditions of consent. On 7 April 1987 another appeal was made to the Land and Environment Court against Council's decision.

After extensive consideration of the evidence, the Court granted development consent subject to numerous conditions, including limitation of extraction to Area A only. The owners of the quarry at the time of approval subsequently decided to sell their majority shares in the venture.

Since taking over the quarry operations, the current management of Possum Brush quarry have successfully implemented a responsible and consultative approach to quarry operations. Despite initial 'teething' problems, effective management over the last five years has resulted in no known outstanding matters of concern from any statutory authority.

In accordance with the current development consent which permitted the extraction, processing and transportation of 6.4 million tonnes of material from Area A over a period of 32 years, the quarry's subsequent operation has involved the annual extraction of up to 200,000 tonnes of hard rock. Operations have included blasting, processing and transportation of material to markets extending from Raymond Terrace in the south to Telegraph Point in the north.

To maintain consistency with Geological reports and to avoid confusion over terminology, in the remainder of this EIS the three separate sections of the quarry which were defined as Areas A, B and C respectively in the 1986 Development Application are referred to as Block A, Block B and Block C.

1.2 THE NEED FOR ADDITIONAL RESOURCE

The Commonwealth and NSW State Governments recently launched the largest peacetime civil construction project in Australia's history since the building of the Snowy Mountains hydro-electric scheme, with the announcement that $2.2 billion would be made available for major upgrading of the Pacific Highway. The project has now commenced, creating an urgent need for the supply of large volumes of high quality road building materials. Pacific Blue Metal Quarries Pty Ltd has been asked to supply quarry materials for the project.

The upgrading will involve the rebuilding of the 700 km of the Pacific Highway in New South Wales and will include:

- the construction of a four lane freeway along a new 22km section of highway between Bulahdelah and Coolongolook, costing $193 million; and
- the extension of the four lane freeway to Possum Brush.

Consequently, major supplies of road construction material will be required to undertake such roadworks.

The Roads and Traffic Authority (RTA) has particular specifications for road material to be used on major upgrading of roads such as the Pacific Highway. The material currently being extracted from Block A of the quarry is not meeting these requirements. Consequently, Pacific Blue Metal Quarries Pty Ltd is seeking to extract material from a 7 hectare section of that part of the quarry known as Block B and to deepen extraction in Block A. This material will meet the RTA's specifications and contribute to satisfying the demand for road materials that will occur as a result of the Pacific Highway upgrading.

The study areas and Blocks A and B are shown in *Figure 1.1.*

The extraction of material from Block B is necessary to enable Pacific Blue Metal Quarries Pty Ltd to provide high grade road materials to markets extending from Raymond Terrace to Johns River while at the same time minimising environmental impacts resulting from quarry operations and addressing the concerns of local residents.

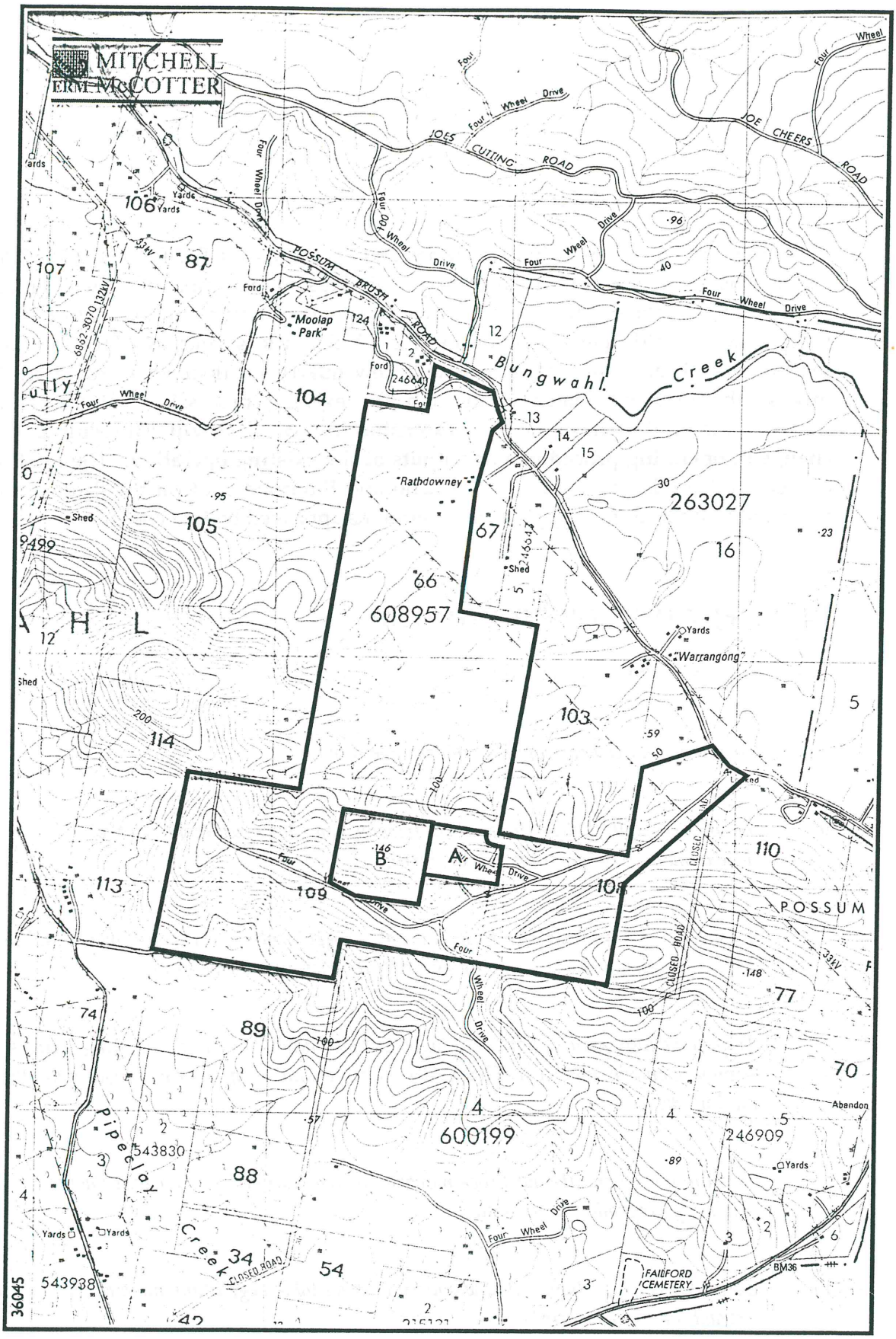

Figure 1.1 LOCATION OF STUDY AREA

N

0 1km

metres

1.3 PURPOSE OF THIS EIS

This Environmental Impact Statement has been prepared for Pacific Blue Metal Pty Ltd as trustee for Possum Brush Quarry Unit Trust to accompany a development application to Greater Taree City Council to extend quarry operations into part of Block B, to allow deeper extraction in Block A down to 40 metres AHD, to allow secondary rock breaking on the resultant new quarry pit floor when required, to process the resultant materials through the existing processing plant, and to transport the product from the site. **Extension into Block B will not result in any change to operating procedures or outputs of the existing operation.** The existing consent and conditions issued by the Land and Environment Court will remain in force and will continue to apply to all operations approved by that consent.

1.4 OBJECTIVES OF THE PROPOSAL

The objectives of the proposal are:

i. *To extend an existing approved quarry operation;*

ii. *To conform with the requirements of relevant statutory authorities in the development and operation of the quarry;*

iii. *To supply high quality hard rock material to meet local market requirements and to secure additional markets outside the local district for this material;*

iv. *To provide high quality hard rock material as an alternative to the existing sources of supply to enable more cost efficient development and maintenance of roads and other civil works;*

v. *To supply high quality hard rock material for the Nationally important Pacific Highway Upgrade project; and*

vi. *To progressively rehabilitate the quarry with suitable vegetation and tree planting as extraction areas are worked out.*

1.5 CONSULTATION WITH REGULATORY AUTHORITIES AND THE COMMUNITY

1.5.1 *Consultation with Regulatory Authorities*

The Director-General of the Department of Urban Affairs and Planning advised of requirements for the preparation of an EIS for the proposed hard rock quarry on 14 June 1996. A copy of the Director-General's requirements is given in *Appendix A*.

Those requirements specify that the EIS is to conform with Clauses 50 and 51 of the Environmental Planning and Assessment Regulation 1994, together with a number of additional matters.

Table 1.1 outlines the additional matters specified by the Director-General and identifies where these particular issues are discussed in the EIS.

Table 1.1 Director-General's Additional Requirements

Requirements	Page No.
Environmental performance of existing operations.	4.1
Likely cumulative impact of the extended operation.	9.2
Potential for surface and groundwater contamination and proposed mitigation measures.	2.24
Flora and fauna impacts and an assessment of the need for a species impact statement to be prepared.	6.1
Applicability of Statement Environmental Planning Policy No. 46 - Protection and Management of Native Vegetation.	6.14
Erosion and sediment controls.	2.25
Noise and dust generation and proposed mitigation measures.	7.1
Potential impacts of increased traffic generation.	7.16
Community consultation.	1.5

During preparation of the EIS various statutory authorities with responsibilities for land use or environmental matters were consulted about the project. Representatives from a number of these authorities have inspected the study area in the course of these consultations. The organisations contacted were:

- Department of Land and Water Conservation;
- Roads and Traffic Authority;

- NSW Fisheries;
- NSW Agriculture;
- Department of Mineral Resources;
- National Parks and Wildlife Service;
- Department of Public Works and Services;
- Environment Protection Authority; and
- Greater Taree City Council.

Responses received from the above authorities are given in *Appendix B*.

1.5.2 *Consultation with the Community*

A community consultation meeting was convened by Pacific Blue Metal Pty Ltd on 11 July 1996 at Greater Taree City Council chambers, in accordance with commitments previously given to local residents that they would be consulted in respect to any proposed changes to quarry operations. The purpose of the meeting was to advise interested people of the proposed expansion of quarrying activities into Block B and to seek comments on issues to be addressed in the EIS.

Thirty local residents and other interested people, two Greater Taree City Council representatives, five representatives of Pacific Blue Metal Quarries Pty Ltd and project consultants attended the community consultation meeting. Minutes of the meeting are given at *Appendix C*. The main issues raised and discussed at the meeting included:

- an open invitation for site visits by interested persons (for safety reasons by arrangement with the quarry manager);
- availability of Block A material;
- traffic volumes in the locality;
- water quality/dam siltation;
- extraction operation sequence;
- material crushing hours;
- quarry starting times;

- provision of bund wall required by the Land and Environment Court;
- economic viability;
- truck safety and truck routes;
- residents' trust in the quarry management;
- visual impact;
- rehabilitation planning;
- noise from blasting, crushing and the quarry telephone;
- quality assurance program for quarry operations;
- crushing noise monitoring;
- establishment of formal review process with resident representation; and
- upgrading of Possum Brush Road.

1.6 APPROVALS REQUIRED

The development is permissible with the consent of Greater Taree City Council. It is also a *designated development* as defined in Schedule 3 of the Environmental Planning and Assessment Regulation 1980. Consequently, an EIS must accompany the development application.

This EIS has been prepared in accordance with Clauses 50 and 51 of the Environmental Planning and Assessment Regulation 1980 and the Director General's requirements.

Additional environmental approvals may be needed under other legislation, including:

- the quarry extension would be scheduled premises under the Noise Control Act, 1975. Its operation must be licensed by the Environment Protection Authority;
- licences and approvals for the construction and operation of any additional pollution control structures, including sedimentation dams will be required under the Clean Air Act and Clean Waters Act. The Environment Protection

Authority must issue relevant licences and approvals before operations may commence;

- building approvals will be required under the Local Government Act, 1993 for the construction of any structures; and
- a licence will be required to store fuel oil under the Dangerous Goods Act, 1975.

All necessary licences and approvals have been obtained for the current operation under the existing development consent.

Chapter 2

THE PROPOSED DEVELOPMENT

2.1 GEOLOGY AND RESOURCE SIGNIFICANCE

2.1.1 *Geological Investigations*

The geological and mining character of the deposit were investigated in the early 1980's by Geological and Resource Development Consultants KR Steggles and Associates Pty Ltd and reported to the then owners Wyan Holdings Pty Ltd in a report dated 18 January 1985 and titled *Nabiac Blue Metal Deposit - Exploration 1984* (KR Steggles and Associates 1985). Mr Kerry Steggles has been retained by the current owners to provide geological, mining, processing, and product technical services.

More than 1,000,000 tonnes of various products have been produced from the deposit to date, all from the section of the deposit defined as Block A. The total deposit has been defined in three adjoining blocks, Areas A, B, and C, running from east to west (resp. 7.5 ha, 15.4 ha and 6.4 ha). The Development Consent granted in the 1980's nominated Block A as the initial area to be quarried and directed that it be developed from the highest southern part of the block.

The geology and quarry plan for the proposed extension at Possum Brush Quarry are detailed in the latest report by Kerry Steggles titled *Deposit Geology, Quarry Design and Reserves - Re Extension of Their Quarry at Possum Brush Near Nabiac NSW* (Kerry R Steggles 1997) *and addendum report to February 1997 report on Deposit Geology, Quarry Design and Reserves (Kerry R Steggles 1997a)* which are provided as *Appendix D*.

The report defines the deposit as having a sequence of metamorphosed fine to conglomeratic greywacke with pyroclastic characteristics, and containing interbedded chert and fine quartzite, divided into lithological units A to I. These Units have a total thickness of approximately 500m. They are stratified Palaeozoic rocks, probably Devonian Age, of the Tamworth Belt in the New England Geosyncline. Quarrying has confirmed the exploration interpretation of the structure as being a sequence dipping at about 45^0 average to the south east, with a strike ranging from 35^0 to 70^0.

Division of the sequence into Units was based on lithological continuity of either coarse or fine rock assemblages using a number coding system to denote coarseness, 1 being the coarsest and 4 being the finest. Unweathered coarse assemblage rock provides the better quality rock for most applications. Unit A is the basal unit and is the oldest, Unit I is the uppermost and is the youngest. Weathered rock depth is very variable (0 to >20m) with most being the higher parts of the deposit. Units B, D, F, and H are coarse assemblage units, with the thickest being Unit B at 105m true thickness.

Unit B provides the best rock for consistency of hardness, durability, strength, crushed shape and inertness, these properties being reflected in the development of only a thin cover of weathered rock. In Block A it only outcrops across the north western section which has the lowest part of the deposit (85m AHD) and carries the main drainage gully. In the westerly adjoining Block B it is the major outcropping Unit. Exploration data indicate that finer lithology bands develop in Unit B in the western part of Block B.

2.1.2 *Existing Quarry Reserves*

KR Steggles and Associates (1984) estimated reserves in Block A as 6.4 million tonnes of weathered plus unweathered (fresh) rock if completely extracted to a remnant benching pattern of 5m benches and 10m faces at 75^0 down to 85m AHD. To date approximately 1.3 million tonnes have been extracted with weathered rock accounting for 70 percent of the excavated material. This high percentage is primarily due to higher ratios of weathered to unweathered rock encountered on the upper benches. It is predicted that material extracted from future benches will encounter a significantly reduced ratio of weathered to unweathered rock with weathered rock accounting for approximately 12 percent of the resource.

The development consent granted in 1987 by the Land and Environment Court directed that a revised extraction sequence (from that proposed in the original development application) be implemented such that Block A was to be quarried from the highest southern part of the block. The implications of this revised extraction sequence were:

- higher than expected ratios of weathered to unweathered rock encountered in the early stages of quarry development;
- access difficulties in respect to the reserves of higher quality Unit B material generally located below 100m AHD east of the main gully through Block A;

- placing of major water and silt dams higher in the main gully in Block A impeded access and development of benches below 120m AHD and around them west of the gully; and

- previous quarry management used part of Block A as a fill site for excess weathered material which impedes the development of benches below 120m AHD west of the gully.

The only Unit B resource available in the near future within Block A is generally restricted to a narrow area west of the drainage gully. Access to this area is restricted from the east by the location of the dam and fill material in the gully and from the west by the development consent restricting extraction to Block A only. Kerry R Steggles (1997) indicates that it is not economical to relocate the dam and fill material within the confines of Block A and the existing development consent to enable access the Unit B material from the east. Kerry R Steggles (1997) estimates that this would result in a reduction of available reserves in Block A to about 3 million tonnes. At the maximum allowable production rate of 200,000 tonnes per annum this would give the existing quarry a life of about 15 years.

2.1.3 *The Need for Expansion*

The need for the expansion of the quarry is discussed in Kerry R Steggles (1997) and is reproduced below.

The available market to date for this quarry's products has been heavily biased towards road base type products with such products being more than 90% of output. This has been fortunate as it has allowed the use of a high percentage of the weathered rock encountered. With the quarry now extensively developed, the ratio of weathered rock to unweathered rock has reduced. However, major technical changes have occurred over the past 10 years and stronger, more durable, lower porosity, more consistent rock is now required, in particular for aggregates. Some 50,000 tonnes of aggregate have been produced to date, most to these more exacting specifications, and almost all from Unit B rock. An example is the QA Specification RTA 3151 Edition 3 issued by the RTA.

Market requirements are currently moving markedly towards very high specification aggregates and current projections are that output in the immediate future will move from the previous 90:10 to 50:50 (road base to aggregates). Specific applications for such aggregates are asphaltic concrete, skid resistant cover aggregates, concrete pavements for expressway construction, and concrete plants. Production has established the suitable character of Unit B rock for these applications whereas rock from the other Units has not met all the requirements.

As discussed in Section 2.1.2 above, access to Unit B material remaining in Block A is restricted primarily due to the consequences of the extraction sequence required under the existing development consent and previous management decisions made in relation to complying with the development consent.

To meet the more exacting product specifications it is necessary to extend the quarry into Block B, both for its reserves of Unit B and for accessing the reserves of Unit B in the adjoining Block A west of the drainage gully. Also, expansion of the quarry area allows the accessing of reserves below the four hectare floor of Block A at 85m AHD. The self draining 85m AHD floor level was the functional limit when the quarry had to be developed only on the 7.5 hectares of Block A.

The requirement to extend the quarry in order to access Unit B material has received added urgency due to the massive scale of Highway construction that is occurring now and planned to continue for some years. Quarry management advises that inquiries for very large quantities of aggregates have arisen in recent months. The major reason is a change in pavement design characteristics for the planned reconstruction and upgrading of the Pacific Highway.

2.1.4 *Quarry Extension Reserves*

The proposed extension to the existing quarry includes lowering the final floor level for Block A from the current development consent level of 85m AHD to 40m AHD and the expansion of the quarry westwards into Block B. Tables 6, 7 and 8 in Kerry R Steggles (1997) provide estimated reserves of material available for extraction from each of the new bench levels in Block A and Block B. A summary of the estimated reserves to be extracted by the quarry extension is given in *Table 2.1*.

Table 2.1 Quarry Extension Reserves

Area	Weathered Rock (million tonnes)	Unit B Fresh Rock (million tonnes)	Other Fresh Rock (million tonnes)	Total (million tonnes)
Block A Extension	0	2.9	1.3	4.2
Block B	0.7	6.3	5.7	12.0
Total	0.7	9.2	7.0	16.2

The estimated total reserve in of the quarry extension is 16.2 million tonnes with weathered at 4 percent and unweathered at 96 percent. Total reserves of Unit B material are estimated at 9.2 million tonnes or 57 percent of the total reserve. With the remaining reserves of 5.1 million tonnes in Block A, the total reserve available

becomes 21.3 million tonnes. If production averaged 200,000 tonnes per annum, this would yield a quarry life of about 100 years.

2.1.5 *Resource Significance*

The quarry industry is market driven. The two major purchasing considerations for consumers of quarry products are the quality of material and price at the point of delivery. Delivery costs of providing quarry material contribute significantly to the overall cost of the product. Consequently, it is necessary to consider the existing and potential sources of quarry products that are within a distance of Possum Brush quarry where delivery costs do not make the sourcing of material uncompetitive. Generally it is accepted that only quarries within the coastal strip extending from Bulahdelah to the south and Johns River to the north will compete economically with Possum Brush quarry for the supply of material for major upgrading of the Pacific Highway.

Existing sources of supply considered within this report comprise all of the substantial producers of crushed and screened hard rock and river gravel, within the coastal strip described above, that have the potential to supply aggregate material for roadworks projects.

Quarries located within the subject area are listed along with production statistics within *Table* 2.2. The production figures listed are for all major regional quarries, in this area, who have approved quarry operations. *Table* 2.2 does not include any detail of production from public sector quarries operated by Councils, the RTA and State Forests.

Table 2.2 REGIONAL QUARRY PRODUCTION ANALYSIS

	Quarry	Location	Rock Type	Estimated Reserves	Production
1	Midcoast Earthmoving	Tinonee	Shale	NA	25,000 cu.m.a
2	Jandra	Possum Brush	Greywacke & Metasediments	NA	150,000 tpa
3	Pacific Blue	Possum Brush	Greywacke & Metasediments	6.4 mt (1988)	200,000 tpa
4	Campbells	Failford	Greywacke Tuffs &	660,000m³	50,000 cu.m.a

Table 2.2 REGIONAL QUARRY PRODUCTION ANALYSIS

	Quarry	Location	Rock Type	Estimated Reserves	Production
			Metasediments	(1992)	
5	CSR Readymix	Taree	River Gravel	1.5 mt	58,000 tpa
6	Wrights (Wingham)	Charity Creek	River Gravel	0.4 mt	20,000cu.m.a
7	Boral	Johns River	Quartz Microdiorite/Monzodiorite	NA	130,000 tpa
8	Scadden's	Moorland	Shale	NA	14,772 cu.m

Notes: *1. Production figures are the maximum allowable per year under existing development consent or registration under SEPP 37.*

2. NA = not available

Comment on quarries located within the identified coastal strip north is as follows:

i. Johns River Quarry

The EIS for the new Johns River quarry nominates "quarriable" reserves of quartz microdiorite/monzodiorite as approximately 3.3 million tonnes. The document nominates probable case production and sales of 70,000 to 130,000 tpa indicating a reserve life of more than 25 years. The same document however allows for the turnaround of up to 60 trucks (say 1,500 tonnes) per day which on a year round basis will result in production of up to 350,000 tpa and a reserve life of less than 10 years.

The resource at Johns River is understood to be of a high quality suitable for the manufacture of a wide range of premium aggregate and road pavement materials. Given its vertically integrated interests however, Boral understandably nominates that 75 per cent of production will be crushed aggregates, principally for use in the manufacture of ready mixed concrete. Consequently, only 82,500 tonnes per annum will be available for major road sealing works.

ii. Moorland Quarry

Material is extracted from this quarry by dozer ripping and supplied as an uncrushed, unspecified road pavement material or fill.

The material quarried at Moorland cannot be compared in quality with the Possum Brush deposit and will not compete with this quarry in the future production and sale of quality assured aggregates and road pavement materials.

iii. Campbell's Quarry

This quarry produces sealing aggregates and lower grade road material primarily used for road construction. The 50,000 cubic metre annual production limit hampers its ability to supply large road construction contracts. At current production rates this quarry has a life expectancy of approximately 12 years.

iv. Jandra Quarry

This quarry also produces sealing aggregates and lower grade material for road construction. This quarry has the potential to supply high grade material, however, its anticipated operating life at current production levels is approximately 10 years.

v. CSR Readymix - Taree

The material being obtained from this dredging operation is sand and river gravel of varying proportions. The proportion of existing material that would qualify as suitable road sealing aggregate is not able to be determined however the existence of rounded faces in the material makes it less suitable than hard rock deposits. The resource is limited and the expected life of the operation is approximately ten to twenty years.

vi. Tinonee and Charity Creek Quarries

Both of these quarries have small reserves and primarily serve markets in which small amounts of road material are required. The quality of material is not of high enough standard to meet the RTA's requirements for Pacific Highway upgrading.

vii. Conclusion

The delivered price of quarry products comprises their "ex bin" value plus the cost of transport to the point of usage. Because quarry products are generally sold on a high volume low margin basis, two factors are critical, these being:

- the proximity of the quarry to end-users; and
- the relative cost of production.

The Possum Brush quarry offers a number of obvious advantages to the applicant, including:

- the size and quality of the resource;
- quarry location in relation to targeted market and major regional projects such as the upgrade of the Pacific Highway; and
- the topographic setting of the resource which will be able to be quarried and processed at relatively low cost.

Any long-term planning for the region must be conscious of the critical need to secure additional, long-term sources of supply of quality quarry materials, particularly within the area between Taree and Bulahdelah where major Pacific Highway upgrading is to take place over the next twenty years.

2.2 QUARRY DEVELOPMENT

The proposed extension of Possum Brush Quarry does not involve the intensification of quarry activities at the site, nor any increase in the volume of material processed annually at the quarry. The current development consent regarding extraction from the existing extent of Block A, processing and delivery of product will remain unchanged. The proposal involves increasing the total extraction area available for development.

The objective of the proposed extension to the quarry is to immediately produce large quantities of the Unit B rock, a rock that has properties suitable for meeting current high quality aggregate specifications. The demand for this specification rock has increased considerably as large quantities are now required for major road projects. Processed Unit B rock can satisfy this specification and is the major rock type in Block B and is immediately accessible. Lowering the final floor level of the quarry will provide long term access to large quantities of Unit B rock.

2.2.1 Site Development

The proposed development includes:

- immediate extraction of Unit B material from the north-east section of Block B, processing of that material in the existing processing plant, and transport from the site, all in accordance with a new development consent. This material will be a primary source of aggregate products;
- extraction from Block A below the existing permitted floor level, processing of that material in the existing processing plant, and transport from the site, all in accordance with a new development consent. This extension will

supply major quantities of Unit B material in the latter stages of development of the quarry;

- secondary rock breaking on the resultant new quarry pit floor when required; and

- producing, processing and transporting all product from the site at the same rates as permitted by the current development consent.

The order of site development will comprise:

- if required to supplement the existing functioning drainage system, the installation of drainage systems, geofabric filter fencing and other structures to ensure containment of run-off from disturbed catchment areas;

- stripping and clearing of vegetation and overburden from the initial undisturbed portion of Block B to be quarried; and

- the commencement of extraction operations.

2.2.2 *Layout of Facilities*

Figure 2 in Kerry R Steggles (1997) and reproduced as *Figure 2.1* shows the general quarry layout for the existing operation. Essential components of that layout are:

- the extent of the existing quarry;

- the outline (rim) of the quarry at the final extent of quarrying;

- the main quarry access road;

- the current processing area (crushing and blending) to the south of the quarry pit;

- the location of associated quarry workshop and office area within the existing processing area including:
  - site office;
  - workshop;
  - weighbridge;
  - staff amenities block; and
  - storeroom.
- the existing product stockpile and mixing area; and

- location of sedimentation ponds.

2.3 SITE PREPARATION

2.3.1 *Site Drainage of Catchment*

Extraction of material from the quarry extension will progress from areas previously disturbed under the existing development consent into the new extraction areas. This will ensure that drainage of newly disturbed areas will always be directed back to the existing sedimentation ponds established in accordance with the existing development consent.

The primary water control structures to be constructed will include central and peripheral drainage systems to divert disturbed area runoff to the existing sedimentation ponds. Further description of the proposed erosion and sedimentation control systems is provided in Section 2.8.4.

2.3.2 *Clearing of Existing Vegetation*

The proposed extension will involve the clearing of approximately 4.4 hectares of vegetation. Clearing of vegetation will be undertaken in stages as determined by the extraction sequence and production requirements. Initially vegetation will be cleared to allow extraction from the 150m AHD and 140m AHD benches. These benches will be quarried from the access road into and behind the small knoll in the north-east section of Block B. Clearing of other sections of Block B will be undertaken progressively as extraction proceeds westwards and on to lower benches.

Runoff from any areas disturbed by the clearing the slope to the north will flow downstream to the existing lower sedimentation pond or if necessary a perimeter bank will be constructed to divert the runoff around the contour of the hill into the existing upper sedimentation pond. Where necessary geofabric filter fences will be used to trap sediment from runoff not diverted to either sedimentation pond.

Wherever possible, selected foliage and branches from cleared vegetation will be placed immediately on rehabilitation areas. When no rehabilitation areas are available, it will be windrowed at the periphery of the quarry areas, outside of the area to be extracted and adjacent to future rehabilitation areas.

Natural vegetation buffers will be retained, adjacent to the extraction area. Such buffers will be left:

- between the northern extent of Block B and the boundary of Portion 109;
- between the existing access road and the southern ridge; and

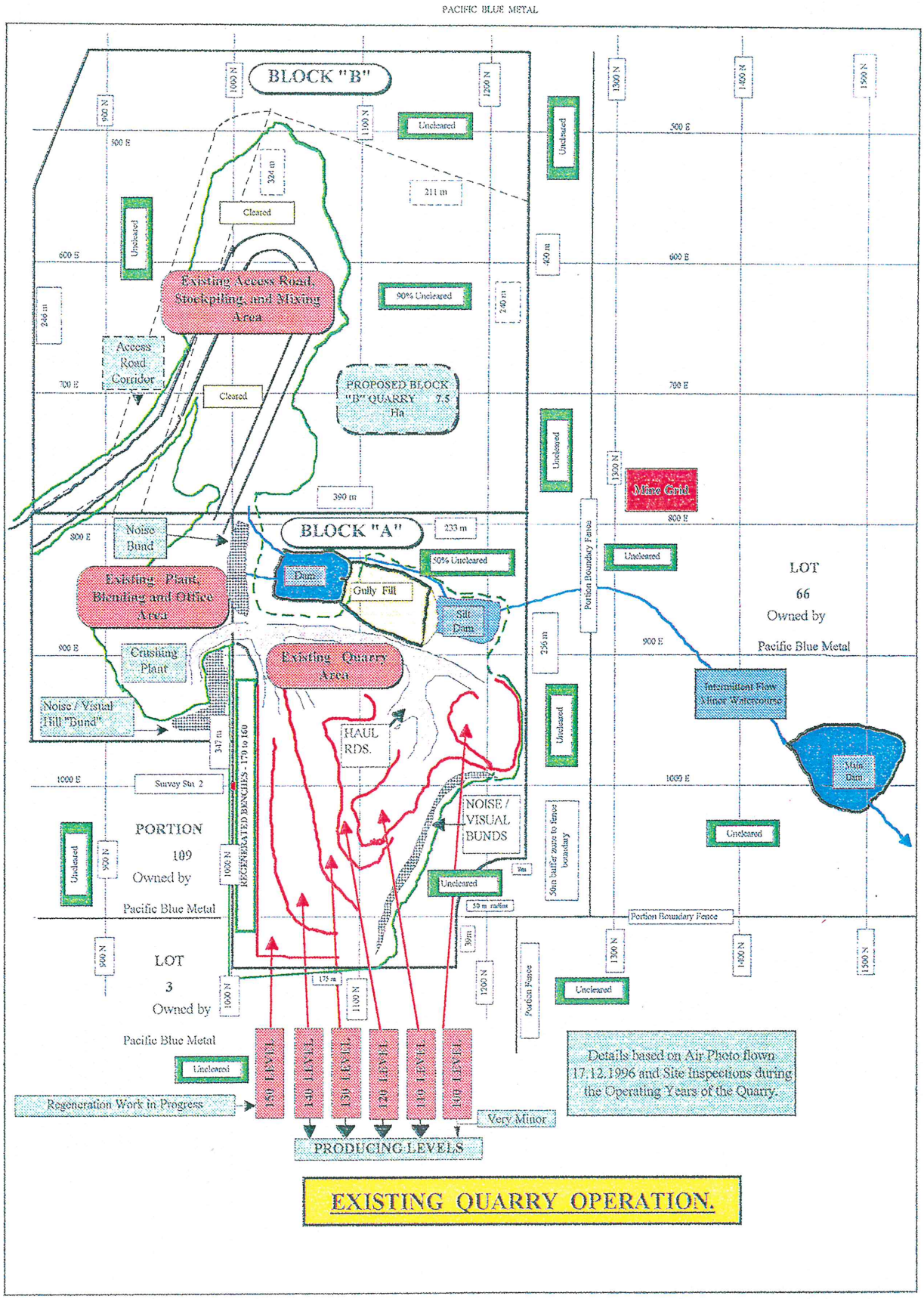

Figure 2.1 EXISTING QUARRY OPERATION (SOURCE: STEGGLES 1997)

- between the western extent of the quarry pit and the boundary of Portion 109.

2.3.3 *Removal and Stockpiling of Overburden*

Quarry overburden comprises topsoil overburden and underlying, weathered rock profiles unsuitable as a blending agent in road pavement.

The overburden profiles in this area are generally less than 0.3 metres deep. The topsoil and subsoils are stony throughout and are described in more detail in Section 5.2.2.

Topsoil will be stripped using a bulldozer on more gentle slopes and a hydraulic excavator on steeper sections. Where possible, stripped topsoil will be immediately respread on rehabilitation areas to optimise regeneration of naturally occurring seed stock.

Where immediate respreading is not possible, topsoil will be stockpiled for future use. The stockpiles will be located at the periphery of the quarry area, outside of the area to be extracted and adjacent to future rehabilitation areas. Stockpiles will be constructed 1.5 metres high with 1 (vertical) : 3 (horizontal) batters and will be vegetated to protect the material which will be used in subsequent rehabilitation programs. When possible, topsoil stockpiles will also be protected by windrowed vegetation.

Weathered rock profiles vary from three metres on the lower to mid-slopes to over 11 metres below the surface on top of the small knoll. Weathered rock excavated as overburden will be used as a blending agent for quarry product or for a wide range of purposes including bunding, road repairs, upgrading of drainage works, revegetation areas and sedimentation pond construction.

Overburden will be removed using a bulldozer (currently CAT D9) and a hydraulic excavator (currently CAT 245ME). One or more dump trucks with a capacity of approximately 40 tonnes (currently CAT 769) will be used to transport the overburden material.

2.3.4 *Hardstand Areas for Processing and Stockpiling of Quarry Products*

The current quarry development has a designated processing area operating under the existing development consent. This hardstand area is at approximately 130m AHD and is located to the south and east of Areas A and B respectively. The crushing and screening plant, short-term quarry product and by-product (scalps) stockpiles, weighbridge, site office and amenities are located in the processing area.

Secondary stockpiles are located on hardstand areas within Block B as is the machinery workshop and diesel storage tanks.

It is envisaged that the current processing area will be utilised for the majority of the life of the quarry, with the option of moving the processing plant to the quarry floor once benches have been extracted to below 130m AHD. The option of relocating the processing plant will depend on cost/benefit analysis. Costs of relocation (possibly a number of times) as the quarry floor is lowered would be measured against the benefits of reduced haulage distances and improved acoustical shielding.

The plant to be employed at the site will be of the type currently operated by the proponent together with the option of secondary breaking using a hydraulic rock hammer.

2.4 QUARRY PLAN

Extraction will proceed in both Block A and Block B concurrently. Generally, the higher quality Unit B rock will be extracted from Block B with Block A planned to be the main source of blends requiring a weathered rock content. **The quarry plan for Block B has been developed to ensure that there is minimal impact on neighbouring residents**. This will be achieved by using the existing landform and vegetation to the north of the pit as a screen for quarry operations in Block B. The proposed deepening of Block A from RL 85 to RL 40 metres will occur wholly within the Block A quarry pit and as such there is no increase in the spatial extent of the Block A quarry. Work below 85m AHD will be fully screened in all directions by natural topography and the quarry void.

Production operations from the proposed extension will not significantly alter from the current quarry operation. The maximum annual quarry output of 200,000 tonnes along with extraction methods, plant, traffic movements and ancillary operations will remain generally unchanged. Details of the extraction sequence and quarry operations are provided below.

2.4.1 Sequence of Extraction

The mining procedure for the proposed quarry expansion is detailed in Kerry R Steggles (1997) and is reproduced below.

i. Block B

The working of Block B will be in two stages, a Northern stage and a Southern stage. The former is north of the current quarry access road and is largely timbered. The latter is south of that road and is generally cleared, being the area on which materials are currently stockpiled. This area would continue for many years (probably more than twenty) to be used for stockpiling and blending activity. Quarrying will commence immediately in the Northern Stage. It will be the dominant provider of high grade Unit B aggregate rock. The weathered rock from this stage occurs mainly above 140m AHD, and will be used in road base and associated material.

Figure 1A in Kerry R Steggles (1997a) report shows the optimum final extraction plan, with the final operating roadways, including the quarry site access road and the material haul road to the process area from both Block B and the deepened Block A. This figure is reproduced as *Figure 2.2*. Final remnant benches will be five metres wide, faces 10 metres deep at 75 degrees to the horizontal. Where appropriate, near the surface and in unstable ground, bench width will be widened and/or the depth reduced and angle varied. The upper benches would be regenerated with suitable tree plantings when required. The approximate division between the Northern and Southern Stages is shown in *Figure 2.2*.

a. Northern Stage

In the first few years the Northern Stage will be worked in two zones. Zone 1 would be developed off the existing access road near the stockpiling area. This is behind the hill structure and would allow extraction to generally proceed without being visible from Possum Brush Road or from the nearest residences along Possum Brush Road. The working face would probably need to be oriented slightly north of east so as to allow natural drainage of workings to the main gully. Benches at 140, 130, and 120m AHD would drain to the main quarry water dam. They would be the first to be established.

Zone 2 workings would be from the north west corner of Block A quarry, west of the gully. This would initially involve level 100, 110, and 120. Workings would develop west and south with a maximum face height of 130m AHD. This would keep the quarrying below sightlines from the nearest residences. The two zones would join as Zone 1 develops northward to work off the visible northern face of the hill from behind a buffer of trees and remnant hill.

b. Southern Stage

It is unlikely that this area will be worked for at least 20 years. It is more functional in its current stockpile/roadway use until extraction in the Northern Stage is sufficiently advanced to warrant relocating the roadway. The only early extraction

currently favoured in the Southern Stage is associated with lowering the area adjoining the Plant Area. This would allow more efficient moving of materials into stockpile. Work should also be undertaken in the early years to establish small replanted benches along the near surface route of the final access and quarry haul road.

ii. Block A - Deep Quarry

The extraction of this resource will not occur until late in the life of the quarry. It is simply an extension of the existing Block A quarry below the 85m AHD base nominated in the current development consent to a depth 40m AHD. The enlargement of the quarry floor area at 85m AHD that results from the Block B quarry, provides a capacity to work and haul from the deeper levels. No increase in surface area is involved and it is deep below the surface.

The only feature of extraction that would be different to the current operation is the need to pump out the workings below natural drainage level. Currently this level is approximately at 85m AHD. The gully drops quickly beyond the northern boundary of the quarry before reaching the major sedimentation pond on the property. It would be possible to deepen the drainage outlet of Block A to the gully by at least five metres. However, such would only give a temporary solution. The proposed deeper levels of Block A would require installation of a suitable capacity pump. The Quarry Manager advises that the drainage gully only flows during rain events and for a few days afterwards indicating that the deepening of the quarry would intercept subsurface water flows rather than a major groundwater aquifer. With an upstream catchment of only 22 ha, pumping the accumulated water quantity is not a difficult or costly operation. It will simply require an appropriate capacity sump facility.

A number of activities now located on the surface could be relocated on the floor of the quarry when extraction is advanced. For example, it would have adequate size with the extension of Block B for installation of a new Crushing Plant. Such a location would provide excellent vision and noise isolation.

2.4.2 *Completion of Quarrying*

Rehabilitation of the site will be undertaken progressively, so that at the completion of quarrying substantial portions of the quarry will already be under native vegetation. Once extraction has been completed, the remainder of the quarry above the self draining elevation will be rehabilitated. Benches of the lower quarry will stabilised. Current intent is that this area will be allowed to fill up with stormwater runoff to act as a private farm dam for the extended property.

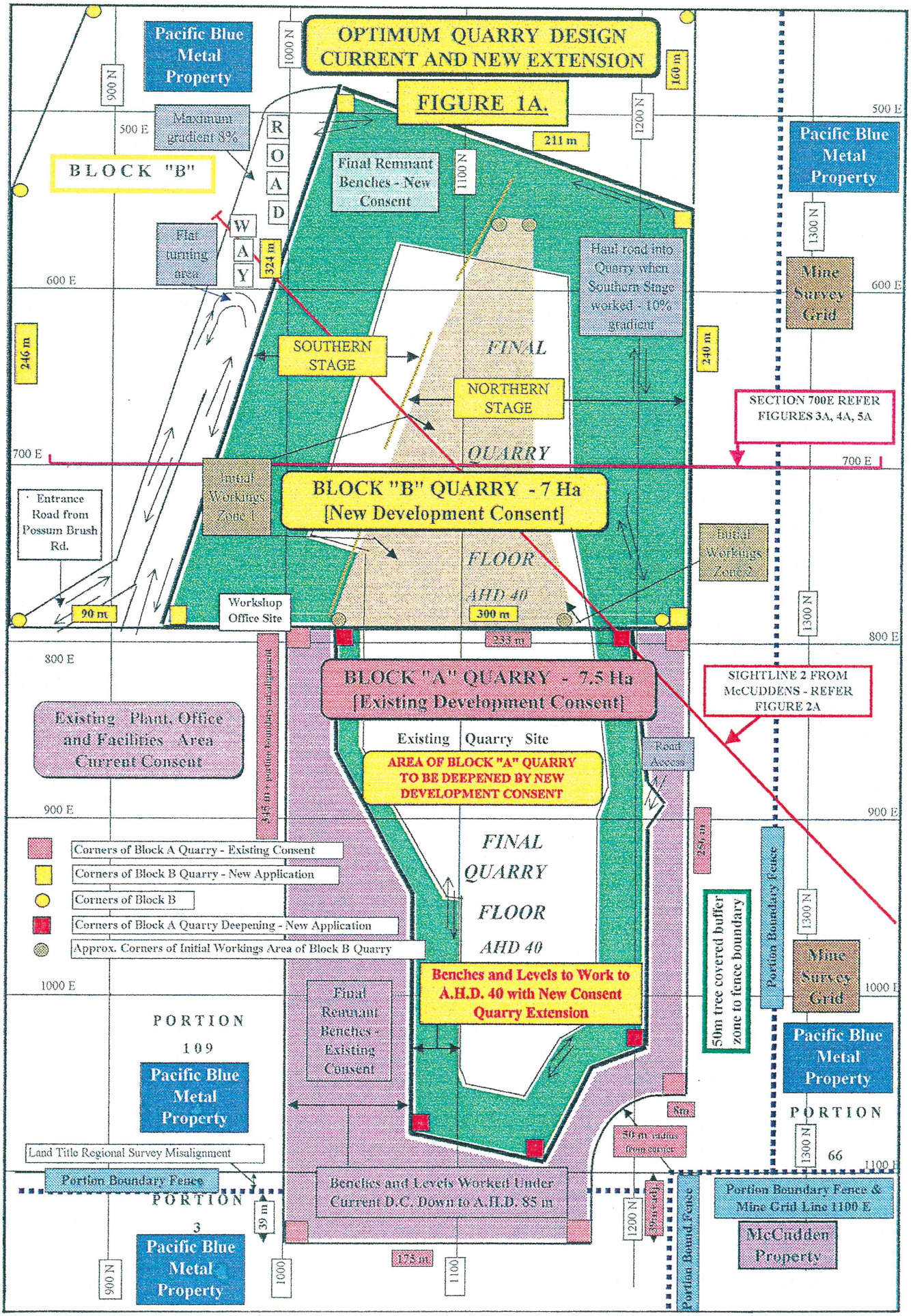

Figure 2.2 OPTIMUM QUARRY DESIGN (SOURCE: STEGGLES 1997a)

2.5 QUARRY OPERATION

2.5.1 *Method of Extraction*

The method of extraction for the proposed extension will not vary significantly from those methods currently employed at the quarry. Cleared vegetation and stripped topsoil will be either placed immediately on rehabilitation areas or windrowed/stockpiled at the periphery of the quarry area and adjacent to future rehabilitation areas. Weathered overburden will be ripped by dozer or excavator to a depth of about two metres after which benches will be developed by drilling and blasting. Blasting will be carried out by an experienced contractor registered under the Mines Inspection Act, 1901.

An explosives magazine is located on the site, to the south of Block A. The magazine is stored in accordance with the requirements of Part 4 of the Dangerous Goods Regulation, 1978 and is licensed by NSW Workcover Authority (Licence Number 35/026979).

Drill and blast design has been (and will continue to be) determined primarily by the following:

- site topography;
- site geology;
- material production and market demand;
- size of primary jaw crusher; and
- environmental and safety constraints.

The development of 10 metre benches has been selected in order to:

- match the quarry plan with existing topography;
- optimise the blasting efficiencies;
- minimise inter-bench movements of mobile equipment;
- minimise the number of drill movements;
- minimise the number of inter-bench haul roads; and
- adhere to industry practice in relation to safety standards.

Drilling will be carried out either by above-ground pneumatic or hydraulic equipment, or "down the hole" technology. Drill rigs employed at the quarry will be chosen and configured to match the production and environmental requirements of the job at any given time. Currently, drilling is carried out by contractors who operate a LM500 hydraulic rig with on-board compressors.

Drill units will be fitted with dust suppression and/or dust collectors and pre-cleaners. Whenever possible, blasting will not be carried out during periods of unsuitable meteorological conditions such as high winds or temperature inversions. Dust suppression and noise controls are discussed further in sections 5.4 and 7.1 respectively.

Optimal drilling and blasting will be achieved by face inspection and careful monitoring of the face geology profile and structure. Modifications to the drilling and blasting techniques will be made on a blast-by-blast basis. Typical blast design has been based on the schedule and assumptions given for typical production tonnes in *Table 2.3.*

Table 2.3 BLAST SIZE, SCHEDULE AND FREQUENCY

Production Tonnes(1)	Bank m³ (BCM) Quarried(2)	Mean BCM	Blast Frequency (Weeks)	Blasts Per Annum
160,000	60,000	3,500	3.1	17
200,000	75,000	4,250	2.9	18

Note: *(1)* *Production tonnes = 0.985 x tonnes quarried.*

(2) *BCM (Bank Cubic Metres) calculated as 2.7 t/bcm*

Blast design for typical quarry development has been calculated as follows:

Target ground vibration at nearest residence		<5 mm/sec
Target airblast over pressure at nearest residence		<115 dB L
Target maximum instantaneous charge (MIC)		75 kg
Face height		10 m
Drill hole diameter		89 mm
Hole burden		2.0 m
Hole spacing	dry blast	2.5 m
	wet blast	2.7 m
Blast size		3,500-4,250 bcm
No. of holes per blast		48-68
No. of blasts per annum		17-18
Blast frequency (weeks)		2.9-3.1

The above blast design is based on optimal conditions. At times, smaller and more frequent blasts will be required to rectify minor problems with site geology or bench alignment.

For a blast to yield 4,250 bcm, preliminary design calculations have been undertaken for the two most currently used bulk explosives at the quarry. Calculations are summarised as follows:

Total depth of holes (face height plus 1 metre sub-drill)		11 metres
Bulk explosives	Ammonium Nitrate Fuel Oil (ANFO)	800 kg/m^3
	Handibulk Wet	1,200 kg/m^3
Explosive column	ANFO	8 m
	Handibulk Wet	8 m
Explosive mass per hole	ANFO	40 kg
	Handibulk Wet	60 kg
Rock yield per hole	ANFO	62.5 bcm
	Handibulk Wet	73.3 bcm
Rock yield per metre drilled	ANFO	5.7 bcm
	Handibulk Wet	6.7 bcm
Explosive mass/blast	ANFO	2,720 kg
	Handibulk Wet	3,480 kg
Charge per delay	ANFO	40 kg
	Handibulk Wet	60 kg

Impacts from a blast designed with a MIC of 60 kg have been assessed and reported on in Section 7.1. Airblast overpressure and ground vibration resulting from blasts of this intensity have been modelled and assessed as acceptable at nearby residences. It should be noted that as all blast holes will be delayed the MIC is equal to the maximum explosive mass in a hole and does not change due to the number of holes used in a blast. MIC and other blast factors will always be stringently controlled to ensure compliance with EPA guidelines.

Standard quarry practice will include the following:

- blasting to be conducted between the hours of 9 am and 3 pm wherever possible;
- if requested by nearby residents, they will be advised of specific blast times;
- blasting will be avoided in adverse meteorological conditions wherever possible;
- fly rock to be minimised/eliminated by adequate stemming of drill holes (using crushed aggregate) and by careful monitoring of the drilled burden to

avoid substantial cracks, fissures and other face conditions that may allow fragmentation/escape of explosive energy;

- ground vibration will be minimised by paying particular attention to such critical factors as:

  - the confinement of the explosive charge;

  - the detonation efficiency of the charge; and

  - the degree of water saturation in the ground at the time;

- air blast overpressure will be similarly controlled with particular attention being paid to:

  - blast hole diameter

  - explosive strength

  - concentration in blast holes; and

  - best practice stemming procedures.

  It is noted that the highest levels of overpressure relate to gas venting (either through the face or stemming ejection) and that these sources can be completely eliminated without loss of fragmentation control; and

- secondary breakage of oversized rock is expected to be done mechanically (by hydraulic rock breaker), as opposed to secondary blasting.

Typically, blasts will be fired with non-electric (Nonel) detonation system using 17 ms delays along rows and 42 ms delays between rows. All holes will be primed using appropriate primers, currently Powergel.

Drilling and blasting design and practice are to be approved and monitored by the Department of Mineral Resources (DoMR) regional mines inspector and the EPA. The handling and storage of explosives will be carried out by contractors under licence from the DoMR.

Secondary breaking will be required to reduce the quantity of oversize material accumulating within the quarry. Secondary breaking will be undertaken on the quarry floor utilising a hydraulic hammer and will occur infrequently on an as required basis. Oversize rock will be broken to order (eg for rip rap or armour etc) or reduced to a size suitable for loading into the primary crushing plant.

2.5.2 *Loading and Haulage of Blasted Rock*

Shot rock will be loaded by a front-end loader (or hydraulic excavator) to dump trucks and hauled to the existing crushing plant site along internal haul roads constructed to a hardstand surface condition.

Typical machinery to be employed would be similar to:

- a Michigan 175B, CAT 966 or 988 front end loader (or equivalent); and/or
- a CAT 245 ME hydraulic excavator (or equivalent); and
- one or two CAT 769 dump trucks (or equivalent).

2.5.3 *Raw Materials Processing and Product Stockpiling*

The primary processing and stockpiling procedures currently employed at the quarry are subject to the existing development consent. Those procedures will not be amended by this proposal. A brief description of the plant follows.

The processing plant reduces the size of quarry material by crushing. Blasted rock is dumped into an apron feeder and then passed over the initial scalping screen. Rock falls into the jaw crushers, for initial primary crushing, set to produce material less than 80 millimetres.

Crushed material is conveyed to primary screens that separate crushed rock and scalps. Primary crushed rock is conveyed to a gyrosphere crusher for secondary crushing and then conveyed to the product screens for sorting into specific product gauges which are then conveyed to product stockpiles. Screen oversize is returned to the gyroshere or the Duo-pactor for closed circuit recrushing before final screening. Water sprays to aid in dust suppression are fitted to the gyrosphere and duo-pactor, transfer points and scalp chutes.

Four or more products (typically 20 mm, 14 mm, 10 mm and <5 mm), are produced and stockpiled separately for sale or subsequent blending. The capacity of the stockpiles is up to 4,000 tonnes before double handling is required to transfer product to the secondary stockpiles. Quarry fines are stockpiled separately in the processing area or the secondary stockpile area.

The crushing and screening plant is generally a low profile configuration. At times minor items of portable plant may be brought on site for short periods of time for special projects. Loading will be effected directly from ground-based stockpiles to sales trucks. No overhead bins are planned at this stage.

The product stockpiles may reach a height of 6 metres and provide an additional acoustic bund around much of the northern sides of the processing plant.

A dust suppression device (spray bar) is installed at the head of the scalps conveyor to wet material before stockpiling prior to subsequent use. Scalped material provides good quality road pavement for maintenance of haul roads and quarry floors as well as for the construction of bund walls. Excess scalps are available for blending (into road pavement material) for sale to local markets.

Dust suppression on the process hardstand area is achieved through the regular use of a water cart.

2.5.4 *Plant and Equipment*

The majority of the plant and equipment to be used for the proposed expansion will be the same as that used for current quarry operations and is summarised below:

i. Site Development

Internal Road Construction - bulldozer, grader, road compacters, water cart and off-road dump trucks.

Quarry Area Clearing and Stripping - bulldozer, hydraulic excavator and front-end loaders.

Earthworks for Hardstand Areas, Dams etc - bulldozers, scrapers, graders, hydraulic excavators, compacters, front -end loaders and off road dump trucks.

ii. Quarry Operations

Drilling - hydraulic drill rig.

Loading - front-end loaders and hydraulic excavator.

Haulage - off-road dump trucks.

Additional plant to be employed will be a hydraulic rock hammer operated by the hydraulic excavator.

It can be expected that over time equipment will be replaced or updated to ensure the quarry remains efficient and competitive. The types and numbers of plant items relevant to extraction work currently employed on-site include:

- one bulldozer — CAT D9L;
- three front-end loaders — CAT 980B, CAT 988B & Michigan 175B;
- one excavator — CAT 245ME;
- two dump trucks — CAT 769B;
- one hydraulic drill rig — LM500; and
- one 12,000 litre water cart.

2.6 SITE FACILITIES, WORKFORCE AND OPERATING HOURS

The proposed expansion will not result in changes to the existing site facilities or workforce. Operating hours for quarry operations under the existing development consent will remain unchanged though alternate operating hours for the expansion works are proposed to be more flexible to enable the quarry to meet client requirements.

2.6.1 Site Facilities

Site facilities include a site office and lunchroom, staff amenities block, workshop and materials storage shed. On-site parking facilities are provided for six vehicles. A star picket and wire fence has been installed around the perimeter of the quarry site for pedestrian safety.

2.6.2 Workforce

The current workforce of nine full-time employees, including site management, and approximately five contract truck drivers will be required for the continued operation of the quarry. Most of the full-time personnel are multi-skilled and capable of operating several pieces of plant depending on operational requirements.

A significant number of local people will be indirectly employed as drivers and maintenance contractors as well as through service industries (fuel, spare parts, etc).

2.6.3 Operating Hours

Quarrying in the proposed expansion will occur between 6.00 am and 6.00 pm Monday to Friday and 6.00 am to 1.00 pm Saturdays. Whenever possible blasting

will be restricted to between 9.00 am and 3.00 pm Monday to Friday and 9.00 am to 1.00 pm Saturday. Ancillary operations such as refuelling, servicing and maintaining plant and maintenance of the access road may be undertaken at any time.

In order to supply specific contracts, operations outside normal hours may be required. In such circumstances agreement in writing from Council will be obtained prior to proceeding with such operations.

2.6.4 *Waste Management*

Small quantities of waste will be generated throughout the quarry's operational life. These include:

- domestic type refuse and workshop wastes that will be stored in approved containers and transported regularly to an approved waste disposal area;
- sullage wastes and septic wastes from staff amenities will be discharged into an approved septic tank with pump-out facilities; and
- stormwater potentially contaminated with petroleum products will be drained to a proprietary oil/water separator from which clarified water will be allowed to drain to the sedimentation pond system. Oil-contaminated fluids will be collected by a licensed recycling contractor for disposal.

2.6.5 *Services*

i. Power

The quarry is currently connected to the local electricity grid. Diesel powered water pumps are used to provide water to the water cart.

ii. Water

Potable water demands will be provided by a roof collection system from the site facility buildings and/or will be imported. Non-potable water requirements will be provided by a system of on-site sedimentation ponds.

iii. Telephone

Telephone services are available to the quarry site.

iv. Sewage

Quarry personnel will generate small volumes of domestic sewage. These will be treated and disposed on site through a previously approved septic tank system.

2.7 TRANSPORT OF END PRODUCT

The markets for quarry products are located both north and south of the quarry site. Generally, traffic volumes have been assumed to be evenly distributed in each direction.

The RTA has expressed a considerable interest in the quarry products due to their relatively high polished aggregate friction value for the ongoing construction and maintenance needs of the Authority's road network. Quarry product is also in demand by local government and private contractors for use as road base. Another market is supply of aggregates to ready mixed concrete plants and other construction material outlets up and down the mid-north coast.

Road transport is the most economic and practical means by which transport requirements can be met due to the accessibility of the Pacific Highway.

The proposed quarry extension will not increase total annual production currently allowed from the quarry under the existing development consent. Therefore there will be no significant change in traffic movements from those currently experienced at the existing quarry.

2.8 WATER MANAGEMENT

2.8.1 Water Management Controls

i. Clean Water Diversion

Runoff from undisturbed areas will be diverted around the quarry. Vegetated diversion banks and/or channels will be used to divert runoff to a stable downstream location. Catchments above the working areas are generally small and diversion structures will be sized using suitable guidelines such as *Urban Erosion and Sediment Control* (CaLM, 1992) and *Soil and Water Management for Urban Development* (Department of Housing, 1993).

ii. Groundwater

Minor volumes of groundwater have been detected in drill holes during initial quarry resource assessments and blasting operations. This groundwater dissipates quickly following blasts as it originates from subsurface flows following recent rainfall events rather than from interception of the watertable. Therefore, this groundwater has limited flow potential. Given that the catchment is limited to the ridge above the quarry, groundwater inflows to the quarry area are considered negligible.

Currently intercepted subsurface flows are directed into the existing sedimentation ponds that overflow into the main gully downstream of Block A. This will continue for the proposed expansion, however, once the quarry becomes non self draining ie. floor level below 85m AHD, any excess subsurface flows above quarry demands will be collected in a sump and pumped into the main gully.

iii. Quarry Areas

Stormwater runoff from quarry operation areas will drain into the surface drainage system. A cross fall of one per cent will be provided in the quarry floor with perimeter surface drains to discharge into the sedimentation ponds.

iv. Fuel and Oil Storage Area

One 10,000 litre and two 5,000 litre diesel fuel tanks located in Block B will be contained in two separate bunded compounds in accordance with Australian Standard AS1940 (Storage and Handling of Flammable and Combustible Liquids). The bunded areas will have a minimum volume equal to 110 per cent of the relevant storage tank volumes.

Hydraulic and lubricating oils, greases and small quantities of petrol and kerosene will also be used on-site, in the workshop area. These will be stored adjacent to the workshop in an area that will be roofed. Small volumes of oils spilt in the workshop will be contained, mopped up by appropriate means and temporarily stored in drums until collected by a licensed contractor for disposal.

2.8.2 *Erosion and Sediment Controls*

Erosion and sediment control will be achieved in three ways:

- collection and treatment of stormwater flows from disturbed areas;

- temporary and permanent rehabilitation of disturbed areas of high erosion potential; and

- control of soil erosion at source using suitable control measures.

The potential for erosion and sediment movement will be highest during development operations when topsoil and overburden are being stripped and stockpiled. However, there will be ongoing potential for sediment movement from the quarry working benches.

To control erosion and sediment movement the following measures will be used:

- preparation of an erosion and sediment control plan for the site. This will entail design and description of all erosion and sediment control structures, both temporary and permanent;

- use of existing sedimentation ponds. These are discussed further below;

- minimisation of disturbed areas. Quarry and ancillary area boundaries will be marked and no activity permitted outside designated areas;

- diversion of clean water from undisturbed areas around working areas;

- exposed batters resulting from construction of the access road, diversion bunds and topsoil and overburden stockpiles will be seeded with local grass species;

- the installation of temporary erosion and sediment controls, such as geofabric filter devices, prior to commencement of topsoil and overburden removal;

- sequential clearing and rehabilitation of the quarry as extraction of the hard rock material proceeds; and

- the regular maintenance of erosion and sediment control structures, particularly after rainfall, to ensure their efficiency.

Three sedimentation ponds have been constructed at the quarry site. These include:

- pond No. 1 in the centre of the quarry in a gully between Block A and Block B;

- pond No. 2 in the north-western corner of Block A; and

- pond No. 3 downstream of the quarry pit, within Lot 66 (also owned by Pacific Blue Metal Pty Ltd).

The location of the ponds is shown on *Figure 2.1.* Sedimentation pond No. 1 is currently acting as the primary water storage for quarry operations and also provides sediment control for the process area and existing hardstand areas in Block B. Sedimentation pond No. 2 is located on the floor of the lowest bench in Block A and collects all runoff from disturbed sections of Block A. Overflows from these ponds are directed to the downstream creek. Sedimentation pond No. 3 located in the creek downstream of ponds 1 and 2 provides additional storage and water quality control for runoff sourced from the quarry. This pond also receives runoff from undisturbed areas within its catchment.

The location and operation of the sedimentation ponds will continue to be subject to the existing development consent. The consent allows for a future primary pond to be constructed in Block A once the extent of extraction requires the removal of sedimentation pond No. 1. The impact of the proposed extension of the quarry will be to increase the disturbed catchment area initially for sedimentation pond No.1 and later for the future primary sedimentation pond. The proposed extension will also slightly increase water demands for dust control by the water cart and for rehabilitation works.

The three existing sedimentation ponds were constructed in accordance with Pollution Control Approval Number 89/242H dated 4 September 1989 and operate under Pollution Control Licence Number 03393.

The majority of the disturbed surface of the quarry consists of exposed bedrock. The nature of the material and experience to date indicate that there is little dispersible/fine sediments in runoff from disturbed areas. Test results from previous water quality samples taken from the sedimentation ponds show total suspended solids (TSS) concentrations of:

- 13 mg/L in pond No 3 taken 22 June 1990;
- 15 mg/L in pond No 3 taken 25 July 1996; and
- <2 mg/L in pond No1 taken 25 July 1996.

These results are well below the allowable limit of 50 mg/L.

Therefore, the sedimentation ponds should be designed as coarse sediment basins (Type C) as detailed in EPA (1996). That is, the sediment basin should have as its minimum capacity, the volume of water that will enter in six minutes in a five year ARI, one hour storm event plus an allowance of an additional 50 percent volume for sediment retention between clearing.

However, development consent condition 33 for the existing quarry requires that the sedimentation ponds have the capacity to contain runoff from a 1 in 10 year storm. In the past the EPA has recommended that a 1 in 10 year storm with a duration of two hours is applicable for design of sedimentation ponds.

The volumes from the above two design storms based on catchments that include the proposed extension and the volume of the existing ponds are given in *Table 2.4*. The volume of sedimentation pond No. 2 is conservatively based on the current surface area of the lowest bench in Block A over a depth of one metre. As a guide to the ponds flow retention capacity, the retention time for peak flows from one hour storms with average recurrence intervals of 10 and 20 years are also given in *Table 2.4*. The ponds will provide a minimum retention time greater than one hour for both scenarios.

Table 2.4 DESIGN CHARACTERISTICS OF SEDIMENTATION PONDS

POND	Catchment Area (hectares)	Catchment Discharge Over Six Minutes From a 5 year ARI [1] One Hour Storm (ML [2])	Catchment Discharge From a 10 year ARI [1] Two Hour Storm (ML [2])	Volume (ML [2])	Peak Flow Retention From a One Hour Storm (hours)	
					10 year ARI[1]	20 year ARI[1]
No. 1	10.8	0.283	4.48	5.6	1.68	1.46
No. 2	6.4	0.168	2.65	2.7 [3]	1.32	1.14
No. 3	32.8	0.700	11.07	11.7	1.42	1.23
Future Primary	17.4	0.456	7.21	8.0 [4]	1.49	1.29

Note: *1. Average Recurrence Interval*

2. Megalitres

3. Conservative estimate

4. Minimum volume to be adopted

The capacity of the primary sedimentation ponds (Nos. 1 and 2) more than adequately covers the EPA's requirement for treatment of course sediments (including the 50 percent allowance for accumulated sediment). The ponds will also comply with the requirements of the current development consent.

The sedimentation ponds will be shaped such that the ratio of length to width is approximately 3:1. The shape of the ponds will assist in the containment of any sediment generated in runoff from the quarry site. The Soil Conservation Service (letter of 24 September 1984) recommends the ponds provide a minimum freeboard of 1.3 metres, minimum batters of 1 vertical to 2.5 horizontal both upstream and downstream and all areas exposed above the top water level to be topsoiled and sown to seed and fertilised. The embankments of the sedimentation ponds will be built of earth and rock fill with all construction material adequately compacted.

Development consent condition 33 for the existing quarry also requires that the sedimentation ponds have the capacity to safely convey water from a 1 in 100 year storm. If necessary the existing overflow channel for sedimentation pond No. 1 will be modified to take into consideration the change in flows due to the expansion of the pond's catchment.

The existing development consent requires sediments to be removed once storage volumes have been reduced by 10 percent. The sediments will be removed by drag line or hydraulic excavator and dried and blended with quarry overburden and placed on quarry rehabilitation areas.

The erosion and sediment controls proposed will maintain the integrity of water quality in water courses downstream of the quarry. Experience shows that the requirement for flocculating agents to settle out suspended solids is unlikely. However, should water quality monitoring indicate that overflows from pond No 3 have TSS in excess of 50 mg/L, an artificial flocculation program will be carried out in accordance with guidelines provided in Soil and Water Management for Urban Development (NSW Department of Housing, 1993).

Sedimentation pond No 1 (and the future primary sedimentation pond) is designed to provide both sufficient water supply for quarry activities and adequate sediment control. Experience to date has shown that the capacity of the pond is adequate to satisfy existing non-potable water demands for dust suppression, process water and irrigation of rehabilitated areas. The increase in catchment area will ensure that the small increases in non-potable water can be satisfied.

Water for quarry use is pumped using an electric pump for the on-site reticulation system and one diesel driven high volume pump for rapid filling of the water cart. The pumps are located on a platform to the side of the pond. The pump inlets will be located on a floating pontoon at the end of the pond furthest from the inflow area to ensure bottom sediments are not disturbed or entrained during pumping.

2.9 LANDSCAPING AND REHABILITATION

The completed benches in Block A (150m AHD and above) have been stabilised, landscaped and revegetated. Revegetation of the upper benches was initially hindered by unfavourable weather conditions, however, the new quarry management has intensified its efforts through the implementation of a number of initiatives. These include:

- installation of an irrigation system to encourage quick growth during plant establishment stage;

- involving a horticulturist employed by an associated company of Pacific Blue Metal to gather and propagate seed from naturally occurring native species found on the site which are returned to Possum Brush Quarry for immediate planting; and

- increased monitoring of rehabilitation sites including the soil moisture status by both quarry management and by the horticulturist during site visits.

There has been a marked improvement in the success of the revegetation program over the past 12 to 24 months.

The quarry area will be progressively rehabilitated to produce a stable landform which is compatible with the surrounding area. Topsoil and weathered overburden will be stockpiled and placed progressively on completed quarry areas with the revegetation program to establish endemic plant communities.

Two landscape and rehabilitation strategies have been prepared for the quarry. *Proposed Quarry at Possum Brush Landscaping and Rehabilitation Guidelines* (Resource Planning, 1989) was prepared to satisfy a condition of consent for the original development. *Re-establishment of Vegetation at Possum Brush Hard-Rock Quarry Possum Brush, NSW* (Landless, undated) was prepared to address problems with establishing revegetation on the upper benches of Block A. Both reports have been accepted by Council for the rehabilitation of the quarry.

Landscaping and rehabilitation of the proposed expansion will be undertaken as described below and incorporating components of the existing strategies, where appropriate.

2.9.1 *Landform Design*

In Block B, the upper batters of the quarry containing weathered rock will be laid back at a flatter slope than the underlying fresh rock. Final remnant benches of the underlying fresh rock and the deepened extension to Block A will be five metres wide, faces 10 metres deep at 75 degrees to the horizontal.

Surface run-off will be directed along benches to a constructed diversion drain so that the potential for sheet erosion and batter slump is reduced.

2.9.2 *Topsoil Management*

Prior to topsoil stripping, vegetation will be removed and native seeding or brush material will be stockpiled for later redistribution as mulch over areas undergoing rehabilitation. Topsoil will be stripped and either transported directly to rehabilitation areas to optimise regeneration of naturally occurring seed stock or stockpiled and progressively distributed over future areas requiring rehabilitation. Topsoil stockpiles will be fertilised and seeded to stabilise the material against soil erosion and to maintain soil fertility during storage.

Topsoil resources in the quarry area have been shown to be fairly limited and stockpiled weathered overburden will be used to supplement topsoil stocks for rehabilitation activities. Weathered overburden has been used successfully as suitable material for revegetation of quarry sites (EPA, 1995). This material will require additional treatment to increase its organic matter content and nutrient status. Whenever necessary, topsoil products will be imported to supplement site topsoil and overburden in order to ensure the ongoing success of the rehabilitation program.

2.9.3 *Revegetation*

The aim and objectives of the revegetation program for the Possum Brush Hard Rock Quarry are stated in Landless (undated):

"The aim of the revegetation programme in the long term is to rehabilitate the quarry site with indigenous species to conform with existing vegetation.

As the quarry is sequentially developed, the immediate objectives will be:-

1. *To minimise visual impact;*

2. *To control runoff, and therefore erosion/siltation problems;*

3. *To re-establish native flora for the above reasons, and as habitat for local fauna."*

i. Quarry Area

The adopted revegetation programs include consideration of site preparation, planting and maintenance. The main structures that will require revegetation include:

- temporary bunds ;
- permanent bunds (including access road batters and pond walls); and
- quarry benches.

Temporary and permanent bunds will be revegetated immediately following construction in accordance with the revegetation program prepared by Resource Planning (1989). Quarry benches will be progressively revegetated in accordance with Landless (undated). Revegetated areas will be routinely monitored and maintenance undertaken as required. Additional watering of vegetation will be undertaken should adverse weather conditions inhibit growth during the establishment phase.

ii. Quarry Perimeter

The quarry has been confined to the northern side of the site to avoid any disturbance to the existing tree growth along the heavily timbered ridge at the southern boundary of the quarry. This ridge line forms an important component of the total landscape in this locality and will not be disturbed.

The northern extent of the quarry has been positioned 50 m from the northern boundary of the property (with Lot 66) to retain existing dense tree growth. This buffer will be protected from site works to maintain a complete belt of existing natural forest thus keeping visual impact to the lowest possible level. Additional tree planting will be provided in Lot 66 to develop sight screens for the occupants of the existing dwellings to the north and motorists on Possum Brush Road.

2.9.4 End Landuse

Once extraction has been completed, the remainder of the quarry above the self draining elevation (approximately 85m AHD) will be rehabilitated using the methods described above. Benches of the lower quarry void will be stabilised. This area will be allowed to fill up with stormwater runoff to act as a private farm dam

for the extended property. Rehabilitation of the upper quarry area will provide similar vegetation communities and fauna habitats, as previously occurred over the site. The establishment of a dense shrub understorey in the quarry area will aid in enticing fauna species back to the area. The revegetated quarry will be planned to function as a sustainable ecosystem which reflects the natural ecology of the area.

Chapter 3

PLANNING CONTEXT

3.1 STATE PLANNING

3.1.1 State Environmental Planning Policies

i. State Environmental Planning Policy 11 - Traffic Generating Developments (SEPP 11)

SEPP 11 makes provisions for the referral of certain classes of development to the relevant traffic authority. The policy requires that applications for development consent for activities specified in Schedule 1, which includes extractive industries, be referred to the traffic authority.

GTCC, as the consent authority, advises that an extractive industry with a daily production exceeding 1,000 tonnes must be referred to the Regional Traffic Committee. The proposed development will not result in a daily production in excess of 1,000 tonnes, therefore referral of the development application to the Regional Traffic Committee is not required.

ii. State Environmental Planning Policy 44 - Koala Habitat Protection (SEPP 44)

SEPP 44 came into force on 13 February 1995 and is required to be considered under Section 90 of the EP&A Act 1979. It aims to:

> *encourage the proper conservation and management of areas of natural vegetation that provide habitat for koalas to ensure a permanent free-living population over their present range and reverse the current trend of koala population decline.*

In respect to this Policy the Director of Planning has made guidelines which Councils must consider when determining a development application (DA) or land rezoning to ensure that:

- consent is not issued without investigation of potential Koala habitat. If potential habitat is found, investigation of core Koala habitat must then be undertaken ;

- with the identification of core koala habitat, a Plan of Management must accompany the DA before the council can consider granting consent; and

- if land to be rezoned involves potential koala habitat or core koala habitat, a Local Environmental Study may be required.

An assessment of the study area has been undertaken in accordance with the provisions of SEPP 44 and the results are provided in Section 6.3.

iii. State Environmental Planning Policy 46 - Protection and Management of Native Vegetation

SEPP 46 was gazetted and commenced operation on the 10th August 1995. It aims to:

> *prevent inappropriate native vegetation clearance in New South Wales.*

The Department of Land and Water Conservation has prepared guidelines for the implementation of this policy which require:

> *the assessment of proposals to clear native vegetation for the purpose of ensuring that native vegetation is protected and managed in the environmental, social and economic interests of the State.*

Under the provisions of the SEPP, the clearing of native vegetation is to be carried out only with the development consent of the Director General of the Department of Land and Water Conservation except in certain circumstances, one of which is where less than 2 hectares per annum is to be cleared. "Clearing" of native vegetation means directly or indirectly:

- killing, destroying or burning native vegetation;

- removing native vegetation;

- severing or lopping branches, limbs, stems, or trunks of native vegetation; or

- substantially damaging native vegetation in any other way, but does not include sustainable grazing.

In determining a development application, the consent authority must take into consideration the likely social and economic consequences, for the applicant for the development consent and for the locality, region and State, of granting or refusing to grant the development consent. Despite the other provisions of this Policy, if the development that is the subject of a development application under this policy:

- *is on land that is, or is part of, critical habitat; or*
- *is likely to affect a threatened species, population or ecological community, or its habitat,*

The application for development consent must be determined in accordance with the procedures specified in sections 77A-77C of the EP&A Act 1979.

3.2 REGIONAL PLANNING

3.2.1 Hunter Regional Environmental Plan No. 1, 1989 (HREP)

The HREP provides both a policy framework and a strategy for development in the Hunter Region over a 20 year period. The Hunter Region incorporates most of the catchments of the Hunter and Manning rivers and the coastal waterways of the Myall, Wallis Lake, Port Stephens and Lake Macquarie areas.

The HREP planning strategies concerning mineral resources and extractive materials state that consent authorities should:

- *manage mineral resources and extractive materials to ensure that adverse impacts on the environment and population are minimised;*
- *ensure that development proposals for land containing mineral resources and extractive materials are reviewed in relation to the potential problems of rendering those resources unavailable; and*
- *ensure that the impacts associated with the transportation of mineral resources and extractive materials will be minimised.*

The HREP seeks to ensure that suitable land is provided in an efficient and economic manner to cater for the growth of the Hunter Region. The priority of the government is to establish a secure resource base for the continuing development of infrastructure to service new growth areas. The proposal is consistent with these long-term goals as it will contribute to the supply of materials necessary for the development of infrastructure in the Taree and surrounding areas.

3.2.2 *Hunter Coastal Urban Settlement Strategy (HCUSS)*

The HCUSS has been prepared to ensure that urban growth in the Hunter coastal area is planned and managed in a responsible manner which is environmentally and economically acceptable to the community.

The HCUSS requires Councils to protect mineral resources and extractive materials, which are important for construction/building purposes and for future urban expansion.

The extraction of mineral resources and extractive materials should only occur after detailed environmental assessment has been undertaken.

Greater Taree City Council has recognised that the extractive materials in the Possum Brush locality require protection from impacts of inappropriate development. Provisions for the protection of these resources are included in Greater Taree Development Control Plan 1995 which is discussed further in Section 3.3.2.

3.3 LOCAL PLANNING

3.3.1 *Greater Taree Local Environmental Plan 1995*

The subject site and its surrounds are zoned *Rural 1(a)* under the provisions of the Greater Taree Local Environmental Plan 1995 (LEP 1995). This zone generally encourages the agricultural use of land and extractive industries are permitted with the consent of Council.

Under LEP 1995, the Council must consider a number of issues when assessing development applications for extractive industries. These issues are:

- *rehabilitation of land;*
- *removal of waste material and refuse;*
- *secure public safety in the surrounding area; and*
- *protection of the amenity of the locality.*

3.3.2 *Greater Taree Development Control Plan 1995*

Greater Taree Development Control Plan 1995 (DCP 1995) aims to achieve consistent control of development on land that is covered by the provisions of LEP 1995. It contains specific requirements related to various types and locations of proposed development.

DCP 1995 identifies a buffer area which surrounds the Possum Brush Quarry. The DCP states that for a development application for land within the buffer area, Council shall consider:

- *the environmental conditions within the buffer area and any hazards likely to be encountered by the proposed development;*
- *the likely risks to persons proposing to reside or be employed in the proposed development;*
- *the nature and intensity of the proposed development; and*
- *the likely influence of the proposed development on the continued operation or potential future of any development or activity within the buffer area.*

The purpose of the buffer area is to provide protection of the extractive resources that exist in the Possum Brush locality by ensuring that landuse conflicts do not occur as a result of new development.

3.3.3 *Other Guidelines and Policies*

A number of guidelines and policies apply to development of sensitive lands on or near the coast including the *Coastline Management Manual, Floodplain Development Manual, Estuary Management Manual* and *Guidelines on Public Works Requirements for Sand and Gravel Proposal In or Near Estuaries.* Due to the nature and location of the proposed development, these guidelines and policies are not directly relevant to the proposal.

Chapter 4

ENVIRONMENTAL PERFORMANCE OF EXISTING OPERATIONS

4.1 EXISTING ENVIRONMENTAL PERFORMANCE

Past and present environmental performance of the quarry was determined through review of the previous EIS and current development consent conditions, examination of complaints made to Greater Taree City Council, investigation of matters raised during the community consultation meeting, consultation with the EPA and site examination by ERM Mitchell McCotter.

4.2 WATER QUALITY

In 1995 a complaint was made to both the EPA and Greater Taree City Council from an adjoining landowner in regard to the impacts of the quarry upon a dam located on an adjoining property that is currently used for agricultural pursuits. The landowner claimed that:

- during high rainfall events, highly turbid water is discharged from the quarry sedimentation dams and enters the farm dam thus reducing the water quality of the dam; and
- since quarry operations have commenced the farm dam has experienced reduced water supply.

Both of these issues have been investigated by the EPA. Those investigations found that a new road had been constructed on the quarry property and was unstable and eroding during wet weather. The EPA issued a pollution control notice requiring the road to be repaired. The proponent promptly complied with the notice and deposition of eroded material on the adjoining property has ceased.

A second notice was also issued by the EPA which attaches further conditions to the pollution control licence requiring annual inspection and reporting of the drainage lines of the study area or inspection when rainfall in any 24 hour period exceeds

50 mm. Quarry management keeps written and photographic records of each inspection.

During a site visit by the EPA some clouding of the water contained in the sedimentation dams was apparent. The EPA has suggested that colouration of water discharging from the sedimentation dams is not an accurate indicator of the level of suspended solids in the dam. Evidence at the dam site on the adjoining property indicates that erosion adjacent to the dam is a more likely cause of any siltation problem.

According to the conditions of consent, the developer is to ensure that the level of suspended solids in the overflows from sedimentation dams will be less than 50 mg/L. Sample analyses of sedimentation dam water have determined that the level of suspended solids in the overflows does not exceed 50 mg/L and consequently the addition of flocculant materials to reduce turbidity is not necessary.

The EPA has acknowledged that the issue of controlling turbid water is a widespread and technically difficult issue. In the short term, for operations holding an EPA licence, sedimentation control, clean water diversion, runoff detention and maximum water reuse are primary aims. Conditions have been added to the pollution control licence to require regular inspection of water pollution control facilities.

In regard to the concern of reduced water supply of the farm dam, the opinion of the EPA is that further requirements for additional sediment control ponds at the quarry will lead to the detention of upper catchment runoff and subsequent further reduction in water supply of the farm dam. Proper sediment management controls at the quarry are necessary to ensure that water quality of the dam, and downstream watercourses is protected.

Since the initial complaints, the EPA has undertaken three site inspections and has indicated that it is satisfied that the environmental performance of the quarry has improved significantly and that the quarry operator is meeting EPA requirements with respect to water management.

Since the initial complaint quarry management has made an open offer to assist with improvements to the dam. The owner of the dam has just recently had the siltation in his dam cleaned at the Quarry's expense and on last contact the owner was happy with the result.

4.3 LANDSCAPING AND REHABILITATION

Some local residents have expressed concerns that Block A has not been rehabilitated in accordance with the approved rehabilitation plan.

In the early stages of the development, unfavourable weather conditions were the primary factor responsible for delays in planting and subsequent rehabilitation of the upper benches. The change in management of the quarry about five years ago has seen a greater emphasis placed on successful landscaping and rehabilitation of the quarry to represent the intentions of the original development consent. As discussed in section 2.9, quarry management has intensified its rehabilitation efforts through the implementation of a number of initiatives, including:

- installation of an irrigation system to encourage quick growth during plant establishment stage;
- involving a horticulturist employed by an associated company of Pacific Blue Metal to gather and propagate seed from naturally occurring native species found on the site which are returned to Possum Brush Quarry for immediate planting; and
- increased monitoring of rehabilitation sites including the soil moisture status by both quarry management and by the horticulturist during site visits.

There has been a marked improvement in the success of the revegetation program over the past 12 to 24 months.

4.4 AIR QUALITY

The main concern regarding air quality impacts from the quarry operation is dust emissions. Complaints have been made to the GTCC by local residents concerning dust generation.

Compliance with conditions 24 and 25 of the quarry consent has been questioned by the complainants. Condition 24 states that *"the developer shall retain a water cart on site and shall keep damp any surfaces generating dust"*. Condition 25 states the *"water spraying apparatus shall be installed in conjunction with the processing plant to eliminate the emission of dust during processing"*.

Inspection revealed that the quarry has stockpile water spray systems and fine mist sprays systems at the significant dust generation points of the crushing plant. A 4,000 gallon capacity water cart for spraying hardstand areas was also in operation.

The pollution control licence for the quarry requires that raw material and product stockpiles and handling areas be maintained at all times in a condition which minimises wind blown or traffic generated dust. As late as November 1996 the EPA has advised that it is satisfied the quarry is meeting EPA air quality requirements.

The issue of dust and air quality management is discussed further in Section 5.4.

4.5 NOISE AND BLASTING

4.5.1 Quarry Noise

Complaints to Greater Taree City Council have expressed the opinion that the general noise levels from the quarry exceed the limits of the development consent. Residents were also concerned about noise from the quarry telephone bell. The volume of the external quarry telephone bell has been turned down and other arrangements made for incoming calls.

i. Relevant Consent Conditions

Current consent conditions (31 July 1987) relevant to quarry noise emissions are numbers 27, 40, 49 and 50.

Condition 27 specifies quarry operation noise level limits for surrounding residences and transport noise limits. The wording of condition 27 implies the operational noise limit to be a maximum noise level (L_{max}). This is unusual for developments of this type. It is common for an L_{10} noise level limit (the noise level exceeded 10% of the time) to be specified rather than L_{max}. The Environmental Noise Control Manual (EPA, 1994) recommends that the loudness at a particular location of noise from premises, plant and equipment should be characterised by the L_{10} descriptor. We consider that the intention is to use the L_{10} criteria, and that incorrect terminology has been used in the wording of the condition.

Condition 27 limits quarry truck noise to 52 dB(A) L_{eq} for the O'Brien residence and 50dB(A) L_{eq} for the Maguire and Allen residences on Possum Brush Road. These levels were calculated and presented in the original quarry EIS as those likely to result from quarry traffic.

Condition 40 specifies maximum sound pressure levels at 7 metres for equipment to be used at the quarry for the purpose of or in conjunction with the extraction and crushing of rock (excluding delivery trucks). Whilst actual plant items are specified, condition 40 allows the use of similar plant items provided the listed sound pressure levels at 7 metres are not exceeded.

Condition 49 specifies that '*the drill rig is to be covered by a sound box when in use*'.

Condition 50 required a two metre high bund be constructed along the northern edge of the haul road above the processing plant as specified in the report prepared by Renzo Tonin and Associates Pty Ltd (Tonin, 1986). The bund was specified for noise control.

ii. Measured Quarry Noise Emissions

Noise monitoring was conducted on 23 September 1996 with the aim of quantifying received levels of quarry noise at nearby residences. Timing of measurements was such that the quarry was in full production during monitoring. Monitoring involved measuring noise levels at the McCudden and McLaughlan residences over 15 minute periods using a Bruel and Kjaer Type 2231 precision sound meter.

It should be noted that a consent condition limit is not specified for the McLaughlan residence, however, it is situated between Lucas (35 dB(A)) and Bignall (33 dB(A)) so it would be reasonable to assume a limit of 34 dB(A).

Data gathered during monitoring is the result of many sounds reaching the sound level meter microphone during monitoring. Notes as to the received levels from various noise sources were made during monitoring. Particular attention was paid to the extent of the quarry's contribution, if any, to measured noise levels. Where possible, an estimate was made of what would be the quarry's L_{10} noise level at the receptor location in the absence of any other noise sources.

The estimated quarry noise L_{10} was higher than the consent condition 27 limit at the McCudden residence (3 dB(A) exceedance) and the interpolated limit derived for the McLaughlan residence (between 1 dB(A) and 3 dB(A) exceedance).

These exceedences are considered minor. The EPA in its letter of 26th November 1996 (see *Appendix A*) advised it is satisfied the quarry operator is now meeting EPA requirements with respect to the management of noise pollution on the premises. Quarry management is taking steps to reduce the quarry operational noise levels received at nearby residences to comply with consent conditions.

iii. Quarry Traffic Noise

Noise logging was conducted at the Perkins residence, which is close to Possum Brush Road between the quarry access road and the Pacific Highway. This monitoring was undertaken over the period of seven quarry working days. The average L_{eq} measured during the hours of 7:00 am to 5:00 pm was 51.8dB(A) free field, or 54.3 dB(A) when corrected to simulate facade reflection (in accordance with EPA recommendations). The measured L_{eq} included all noise sources and not just quarry traffic, however the average measured level is below the EPA recommended 55 dB(A) criterion.

iv. Measured Plant Power Levels

Plant power levels (of plant currently operated on site) were determined by direct measurement on 9 June 1993 and 26 July 1996. The sound power levels for two of the front end loaders were in excess of the interpreted consent condition 40 limit by 3 and 5 db(A) respectively. Quarry management advises it has taken steps to reduce sound power levels for those items of equipment to comply with the consent conditions.

v. Noise Control Bunding

Rather than construct the noise control bund, the processing area was extended further into the southern ridge behind the Block A quarry pit. This provided topographic screening of the upper section of the haul road where the dump truck unloads extracted material and the front end loader loads the hopper to the processing plant. The product stockpiles are also located along the northern edge of the process area and along the access road from the process area to the secondary stockpile area. This provides an almost continuous acoustical screen of up to six metres high.

vi. Drill Rig

Sound boxes are specifically designed for fitment to pneumatic (air track) drill rigs to muffle compressed air streams. Sound boxes are not fitted to hydraulic drill rigs. The quarry utilises hydraulic drill rigs for blast hole preparation.

A detailed noise assessment for the proposed extension to quarry operations is presented in Section 7.1.

vii. Hours of Operation

Both GTCC and the EPA have received complaints that the quarry has been operting outside the stipulated hours of operation. The EPA have investigated these complaints and have advised in its letter of 26th November 1996 (see *Appendix A*) that it is satisfied the quarry operator is meeting EPA requirements with respect to hours of operation.

4.5.2 Blasting

Council has received numerous complaints over the life of the quarry regarding blasting at the quarry site. The EPA received five complaints relating to one blast incident in 1996. Blast noise (according to some residents) appears to travel along Possum Brush Road, affecting some residents more than others. Blasts are said to vary in intensity from one blast to the next.

Consent condition 13 specified a blast overpressure level limit of 115 dB(Lin) and a ground vibration limit of 5 millimetres per second (resultant peak particle velocity). These limits are applicable for any dwelling house existing at the date of consent. The quarry's EPA licence specifies the same conditions.

A production blast was monitored by ERM Mitchell McCotter near the McCudden residence on 5 August 1996. Overpressure from three production blasts was measured by a blast contractor during 1993. These measurements were made in proximity to the blast and extrapolated to provide values for the McCudden and McLaughlan residences. Additionally the ground vibration was measured close to the blast for one blast (2 July 1993) and the measured value extrapolated to provide a calculated peak particle velocity for the McCudden residence. Two blasts (A and B), 13 June 1984, were monitored by P B Scrivner Consulting at the McCudden, Gaunt, Maguire, Lucas and McLaughlan residences.

Blast monitoring results are presented in *Table 4.1*.

Table 4.1 MEASURED BLAST VIBRATION (MILLIMETRES PER SECOND) AND OVERPRESSURE (dB(LIN))

Date of blast	Residence	Ground Vibration	Overpressure
5 August 1996	McCudden	0.229	110.74
2 July 1993	McCudden	0.09*	107.5*
2 July 1993	McLaughlan	Not measured	105.5*
18 May 1993	McCudden	Not measured	104.5*
18 May 1993	McLaughlan	Not measured	102.5*

Table 4.1 MEASURED BLAST VIBRATION (MILLIMETRES PER SECOND) AND OVERPRESSURE (dB(LIN))

15 January 1993	McCudden	Not measured	94.4*
15 January 1993	McLaughlan	Not measured	92.5*
13 June 1984 (A)	Maguire	0.08	Not measured
13 June 1984 (A)	Gaunt	Blast not detected	Blast not detected
13 June 1984 (A)	Lucas	Not measured	105.0
13 June 1984 (B)	McCudden	0.185	Not measured
13 June 1984 (B)	McLaughlan	Blast not detected	101.0
13 June 1984 (B)	Lucas	Not measured	108.0

Notes: *1. * extrapolated from measurements in proximity to the blast.*

As indicated in *Table 4.1* the measured or extrapolated blast vibration and overpressure were relatively minor and well within EPA and consent condition limits.

Blasting at the quarry is undertaken by an independent contractor. The blast design is based on bench height, volume of material required and occasionally on bench alignment or geological imperfections (often a safety consideration). As all blast holes are delayed, the effect of a blast on vibration and overpressure is generally attributed to the mass of charge in a single hole. The mass of charge in blast holes at the quarry has been fairly minor (< 80 kg), which under normal blast conditions would not produce exceedances in EPA criteria at the nearest residence (> 1000 metres). Higher levels of overpressure can be experienced when the blast design incudes shallow blasts to clean up bench alignment or geological imperfections or when blasts have to proceed in unfavourable weather conditions due to safety precautions. According to quarry management, blast problems are rare, perhaps a couple of times per year.

Since 1993 quarry management has informed Council that it is willing to locate a blast monitoring device at the residence of any complainant should it be requested by that resident. To date no request for blast monitoring has been received by quarry management.

The issues of quarry noise and blasting impacts of the proposed expansion are discussed further in Section 7.1.

4.6 VISUAL

At the community consultation meeting, the visual impact of the quarry was considered by residents to be a significant issue. Greater Taree City Council has recorded no written or verbal complaints about the visual impact of the quarry.

According to residents the three metre bund wall that was provided to the north of the excavation area prevented unsightly views of the quarry. This was a temporary bund that has since been removed and replaced with another bund lower down the quarry face to allow further extraction from Block A as required under the extraction sequence nominated in the development consent.

Although rehabilitation of the upper benches has proved to be more successful in the last 12 to 24 months, areas of the upper quarry faces are visible from a number of locations along Possum Brush Road. These faces will not be significantly shielded until the canopy of vegetation planted on benches below provides a thicker screen. Over time the rehabilitation program should be effective in improving the visual impact of the quarry commencing on the upper benches and gradually down the southern quarry face.

Local residents have stated that views of trucks using the access road are clearly evident from nearby dwellings. The development consent included the requirement that a bund wall be constructed along the northern edge of the access road for control of noise from transport trucks should the EPA deem it necessary for the issuing of a pollution control approval or licence. The bund construction was not required by the EPA for noise control.

The proposed expansion of the quarry includes the establishment, in the early years, of small replanted benches along the near surface route of the final access and quarry haul road, in order to ameliorate views of quarry vehicles from land to the north.

The issue of visual impact of the quarry is discussed further in Section 7.2.

4.7 TRANSPORT AND TRAFFIC

At the community consultation meeting there was some concern expressed by residents about:

- trucks failing to stop at intersections;
- inadequate sight distances at the intersection of Possum Brush Road and the internal access road;

- trucks swerving to miss bad sections of pavement on Possum Brush Road; and

- the danger caused by passing trucks to pedestrians walking along Possum Brush Road and school children waiting for buses at the intersection of Possum Brush Road and the Pacific Highway.

A submission has also been made to Greater Taree City Council by a local resident expressing concern about the speed at which trucks enter Possum Brush Road from the access road.

A stop sign has been erected at the intersection of the access road and Possum Brush Road to ensure trucks have a legal obligation to stop prior to entering Possum Brush Road. Possum Brush Quarry's code of practice for haulage contractors requires them to stop at the intersection. The stop sign is located back from the intersection which allows the trucks to enter Possum Brush Road on a curved radius. Consequently, passing traffic may not see trucks stopping at the intersection. Pacific Blue Metals has recently completed the construction of a truck arrester bed at the end of the access road such that in the event of a malfunction a truck will not have to enter Possum Brush Road prior to an emergency stop.

Sight distances for the intersection of Possum Brush Road and the quarry access road are currently inadequate. Design sight distances for this intersection have been obstructed by regrowth of roadside vegetation. Quarry management has requested Council to attend to this problem as part of its road maintenance program.

In certain locations the width of shoulder on Possum Brush Road is likely to be inadequate in respect of provision for non-vehicular traffic or room for a vehicle to pull off the road without impeding traffic flow. Possum Brush Road, originally a rural gravel road, has been reconstructed and sealed between the Pacific Highway and the quarry access road at the quarry's expense in order to accommodate heavy vehicle traffic and improve road safety for all road users. Quarry management has maintained ongoing consultation with GTCC regarding improvements to Possum Brush Road. Specific outcomes have included better signage indicating heavy vehicle use, centre lines and repair of pavement. Pacific Blue Metal has continually offered to provide to Council material for shoulder construction and repair of Possum Brush Road east of the quarry access road intersection.

The issue of school children awaiting buses at the intersection of Possum Brush Road and the Pacific Highway is one to be resolved by Council. The danger to children is caused by the lack of provision of appropriate bus stops on the both the northbound and southbound carriageways of the Pacific Highway. Nevertheless, the applicant has offered to provide material for construction of an area for children to await buses at this intersection.

There has been one accident on Possum Brush Road involving quarry traffic since the quarry commenced operation. One of the haulage contractors lost control of his vehicle just to the east of the access road intersection. The accident was allegedly caused by a diesel spill on the road. No other vehicles were involved in the accident.

Possum Brush Quarry's code of practice for haulage contractors requires haulage contractors to observe all road rules and abide by a 70 km/h speed limit on Possum Brush Road and a 40 km/h speed limit on the access road as a condition of employment.

Traffic issues are discussed further in Section 7.6.

Chapter 5

INTERACTIONS WITH THE PHYSICAL ENVIRONMENT

5.1 CLIMATE

Meteorological data has been compiled from the nearest official meteorological station at Taree, approximately 25 kilometres from the study area. The Taree district is located in the sub-humid temperature zone where the climate is influenced by topography, latitude, the local differences in altitude, the proximity of the ocean and the effect the ocean has on temperature and precipitation patterns.

5.1.1 Rainfall and Evaporation

Mean annual rainfall of the area is 1183.9 millimetres. Rainfall is seasonally distributed with a late summer/early autumn peak. February and March are the two wettest months, with a mean monthly rainfall of 138.4 and 149.3 millimetres respectively. Rainfall is least from July to September with the lowest mean monthly rainfall being 36.5 millimetres in August. In winter the westerly influences bring most of the rain. The annual rainfall distribution characteristics are illustrated in *Figure* 5.1.

Mean daily pan evaporation rates range from 1.8 to 2.8 millimetres per day during the winter months, increasing to between 5.3 and 6.2 millimetres in summer.

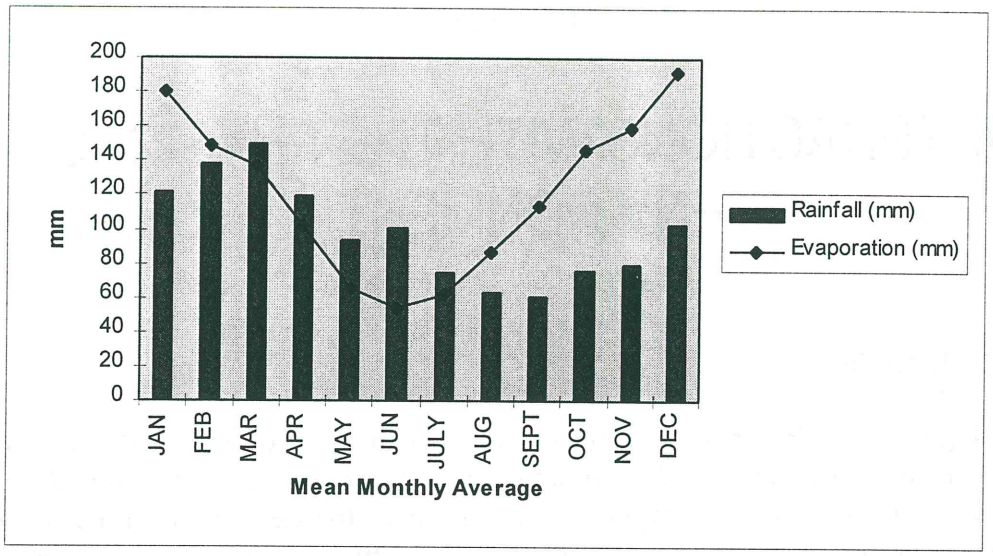

Figure 5.1 ANNUAL RAINFALL DISTRIBUTION

5.1.2 Temperature

Figure 5.2 shows the mean daily temperatures recorded at Taree. The highest temperatures are reached in December, January and February, when the mean maximum temperatures are 28.3°C, 28.8°C and 28.4°C respectively, while the mean minimum temperatures of these months is approximately 17°C. The lowest maximum temperatures are recorded during July, with the mean being 18.3°C, while the lowest mean minimum temperature is recorded in July when it reaches only 5.8°C.

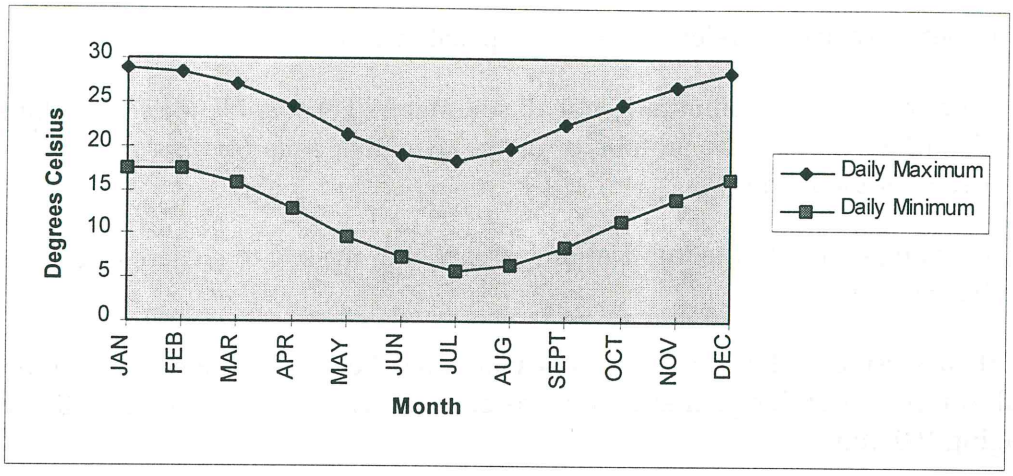

Figure 5.2 MEAN DAILY TEMPERATURE

5.2 SOILS, LANDFORM AND EROSION

5.2.1 Topography and Landform

The study area can be divided into two main topographic units: the flat to gently undulating and the steep hilly terrain.

The lowlands have primarily been cleared of vegetation and have previously been used for cattle grazing. The slopes in this area are gentle, with gradients as low as two per cent.

The topography of the land between the quarry development and Possum Brush Road adopts a more gradual gradient with gullies and spurs extending down to create undulations interspersed with tall timbered outcrops. The quarry area forms part of the northern face of a steep ridge formation which is the southern limit of the Bungwahl Creek Catchment. The Kiwarrak State Forest generally extends across the slopes of the northern side of the valley of the Bungwahl Creek around to the western flank of the study area to link up with the heavily timbered ridge which embraces the study area.

The remainder of the study area is composed of vegetated hilly terrain, which consists of interlocking steeply sloping valleys and ridge tops, with gradients up to 74 per cent.

5.2.2 *Soils*

Soil parameters which are relevant to the proposal include:

- suitability for rehabilitation - not all soil material is suitable for rehabilitating disturbed areas. The suitability of the available soils for this purpose has been assessed; and

- erosion potential - the implications of exposing the soil to erosive forces have been examined.

After site assessment, the soil on the study area has been determined to have little agricultural potential due primarily to slope constraints and very shallow soil cover (averaging 100 mm).

The brown silty loam topsoil layers were found to be only moderately suitable for rehabilitation due to the amount of stones throughout the profile. The topsoil can be used for revegetation purposes subject to:

- *depth of stripping*: generally only the surface soil to a depth of 100 mm is suitable for direct transfer to rehabilitation areas. Soil below this is less suitable and may require additional treatment to increase its organic matter content and nutrient status prior supplementing the topsoil stocks.

- *stockpiling:* the structure of the strippable topsoil material, while good in a natural state, is often dependent on the existing root mass holding the solum together. Therefore, it will be necessary for this organic matter to be retained within the soil during the stripping operation and for stockpiled materials to be sown with suitable cover crops to reduce the leaching of nutrients, and to enhance the retention of organic matter and the subsequent binding effect of the root mass.

Field observations have concluded that soils within the study area are stable with a low to moderate erosion potential.

5.2.3 *Contamination Potential*

After site examination it has been determined that the potential for contamination to occur on the proposed quarry site is minimal. However, appropriate bunding of the diesel storage tanks (bunded area to be capable of holding 110% of the largest tank), located within Block B, needs to take place in addition to replacing the current earth floor with a concrete floor, thus minimising the potential for contamination.

5.3 SURFACE AND GROUNDWATER

The study area is located in the upper headwaters of Bungwahl Creek which receives run off waters from the catchment and discharges into the Wallamba River at a point two kilometres downstream of Failford (approximately 11 kilometres from the study area).

5.3.1 Surface Waters

A network of gullies within the study area provides a surface drainage system to Bungwahl Creek. Three sedimentation ponds exist, two within the quarry area whilst the third is located at the foot of steeper slopes of the study area. Overflows from the latter pond provide water for stock on a neighbouring property. Water storage dams for stock have also been developed on adjoining land.

The sedimentation ponds are operated under the existing development consent and already collect runoff from the majority of Block B to be disturbed. Runoff from a small portion at the western end of Block B (under one hectare) currently flows to a gully that does not feed the lower sedimentation pond. Following development of this portion of the quarry runoff will be directed to the existing sedimentation controls.

5.3.2 Groundwater

Groundwater analysis has previously been undertaken for the previous EIS by KR Steggles and Associates Pty. Ltd, 1986. Drilling carried out on the site resulted in groundwater being encountered in five of the test drill holes at 45m, 25m, 14m, 14m and 27m below ground level. It is likely this groundwater is the result of subsurface flows through jointing in the bedrock and not associated with any significant aquifers. Volume of such flows would be limited as the study area contains a hardrock deposit and is situated on a topographic high point.

The groundwater occurring at the quarry may be used to assist in the suppression of dust generated by quarry operations by producing a damp work area.

5.3.3 *Impacts and Mitigation*

i. Surface Waters

The main potential effects of the proposed development upon surface waters are to change water quality in downstream watercourses and/or to vary the volume of water discharged from the study area.

There are no process wastewaters generated by the quarry and the only potential change to downstream water quality would be generated by sediments leaving the quarry. Without adequate planning these sediments have the potential to increase turbidity in downstream waters, thereby increasing sedimentation.

Existing sediment and erosion control measures at the quarry have shown to be effective in controlling sediment movement. All runoff from disturbed areas due to the proposed expansion will be directed to the existing sedimentation ponds. The proposed extension will have no significant effect on water quality in downstream watercourses.

The proposed extension will result in only minor changes to the volume of runoff leaving the study area. Runoff from a small portion of Block B that normally flows west of the lower sedimentation pond before reaching Bungwahl Creek will be diverted to the sedimentation ponds. All overflows from the sedimentation pond system are within the Bungwahl Creek catchment.

ii. Groundwater

The only potential effect on regional groundwaters would be a loss of groundwater input from rainwater infiltration. Quarry operations would not prevent such infiltration occurring although there may be a decrease in the infiltration rate due to increased runoff from working areas of the quarry.

Currently intercepted subsurface flows are directed into the existing sedimentation ponds that overflow into the main gully downstream of Block A. This will continue for the proposed expansion, however, once the quarry becomes non self draining ie. floor level below 85m AHD, any excess subsurface flows above quarry demands will be collected in a sump and pumped into the main gully.

There will be no significant effects on regional groundwaters as a result of quarry operations.

5.4 AIR QUALITY

5.4.1 *Existing Air Quality*

The quarry is located in the Bungwahl Creek catchment, 12 kilometres from the coast. Because there is little intensive development in the region and the quarry is surrounded by bushland and rural environments, air quality in the locality of the study area is generally high. The predominant winds blow from the north-east to south-east in summer and the south-west to west in winter. No known complaints regarding dust deposition relating to the quarry operations have been received in the past four years. This indicates that the level of dust emissions from quarry operations has not caused a loss of amenity to surrounding residents.

5.4.2 *Emissions During Quarry Operations*

The primary potential impact on air quality due to the proposed extension would be from dust emissions which are mainly dispersed by wind. Potential sources of air quality degradation from the quarry include:

- blasting operations;
- dry excavation operations;
- exposed dry quarry and road areas; and
- topsoil stockpiles.

5.4.3 *Impacts and Mitigation*

Dust generation and air quality are not expected to significantly change from the current levels as all extraction operations would generally remain the same.

Emissions of dust from the quarry will be controlled by:

- the use of a water cart to dampen the haulage and access roads and working areas during dry periods;
- ensuring hydraulic rock drills are fitted with industrial exhaust extraction and control systems;
- avoiding, where possible, drilling or blasting or using dust extraction facilities during high winds; and

- prompt revegetation of exposed areas, bunds and topsoil stockpiles.

Short term episodes of increased dust generation may be encountered, especially in dry periods when winds blow above five metres a second. Typically these episodes would occur when winds originate from the west. Sensible management practices such as cessation of stockpile reshaping or dry crushing during periods of high winds after long dry periods will be implemented to limit episodic impacts.

5.5 BUSHFIRE

5.5.1 Methodology

Clause 65 of the Environmental Planning and Assessment Regulation 1994 sets down certain additional matters to be taken into consideration by a consent authority in determining a development application. Clause 65(e) (Gazetted in October 1994) advises that the Department of Bushfire Services' *Planning for Bushfire Protection* must be used when considering the impact of bushfire on proposed development under Section 90 of the Environment Planning and Assessment Act, 1979.

The Department of Bushfire Services approach considers both basic risks and additional factors related to human intervention, including:

(i) *Are bushfires known to occur in the area and if so, to what size and extent?*

(ii) *Do the shrubs and grasses that form the understorey of the vegetation communities and hence the fuel bed, regularly dry out and burn readily?*

(iii) *Is the vegetation pattern such that extensive (rather than localised) native forests, woodlands or grasslands are found in the area (ie is it continuous?);*

(iv) *Are any gaps in native vegetation filled with pine plantations or crops? Will these crops burn in the bushfire season? If so, with more or less intensity and with greater or lesser resistance to control than the native vegetation they have replaced?*

(v) *Has recent development had little effect on the existing bushfire pattern?*

(vi) *Where the general fuel loadings are low or locally discontinuous, are aspect and slope likely to worsen the behaviour of any resultant bushfire?* (DBS 1991).

This method does not attempt to assign degrees of risk, rather it directs emphasis towards the overall effect of fire behaviour and site characteristics.

5.5.2 *Risk Assessment*

The multi-factorial approach described above has been used to determine the risk to bushfire of the proposed quarry operations. Information relating to fire history and characteristics of the area have been obtained from Council's Fire Control Officer.

The relevant factors under the multi-factorial approach are discussed below:

i. Bushfire History

During typical bushfire weather, winds with a coastal influence cause the most problems. These winds are north-easterly and south-westerly winds. The study area is sheltered from westerly winds by the hills and range directly to the west (Rod Cox, *pers comm* 1996).

A private sawmill is located on the northern side of Possum Brush Road. This is a known ignition source which can cause problems in the vicinity of Kiwarrak State Forest to the north of the study area (Rod Cox, *pers comm* 1996).

Other known ignition sources in the region include private agricultural land to the west, where fire can escape into the timbered regions of Mount Talawahl (Rod Cox, *pers comm* 1996).

Based upon the above information, the fire related problems and known ignition sources of the region form a crescent or arc around the north and west of the study area.

The southern side of Possum Brush road, including the farm land and the timbered regions around the quarry, have not been the focus of a fire problem and are not known as an ignition source. The timbered area around the quarry does not have an immediate or short term fire history and the quarry has not caused a problem in this respect since it commenced operations in the 1980's (Rod Cox, *pers comm* 1996).

Accessibility to the timbered regions around the study area is good, with access along Possum Brush Road, Pipeclay Creek Road and various trails to the west and north west. The road into the quarry off Possum Brush Road also provides access to the site itself. There are a small number of trails within the timbered regions both in and around the study area which could be used for emergency fire purposes.

ii. Vegetation

The vegetation surrounding the study area to the south and west consists of Dry Schlerophyll Forest with Wet Sclerophyll forest and degraded rainforest in the

gullies. To the north-east is cleared pastureland extending to Possum Brush Road, north of which lies Kiwarrak State Forest. To the north west lies a small patch of cleared farmland beyond which lies more forest. Directly to the east are the same forest communities that lie to the south and west.

The main species of the forest communities include Grey Ironbark (*Eucalyptus paniculata*), White Mahogany (*E. acmenioides*), and Grey Gum (*E. propinqua*) with Tallowwood (*Eucalyptus microcorys*), Turpentine (*Sycarpia monilifera*) as well as other rainforest and eucalypt species dominating the gullies. The shrub cover varies from sparse on the tops of the ridges to dense on the slopes and gullies. Lantana (*Lantana camara*) forms part of this dense shrub cover. The species within the shrub layer are variable, with drier species on the ridges and saddles and wetter species on the more sheltered slopes (easterly aspect) and in the gullies.

iii. Surrounding Landuses

The study area is part of a pocket of native vegetation approximately 312 hectares in size. This large pocket of vegetation is surrounded on all sides by cleared farmland. The pasture land surrounding the pocket of vegetation has contributed to the fragmentation of native vegetation in the locality, and reduces the bushfire risk of the study area. However, approximately 500 metres north-west of the study area lies a patch of forest which links up to Kiwarrak State Forest approximately two kilometres to the north. This forest to the north-west forms a potential external source of fire.

5.5.3 Bushfire Hazard and Mitigation Measures

The discontinuous nature of native vegetation around the study area, particularly the cleared farm land lying between the Kiwarrak State Forest and the Talawahl Hill areas, has reduced the bushfire risk. Good access to the site and the low history of bushfire in the immediate area also indicate that the area is of a lower bushfire danger than the surrounding area to the north and west.

The dams located in the quarry working areas will provide a source of water to fight bushfire in the locality. In addition, dust suppression watering systems can be used to prevent the spreading of fire from quarry working areas to surrounding bushland.

No additional mitigation measures are considered necessary to protect surrounding bushland, or the quarry from the occurrence of bushfire.

Chapter 6

INTERACTIONS WITH THE BIOLOGICAL ENVIRONMENT

6.1 EIGHT PART TEST

The Threatened Species Conservation Act, 1995 (TSC Act) commenced on the 1st January 1996, and replaced the legislative scheme introduced by the Endangered Fauna (Interim Protection) Act, 1991. The TSC Act made substantial amendments to the National Parks and Wildlife Act, 1974 (NPW Act) and the Environmental Planning and Assessment Act, 1979 (EP&A Act). The new Section 5A of the EP&A Act, 1979 sets out eight factors to be considered in deciding whether there is likely to be a significant effect on threatened species, populations or ecological communities, or their habitats. If it is determined through the eight part test that the proposal would be likely to have a significant impact on threatened species a species impact statement is required. An eight part test has been undertaken and is attached at Appendix E.

The Brush-tailed Phascogale occurs on the site and the Sugar Glider would be highly likely to occur on the study site, and may experience habitat reduction up to 4.4 hectares because of the proposed quarry expansion. In addition to this, a Glossy Black Cockatoo was identified nearby the proposed extraction area by Debus in 1985 and a Rare Or Threatened Australian Plant (ROTAP) species, Rudder's Box, was identified on the eastern boundary of Block B. An additional four species of threatened fauna had been recorded within a ten kilometre radius of the quarry in similar habitat. It was therefore determined that the proposed quarry expansion may have a significant impact on a number of threatened species. Consequently, a Species Impact Statement (SIS) has been prepared for the proposal.

The SIS accompanies this EIS and forms part of the development application for the proposed quarry expansion. The SIS recommends a number of mitigation measures which should be undertaken in order to minimise the impact of the proposal on threatened species. **The SIS concludes that, provided the recommended mitigation measures are undertaken, the proposed quarry expansion would be unlikely to have a significant impact upon threatened species.**

This chapter outlines the methodology and findings of the SIS, and addresses State Environmental Planning Policies Numbers 44 (Koala Habitat Protection) and 46 (Protection and Management of Native Vegetation).

6.2 FLORA

The following section examines the flora of the study area. A more detailed examination is contained in the Species Impact Statement (SIS) prepared for this project.

6.2.1 Methodology

Investigations involved a review of relevant literature, reports and topographic maps and interpretation of 1:25,000 coloured aerial photographs. A National Parks and Wildlife data search for threatened flora was obtained for the Camden Haven and Bulahdelah 1:100,000 map sheets.

A field survey of the study area was undertaken on 29 February 1996. The purpose of this survey was to examine and describe the vegetation communities present in the study area. Vegetation communities in the study area have been described previously by Griffith in the EIS for the original proposal.

It was not the intention of the field survey to conduct a detailed flora survey as this already had been done for the original proposal, but rather to assess the potential of each vegetation community and fauna habitat to support native flora and fauna populations. Consequently, the flora survey was only opportunistic.

6.2.2 Vegetation Classification and Description

Vegetation communities were defined using the Specht method (Specht *et al*, 1981). Dominant stratum, dominant canopy and understorey species were recorded. Four main vegetation communities were observed. *Figure 6.1* illustrates the distribution of vegetation communities across the study area. The dry open forest covers the majority of the study area and can be found on the ridges and slopes. The depauperate rainforest is found in the sheltered gullies in the study area. A comprehensive list of flora found in the study area is given as an *Appendix* to the SIS. A general description of each of the five vegetation communities is provided below.

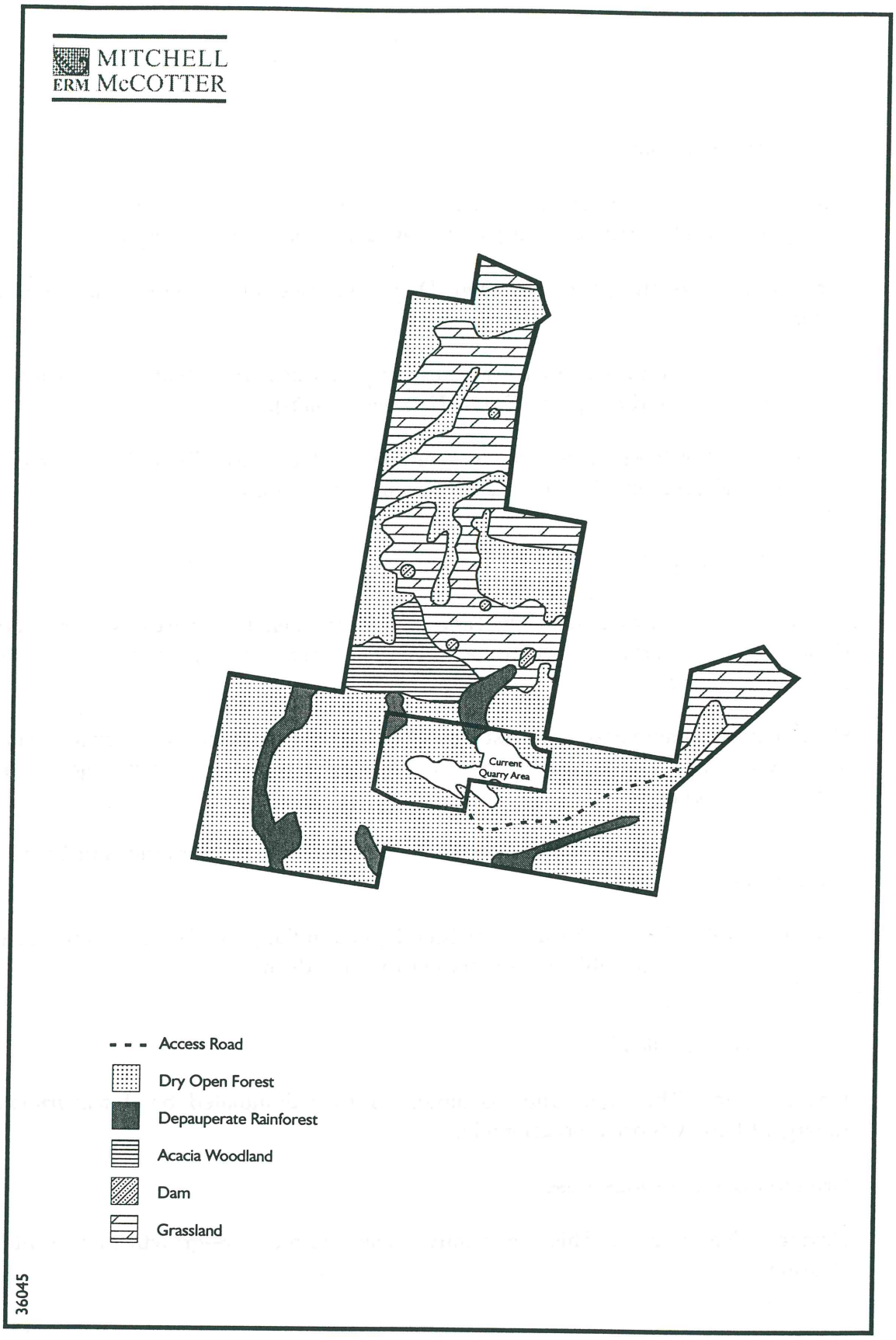

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Figure 6.1 VEGETATION COMMUNITIES

i. Dry Open Forest

Canopy Layer: Dominated by Grey Ironbark (*Eucalyptus paniculata*), White Mahogany (*Eucalyptus acmenioides*), and Grey Gum (*Eucalyptus propinqua*).

Shrub Layer: Wattle (*Acacia irrorata*), Dogwood (*Jacksonia scoparia*), and Lantana (*Lantana camara*).

Ground Cover: Dominated by Blady Grass (*Imperata cylindrica*), Mat Rush (*Lomandra longifolia*), *Poa sp.* and Kangaroo Grass (*Themeda australis*).

Degree of Naturalness: This area has been logged in the past. There is some recent clearing in association with exploratory blasting and drilling.

ii. Depauperate Rainforest

Canopy Layer: Dominated by Tallowwood (*Eucalyptus microcorys*), Brushbox (*Lophostemon confertus*), Turpentine (*Syncarpia glommulifera*), and Grey Gum (*Eucalyptus propinqua*).

Shrub Layer: Dominated by Forest Oak (*Allocasuarina torulosa*). Mesic species such as Brown Myrtle (*Choricarpia leptopetala*) and Brush Kurrajong (*Commersonia fraseri*) occur less frequently.

Ground Cover: This is variable over the study area. Heavy infestations of Lantana (*Lantana camara*) occur.

Degree of Naturalness: This area has been logged in the past. There is some recent clearing in association with exploratory blasting and drilling.

iii. Acacia Woodland

Upper Strata: This community is almost entirely dominated by *Acacia irrorata.* Emergent *Eucalypts* occur occasionally.

Ground Cover: Various grasses.

Degree of Naturalness: This community consists of recent re-growth as a result of clearing.

iv. Grassland

Description: This community is a disclimax community resulting from previous clearing of forest. It is dominated by grasses, a number of them being exotic pasture grasses. It varies from low to medium height.

Dominant Grass Species: This is highly varied over the study area.

Degree of Naturalness: This is a disclimax community resulting from clearing.

v. Quarry Pit

Ground Cover: Occasional patches of Blackberry (*Rubus ulmifolius*), Kennedia (*Kennedia rubicunda*), Hardenbergia (*Hardenbergia violaceae*) and Lantana (*Lantana camara*). Eucalypt seedlings also occur occasionally on the slopes.

6.2.3 *Likelihood of Rare or Threatened Plant Species*

After a review of all relevant literature, it was determined that 7 rare or threatened vascular plant species may occur within the study area due to the presence of suitable habitat.

Rudder's Box *(Eucalyptus rudderi)* was located during field investigations in the eastern portion of Block B. This species is listed by Briggs and Leigh (1988) as a ROTAP species (Rare or Threatened Australian Plant). The remaining 6 species that may occur in the study area include *Hibbertia hexandra, Thesium australe, Tetratheca juncea, Grevillea obtusiflora, Grevillea granulifera* and *Eucalyptus glaucina.*

6.2.4 *Assessment of Conservation Value*

The conservation value of vegetation communities has been determined by reference to the following criteria:

- *Representativeness* describes whether the vegetation communities are unique, typical or common in the immediate region and if the communities are presently held in reserves;
- the existence of *Threatened Species* would add to an area's conservation value. ROTAP species, species listed as threatened on Schedules to the TSC Act or species of special conservation significance may warrant protection;
- the *Degree of Naturalness* is used to indicate the extent of human influence and to identify the condition of the vegetation; and

- presence of *Special Natural Features* is used to indicate uniqueness in that unusual natural features may be present which may not be associated with a particular vegetation unit.

An assessment of the conservation values of the vegetation communities using the above criteria is discussed below.

ii. Representativeness

Kiwarrak State Forest contains approximately 13,110 hectares of dry sclerophyll forest, wet sclerophyll forest, depauperate rainforest, swamp forest, plantation and cleared land. Dry sclerophyll forest constitutes approximately 8,400 hectares, wet sclerophyll forest constitutes approximately 1,900 hectares, and depauperate rainforest constitutes approximately 140 hectares (Griffith et al, 1985).

iii. Existence of Threatened Species

One ROTAP species has been identified in the Dry Open Forest.

iv. Degree of Naturalness

All of the communities on site have either been disturbed or have a high prevalence of exotic plant species.

v. Special Natural Features

None of the vegetation types has been identified to contain special natural features which may contribute to the uniqueness of the vegetation communities. These vegetation types are likely to be better represented in Kiwarrak State Forest due to its non-commercial nature.

Table 6.1 VEGETATION CONSERVATION VALUES

Vegetation Communities	Representativeness	Rare or Restricted Species	Degree of Naturalness	Special Natural Features
Dry Open Forest	Abundant in the regions State Forests and National Parks and Nature Reserves.	*Eucalyptus rudderi* (Rudder's box) recorded in eastern section of Block B.	Highly disturbed in some areas as a result of clearing for exploratory blasting and drilling. Heavily infested with *Lantana camara* in sections.	No special natural features present.
Depauperate Rainforest	Known to occur in Kiwarrak State Forest. Unlikely to be widespread in the region.	No ROTAP or Threatened species recorded.	Disturbed in the past through clearing; heavily infested in sections with *Lantana camara*.	No special natural features present.
Acacia Woodland	A disclimax community, therefore representativeness is not relevant.	No ROTAP or Threatened species were recorded within this community.	This community was originally cleared to facilitate grazing. Now a disclimax community.	No special natural features present.
Grassland	This community is widespread throughout the rural areas of the region.	No ROTAP or Threatened species were recorded.	This is an un-natural community cleared for grazing.	Constructed dams present.
Quarry Pit	A disclimax community, therefore representativeness is not relevant	No ROTAP or threatened species recorded.	This is an unnatural community cleared for quarrying.	Constructed dams present, but contain no natural vegetation and are silty.

6.2.5 *Impacts and Mitigation*

Block A of the quarry has already been cleared, and some completed areas are being revegetated. The quarry operation in Block B will result in approximately 4.4 hectares of vegetation being removed from the Dry Open Forest community. One ROTAP species (Rudder's Box - *Eucalyptus rudderi*) occurs in this community. Rudder's Box occurs throughout Kiwarrak State Forest and also in Rudder's Box Flora Reserve No. 80014, 5km northwest of the study area. Therefore, the impact of removing this vegetation is likely to be relatively insignificant on a local and regional level.

Comprehensive details of the proposed mitigation measures for the quarry are outlined in the SIS and summarised in Section 8.1 of this EIS. The impact of the vegetation removal will be mitigated through revegetation of the quarry site. The current quarry pit has already been cleared and some completed areas have already been revegetated. Future revegetation will be accomplished using local species. Particular emphasis and effort should be placed on replanting Rudder's Box throughout the study area.

6.3 FAUNA

The following section examines the fauna habitats and fauna of the study area, particularly with regard to Threatened species as identified in the Threatened Species Conservation Act 1996 (TSC Act). A more detailed examination is contained in the Species Impact Statement (SIS) prepared for the proposed development.

6.3.1 *Preliminary Studies*

An initial literature review was undertaken, including compilation of fauna species lists and examination of previous fauna surveys in the region. The National Parks and Wildlife Service Atlas of Wildlife was consulted to obtain records. Vegetation types of the study area were mapped.

A field reconnaissance survey was undertaken on the study area, with each habitat being investigated by foot traverse and assessed as to its suitability for native wildlife. Factors considered in determining habitat quality were:

- the presence of habitat trees, their number and distribution;
- the likelihood of rare or threatened fauna species;
- the presence of dispersal and movement corridors; and

- the degree of disturbance.

6.3.2 *Fauna Survey*

A detailed fauna survey was conducted on the study area from the 9 September 1996 to 13 September 1996. An additional bat survey was undertaken by Greg Richards from 3 September 1996 to 8 September 1996. The surveys were designed to assess the fauna occurring in the study area. Survey sites were determined according to the broad vegetation types identified in the preliminary investigations and their likelihood of disturbance.

Table 6.2 lists the fauna surveys conducted on the study area.

Table 6.2 FAUNA SURVEYS

Taxon	Survey Method
Birds	Daylight counts, owl playback calls and spotlighting.
Small Ground Mammals	Elliott trapping and hair tubes.
Arboreal Mammals	Spotlighting, arboreal Elliott trapping, scat searches and hair tubes.
Large Ground Mammals	Scat searches, evidence of diggings and scratchings and hair tubes.
Reptiles	Habitat searches.
Amphibians	Habitat searches, spotlighting, call identification and triangulation.
Bats	Harp trapping, mistnetting and echolocation call recordings.

The fauna survey was not intended to be definitive, but was focused on sampling the range of taxon which may occur in the study area. The likely presence of Threatened fauna was determined primarily on the basis of habitat suitability.

The provision of habitat for native fauna species is directly related to the structure of the vegetation. The vegetation communities described in *Section 6.1* provide the basis for the description of habitats present in the study area. Some fauna utilise specific flora species (for example, the Koala), however, most fauna species cannot detect floristic differences within a community, choosing a habitat based on structural features, such as vegetation strata, density and height.

Four fauna habitats have been identified on the study area. These are Open Forest consisting of the Dry Open Forest and Depauperate Rainforest communities, Woodland, Herbland and Quarry Pit.

Fauna habitats of the study area are shown in *Figure 6.2* and are described below.

i. Open Forest

Vegetation Communities: Dry Open Forest and Depauperate Rainforest.

Structure/Habitat Elements: The canopy cover is 20 to 30 metres in height and consistently open. Occasional trees have hollows for arboreal mammals and birds. A small tree/tall shrub layer is scattered sparsely throughout this habitat type. The understorey varies from sparse to dense, but is mostly dominated by Lantana which is likely to have little value for native fauna. The ground cover varies from sparse to dense, providing shelter for ground dwelling fauna, while there is also a high number of fallen logs, branches and other debris.

Human Elements: Evidence of past logging with many young trees, old stumps and fallen logs. There is also evidence of cattle grazing with fences and tracks scattered throughout this habitat.

ii. Woodland

Vegetation communities: Acacia woodland.

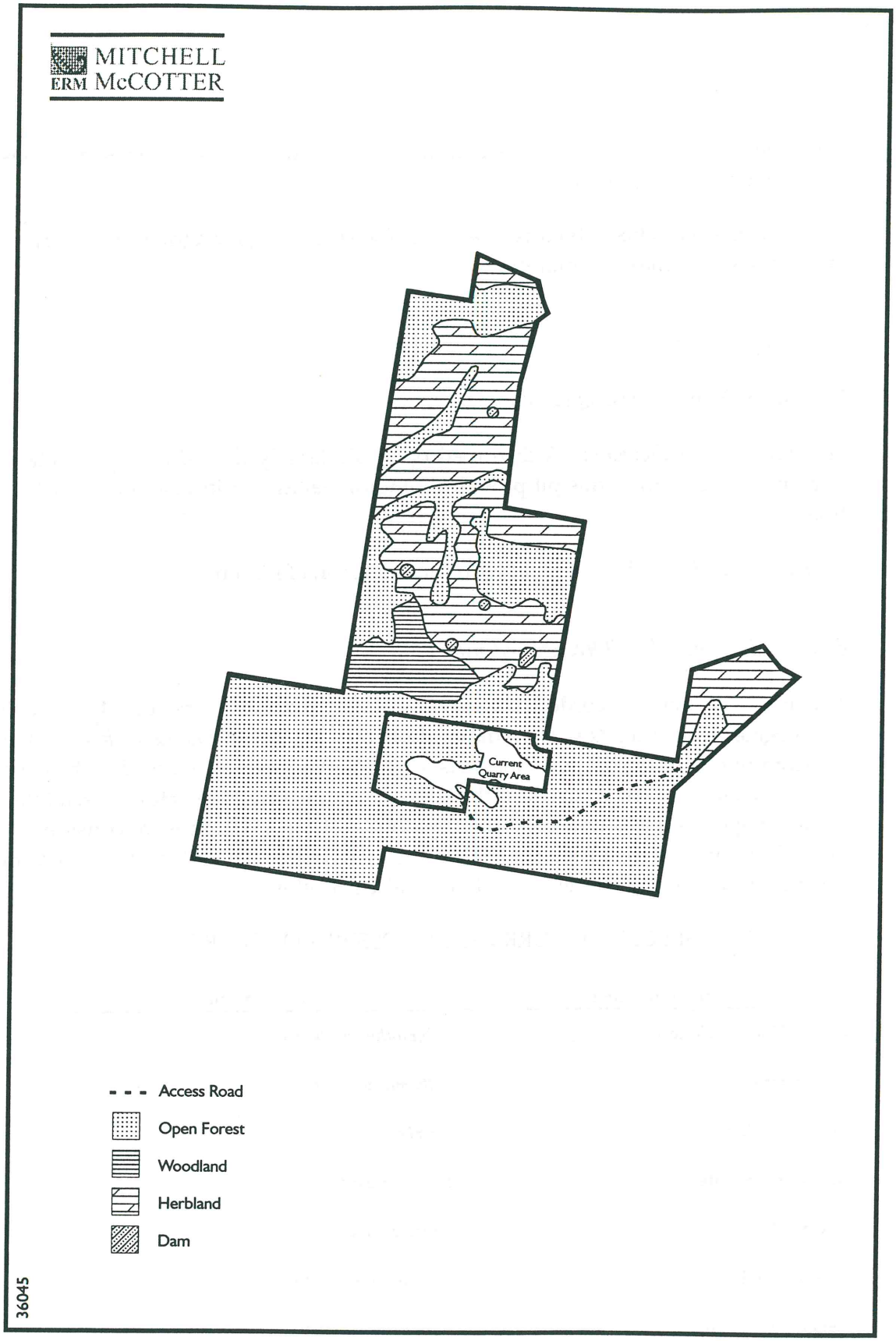
Structure/habitat elements: An open woodland to 6 metres in height. This community consists almost entirely of regrowth no greater than 6 years of age. An abundance of flowers provides a resource for nectivorous fauna, while gliders and possums may feed on the sap of Acacias.

Human Elements: The vegetation is generally in a healthy condition, although the community is grazed by domestic cattle.

iii. Herbland

Vegetation communities: Grassland

Structure/habitat elements: Open pasture containing sparsely scattered individual trees. The abundance of grasses and herbs in this community provides a suitable foraging resource for grazing animals. The denser areas provide suitable shelter for



Note: map is conceptual only

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Figure 6.2 FAUNA HABITATS

small birds and mammals. The abundance of seeding grass species provides a suitable food source for birds.

Human Elements: This habitat is a result of forest clearing for agricultural purposes, making it a disclimax community.

iv. Quarry Pit

Vegetation Communities: Quarry Pit

Structure/Habitat Elements: A disturbed open pit, largely devoid of any vegetation. The open space within this pit provides foraging habitat for insectivorous birds and bats.

Human Elements: A disturbed pit used for extraction of hard rock.

6.3.3 *Likelihood of Threatened Species*

Threatened species recorded during the field surveys were the Brush-tailed Phascogale (*Phascogale tapoatafa*), the Little Bent-wing Bat (*Miniopteris australis*) and the Common Bent-wing Bat (*Miniopteris schreibersii*). Debus also recorded the Glossy Black Cockatoo during a survey of the site in 1985 (Debus, 1985). However, a total of 21 fauna species listed under Schedules 1 and 2 of the TSC Act were considered as possibly occurring in the study area on the basis of habitat suitability or detection during survey. These species are listed in *Table 6.3* below.

Table 6.3 SPECIES OCCURRING OR POSSIBLY OCCURRING

Common Name	Species Name
Glossy Black Cockatoo	*Calyptorhyncus lathami*
Swift Parrot	*Lathamus discolor*
Turquoise Parrot	*Neophema pulchella*
Square-tailed Kite	*Lophoictinia isura*
Powerful Owl	*Ninox strenua*
Masked Owl	*Tyto novaehollandiae*
Regent Honeyeater	*Xanthomyza phrygia*
Tiger Quoll	*Dasyurus maculatus*

Table 6.3 SPECIES OCCURRING OR POSSIBLY OCCURRING

Common Name	Species Name
Parma Wallaby	*Macropus parma*
Common Planigale	*Planigale maculatus*
Brush-tailed Phascogale	*Phascogale tapoatafa*
Great Pipistrelle	*Falsistrellus tasmaniensis*
Eastern Little Mastiff Bat	*Mormopteris norfolkensis*
Yellow-bellied Glider	*Petaurus australis*
Squirrel Glider	*Petaurus norfolcensis*
Koala	*Phascolarctus cinereus*
Large Bent-wing Bat	*Miniopteris schreibersii*
Little Bent-wing Bat	*Miniopteris australis*
Greater Broad-nosed Bat	*Scoteanax rueppellii*
Stephen's Banded Snake	*Hoplocephalus stephensi*
Pale Headed Snake	*Hoplocephalus bitorquatus*

6.3.4 *Potential Impacts*

Five potential impacts upon fauna have been identified from the proposed quarry operations including loss of habitat, interference with faunal movements, traffic mortality, noise effects and direct blasting effects. Each of these potential impacts is discussed below.

i. Loss of Habitat

The clearing of native vegetation in Block B will result in a loss of habitat as either a foraging resource, or nesting and den sites. The clearing of native vegetation is not considered to constitute a significant impact upon the habitat of more mobile and/or widely ranging species such as the Tiger Quoll, Powerful Owl, Masked owl, Glossy Black Cockatoo or Bat Species. However, loss of habitat may impact upon populations of less mobile or sedentary species such as the Squirrel Glider, Parma Wallaby, Brush-tailed Phascogale, Common Planigale and the Koala. Clearing of

native vegetation may also result in direct mortality of hollow-dependent fauna whether highly mobile or not.

ii. Interference with Fauna Movements

The removal of vegetation from Block B is unlikely to directly affect the movement of species in the study area as it does not dissect any movement corridors.

iii. Traffic Mortality

The traffic using the internal access road may result in the mortality of fauna caused by collisions with vehicles. The species at most risk of collision include:

- larger animals, such as macropods, bandicoots, koalas and large reptiles;
- nocturnal hunting birds, such as powerful owls, masked owls, frogmouths and nightjars;
- ground birds including bowerbirds and lyrebirds;
- locally nomadic fauna or animals with large home ranges, such as quolls;
- arboreal mammals, including possums and gliders, which move from one area to another along the ground; and
- reptiles and amphibians, which either bask on the sealed road surface or cross the road in search of foraging habitat.

The impact of the internal quarry road is considered minimal as traffic will not be increasing in terms of operation hours or the number of trucks entering and leaving the quarry. The major incidents of traffic mortality are likely to occur in the clearing phase as fauna are displaced and may attempt to cross the internal road.

iv. Noise and Vibration

There is little relevant information pertaining to the effects of noise and vibration on Australian fauna, with the majority of published data referring to American or domestic fauna. However, it is considered that noise and vibration may further affect fauna already rare or threatened (Shaw, 1978).

Dufour (1980) reports that the main effects of noise on American wildlife are behavioural changes modifying mating, loss of food supply for predators, changes in specific relationships (predator/prey) and competition for shelter. The main reasons

these impacts occur are due to impacts on hearing, communication, non auditory physiological effects and behavioural changes.

There is evidence that some fauna become adapted to the presence of humans and their associated noise after an initial reaction of panic, fear and avoidance of the noise source (Busnel, 1978). The majority of vertebrates may eventually ignore the noise if other sensory organs, ie optical and chemical, are not stimulated (Busnel, 1978), which would be the situation at the quarry. Birds are especially known for ignoring loud noises designed to scare them from cropping areas. In general, studies indicate that birds, after becoming accustomed to high noise levels, have few, if any, strong reactions below 70 dB(A).

In consideration of the above information, it can be generalised that fauna may experience only limited effects of noise at L_{10} noise levels below 50 dB(A); some reaction between 50 dB(A) and 70 dB(A), especially during initial operations; and strong reactions above 70 dB(A).

Therefore, it can be expected that blasting would initially create panic and fear for fauna within at least one kilometre of Block B, most likely leading to evacuations of fauna from this area. However, it is likely that fauna will return to within 110 metres of the quarry as they become accustomed to the noise and vibration. Birds may also move closer to the quarry in between blasting events. In addition, bat species, the majority of mammal species, and some birds are nocturnally active, therefore blasting, wherever possible, should only be carried out only in daylight hours. These species may roost and shelter some distance from the quarry during the day, but use the area closer to the quarry for foraging purposes and/or part of a wildlife corridor.

v. Direct Blasting Effects

Blasting may also have the potential to cause an impact upon fauna through injury or death caused by flyrock. However, if the charge is set correctly and properly managed there should be no, or very minimal, flyrock resulting. This impact is therefore expected to be negligible on species survival. Direct blasting effects will be minimised due to all blasting occurring during daylight hours, as the majority of fauna species are nocturnal, sheltering under rocks or in hollows during the day.

6.3.5 *Mitigation Measures*

Comprehensive details of the proposed mitigation measures necessary to protect fauna are outlined in the SIS. The ameliorative measures which are to be

implemented to mitigate potential impacts of the proposed quarrying operation include:

- revegetation of the quarry which will be undertaken progressively wherever possible to minimise the impact of loss of habitat;
- speed limits of 40 kilometres per hour are to be imposed on internal roads to minimise road kills;
- wildlife crossing signs are to be erected to alert drivers that fauna may be crossing the road.
- blasting, quarrying and primary crushing are to be limited to daylight hours;
- a monitoring program is to be implemented on a yearly basis to determine the effectiveness of the mitigation measures, the suitability of the revegetation techniques used and any changes to the fauna assemblage of the area;
- timed clearing will be implemented to reduce direct mortality of hollow-dependent fauna; and
- habitat enhancement involving such measures as fencing off busland, baiting programs for cats and dogs, provision of nest boxes and the extermination of feral bees will be undertaken to increase the carrying capacity of bushland remaining in the study area.

These measures have been designed in consultation with NPWS, Northern Zone. They have been designed using the latest scientific information, specific to those species that are most likely to be significantly affected by the proposed development. Provided the suggested mitigation measures are implemented in a thorough manner and included in the Environmental Management and Site Rehabilitation Plan, it is considered that the proposed development will not contribute to the local extinction of any threatened species.

6.4 SEPP 44 - KOALA HABITAT PROTECTION

A field survey was undertaken to sample the subject site on 29 February 1996.

Results of the field survey clearly indicated that the study area does not form potential Koala habitat, as outlined by Clause 7 and Schedule 2 of SEPP 44. The potential Koala habitat assessment was based on tree species listed under Schedule 2 of SEPP 44.

Because the study area is not potential koala habitat, no further provisions of the policy apply to the DA.

The SEPP 44 investigations of the study area are detailed as an Appendix to the accompanying SIS.

6.5 SEPP 46 - PROTECTION AND MANAGEMENT OF NATIVE VEGETATION

SEPP 46 was gazetted and commenced operation on 10 August 1995 to regulate the clearing of native vegetation in NSW. It is not proposed that clearing operations will involve an area greater than 2 hectares in any one year and consequently a Development Application will not be required under SEPP 46.

Chapter 7

INTERACTIONS WITH THE HUMAN ENVIRONMENT

7.1 NOISE AND BLASTING

7.1.1 *Noise Criteria For Proposed Quarry Extension*

i. Derivation Of Extraction Noise Limit

Noise criteria for developments of this nature are related to existing noise levels. Therefore background noise level monitoring is required at locations around a proposed development that represent the acoustic climate/s of the area. This monitoring is generally undertaken with a noise data logger.

Because environmental noise levels vary with time, statistical descriptors are required to adequately characterise the noise environment. The L_{10} noise level is the level exceeded for 10 per cent of the time, and is approximately equivalent to the average of maximum noise levels. The L_{90} level is the level exceeded for 90 per cent of the time, and is approximately the average of minimum noise levels. The L_{90} level is often referred to as the 'background' noise level. The L_{eq} level represents the average noise energy during a measurement period.

A range of L_{90} noise levels is obtained from a data logger. In accordance with an EPA interim policy on background noise measurement, the assigned background noise level from the data range is the lowest repeated L_{90} value. Although the EPA has not formally defined lowest repeated, it is generally accepted that the 10 percentile value of the range (that level which 10 per cent of data is less than) can be considered the lowest repeated.

Noise from activities associated with quarry operations should be limited in accordance with guidelines in the NSW EPA's Environmental Noise Control Manual (ENCM) which apply to general industrial noise.

The EPA recommends that the L_{10} noise level emitted from a development should not exceed the existing background L_{90} level by more than 5 dB(A) at the boundary of a residential receptor. Also, the EPA recommends that a development should not raise background noise level by more than 5 dB(A).

In situations where background noise levels are already high, the EPA recommends maximum acceptable background noise levels which must not be exceeded. These are:

- rural and residential areas: 45 dB(A) daytime, 35 dB(A) night-time;
- residential area near an industrial area or busy road: 50 dB(A) daytime, 40 dB(A) night-time; and
- industrial areas: 65 dB(A) daytime, 65 dB(A) night-time.

If existing background noise levels are close to or above the relevant acceptable limit then a noise level limit for the development is derived in accordance with Table 20-1 of the ENCM, the contents of which are provided in *Table 7.1*.

Table 7.1 TABLE 20-1 OF ENCM

Background noise level	Noise level limit for development
Above relevant acceptable level	preferably 10 dB(A) below acceptable level, at least 10 dB(A) below existing level
At acceptable level	10 dB(A) below acceptable level
1 dB(A) below acceptable level	9 dB(A) below acceptable level
2 dB(A) below acceptable level	5 dB(A) below acceptable level
3 dB(A) below acceptable level	3 dB(A) below acceptable level
4 dB(A) below acceptable level	2 dB(A) below acceptable level
5 dB(A) below acceptable level	2 dB(A) below acceptable level
6 dB(A) or more below acceptable level	5 dB(A) above existing level

Dependent on the nature of a developments noise emission an L_{10} and/or L_{90} limit, derived in relation to existing background levels and EPA guidelines, will be appropriate criteria or criterion.

ii. Background noise level measurement

All monitoring was conducted in accordance with Australian Standard AS 1055 'Acoustics, Description and Measurement of Environmental Noise' and guidelines within the EPA's 'Environmental Noise Control Manual'.

The monitoring consisted of measuring noise levels on a continuous basis at three selected locations using noise loggers. Manned monitoring of noise levels was undertaken at two locations.

Weather data for the logging measurement periods were not available.

The following equipment was used to measure and record environmental noise levels:

- ARL EL215 noise data logger;
- Bruel and Kjaer Type 2231 Precision Sound Meter;
- Bruel and Kjaer Type 4155 Microphone;
- Bruel and Kjaer Type UA027 Windshield;
- Bruel and Kjaer Type BZ7101 Statistical Analysis Module.
- Bruel and Kjaer Type 4230 Sound Level Calibrator; and
- Sony WMD3 professional quality tape recorder.

iii. Measured Noise Level

The monitoring locations during this survey, and shown on *Figure 7.1* were;

- Coates residence (away from Pacific Highway);
- McLaughlan residence (away from Pacific Highway); and
- Perkins residence (in proximity to Pacific Highway).

A summary of noise logger data for the hours 7:00 am to 6:00 pm is provided below in *Table 7.2.*

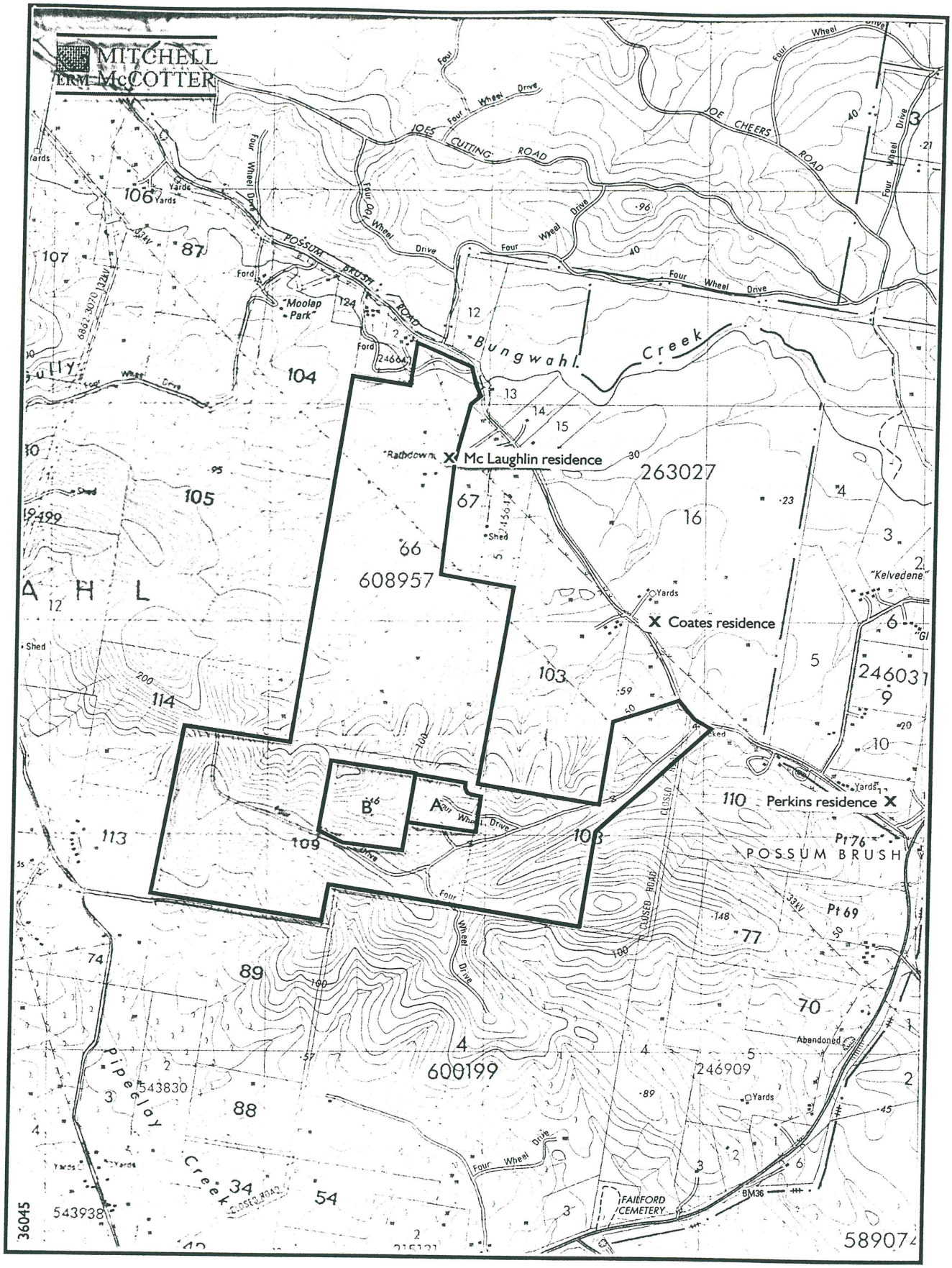

Figure 7.1 NOISE MONITORING LOCATIONS

Table 7.2 SUMMARY OF LOGGED NOISE LEVELS

Location	Leq	L10	L90	L90 *
Coates	43.4	44.7	34.9	30.5
McLaughlan	47.7	46.8	36.9	31.0
Perkins	50.8	50.1	40.5	37.4

Notes: * *Lowest repeated value*

All values are dB(A)

Data gathered during the logger monitoring is presented in *Table 7.2*. These noise levels are the result of many sounds reaching the logger microphone during monitoring. Some manned monitoring was undertaken in the area to provide an indication of local noise sources.

From this manned monitoring and observations made during set out and collection of noise loggers the following summaries of daytime noise sources have been derived for each monitored location.

a. Coates Residence

Manned noise monitoring was carried out near this residence (actually at McCudden), Monday 23 September 1996. Noted noise sources in the area were birds, breeze through tree foliage and Possum Brush quarry operations. A tractor operating to the north and a cow were audible on one occasion.

Lowest repeated background noise levels (L90) would be the result of breeze through tree foliage while average maximum noise levels (L10) would generally be a combination of bird calls and quarry activity.

b. McLaughlan Residence

Manned monitoring was also conducted at this residence on Monday 23 September, 1996. Local noise sources were similar to those noted at Coates/McCudden except that the McLaughlan pool pump (switched off for monitoring) had a measured noise level (on the day) of 36 dB(A) at the noise logger location. The graphs of logged noise levels clearly show periods of pool pump operation.

As for Coates/McCudden lowest repeated background noise levels (L90) would be the result of breeze through tree foliage while average maximum noise levels (L10) would generally be a combination of bird calls and quarry activity. The average background noise level at this location would be influenced by pool pump operation.

c. Perkins Residence

The Pacific Highway was noted as a continual noise source providing lowest repeated background noise levels at this location. Higher noise levels would generally result from traffic on Possum Brush Road.

As for the other monitored locations, bird calls and breeze through tree foliage would make some contribution to measured noise levels.

iv. Derived Criteria

Table 7.3 provides noise level limits for areas around the Pacific Blue Metal Possum Brush operation. These limits were derived from the noise survey results and EPA guidelines.

Table 7.3 DERIVED QUARRY OPERATION NOISE LEVEL LIMITS

Area	Existing L90 *	Acceptable L90	Derived L90	Derived L10
Near Pacific Highway	37	50	42	42
Away from Pacific Highway	31	45	36	36

Notes: * *Lowest repeated value*

All values are dB(A)

The quarry operation noise level limits derived in this report should be referred to the EPA in order to form the basis of an appropriate licence noise limit. It must be noted that these limits have been derived from *guidelines,* not from legislative requirements. Indeed, these guidelines are currently under review. Consideration should be given to the history of land use around the site and other factors such as sterilisation of resources when determining an appropriate licence limit. For the purpose of this assessment it has been assumed that these derived criteria will be those adopted.

7.1.2 Blasting Criteria

EPA blasting criteria are specified in Chapter 154 of the ENCM.

EPA criteria for blasting overpressure are as follows:

- 9.00 am - 3.00 pm Monday to Saturday 115 dB(lin)
- 6.00 am -9.00 am Monday to Saturday 105 dB(lin)

- 3.00 pm - 8.00 pm Monday to Saturday — 105 dB(lin)
- 6.00 am - 8.00 pm Sunday and Public Holidays — 95 dB(lin)
- 8.00 pm - 6.00 am Any day — 95 dB(lin)

Also, the EPA accepts that there could be some exceedance of the overpressure limit of 115 dB(Lin) on infrequent occasions. This should be limited to not more than five per cent of the total number of blasts and should not exceed 120 dB(Lin) at any time.

Australian Standard 2187 - Part 2 (1983) sets a vibration design goal of 10 millimetres per second when measured at houses and low rise residential developments to prevent structural damage. The EPA (1994) recommends a design goal in similar structures of five millimetres per second to avoid vibration nuisance.

The EPA further notes that ground vibration also may sometimes exceed the limit of 5 millimetres per second on infrequent occasions. This should be limited to not more than five per cent of the total number of blasts and should not exceed 10 millimetres per second at any time.

7.1.3 Operational Noise Assessment Of Proposed Quarry Extension

Rock will be broken using drill and blast techniques. It is then transported to the processing area using an excavator, front end loaders and a rear dump truck. After arriving at the processing area the material is crushed and sized onto stockpiles. It is then either loaded onto road trucks or stockpiled elsewhere, a front end loader is utilised for both.

The major noise sources associated with quarry operations and their maximum sound power levels (actual plant measured on site except for dozer, rock breaker and drill) are presented in *Table 7.4*.

Noise levels from these sources were predicted using the NSW EPA approved Environmental Noise Model (ENM). This model takes account of noise attenuation due to distance, atmospheric absorption, barriers and the 'ground effect'.

Using the sound power levels in *Table 7.4*, received noise levels have been calculated for the nearest receptors for neutral atmospheric conditions. Atmospheric parameters of 10 degrees Celsius and 80 per cent relative humidity were used for neutral atmospheric modelling.

Table 7.4 SOUND POWER LEVELS

Equipment	Sound Power Level dB(A)
Front End Loader CAT 980B	113
Front End Loader Michigan 175B	108
Front End Loader CAT 988B	115
Excavator CAT 245ME	113
Dump Truck CAT 769B	115
Dozer CAT D9L	113[1]
Rock Breaker	120[1]
Drill Rig	117[1]
Crushing and Screening Plant (total)	118

Notes: 1. Typical SWL, all other data in table are measurements of actual plant on site.

The above sound power levels represent the maximum levels emitted by each plant item when operating under full load conditions. This will not occur simultaneously for all plant items. For similar operations, experience indicates that the L_{10} noise level from the combined plant operation is approximately 5 dB below the maximum level. Hence in calculating L_{10} noise levels, 5 dB has been subtracted from the maximum noise level calculated from the above sound power levels for all but the crushing and screening plant which can operate continuously.

Calculated noise levels for the nearest receptors as a result of existing and future quarry operations are presented in *Tables 7.5, 7.6* and *7.7.*

Table 7.5 PREDICTED L_{10} NOISE LEVELS, dB(A), BLOCK B NORTH STAGE INITIAL OPERATIONS

Receptor	Received L10	Criterion
Perkins	19	42
Coates	28	36
McCudden	28	36
McLaughlan	27	36
Whitten	29	36
Location X	26	36

Table 7.6 PREDICTED L_{10} NOISE LEVELS, dB(A), BLOCK B NORTH STAGE PIT FLOOR TO RL 120

Receptor	Received L10	Criterion
Perkins	16	42
Coates	31	36
McCudden	32	36
McLaughlan	30	36
Whitten	33	36
Location X	30	36

Table 7.7 PREDICTED L_{10} NOISE LEVELS, dB(A), BLOCK B SOUTH STAGE INITIAL OPERATIONS

Receptor	Received L10	Criterion
Perkins	15	42
Coates	24	36
McCudden	24	36
McLaughlan	22	36
Whitten	23	36
Location X	24	36

Table 7.8 PREDICTED L_{10} NOISE LEVELS, dB(A), BLOCK A AND B AFTER 20 YEARS, PIT FLOOR RL 80

Receptor	Received L10	Criterion
Perkins	14	42
Coates	23	36
McCudden	23	36
McLaughlan	25	36
Whitten	26	36
Location X	25	36

The noise modelling shows no noise impacts (as per EPA guidelines) should result from proposed future quarry operations in Block B.

7.1.4 *Blasting Assessment*

Blast vibration and overpressure have been calculated for the nearest dwelling assuming a minimum distance of 1000 metres from blasting to the dwelling. A range of maximum instantaneous charge of ammonium nitrate fuel oil (ANFO) explosive has been used for calculation.

Vibration calculations were made using the following formula;

$$V = K\left(\frac{R}{\sqrt{W}}\right)^{-B}$$

where;

- V = Vibration as Peak Particle Velocity (in millimetres per second);
- R = Distance between charge and point of potential damage (in metres); and
- W = Charge mass per delay (in kilograms).

K and B are constants related to site and rock properties. The following values have been found to relate to average rock under worst case conditions.

K = 1140

B = 1.6

This formula will normally give conservative vibration predictions.

Overpressure was calculated using the following equation;

$$dBLin = 20 \times \log\left(\frac{3.3 \times \left(\frac{R}{\sqrt[3]{W}}\right)^{-1.2}}{2.0265 \times 10^{-8}}\right)$$

where;

- W = Mass of charge detonated per delay (in kilograms); and
- R = Distance from the charge (in metres).

The calculated vibration and overpressure levels at the nearest dwelling from a range of blast MIC at the proposed quarry are provided in *Table 7.9*.

Table 7.9 CALCULATED BLAST OVERPRESSURE AND VIBRATION

MIC	Distance from blast (metres)	Overpressure dB	Vibration mm/sec
50	1000	105.7	0.4
100	1000	108.1	0.7
200	1000	110.5	1.3
400	1000	112.8	2.2

A typical blast design for the quarry is provided in Section 2.5.1.

As a typical production blast at the quarry has an MIC of 60 kilograms of ANFO (or equivalent) it can be seen from *Table 7.6* that no blast impacts should occur given adherence to proper blasting practices.

7.1.5 *Haul Route Noise*

No change in truck movements is expected due to quarry expansion.

7.2 VISUAL IMPACTS

7.2.1 *Visual Assessment*

The proposed quarry extension is located on the northern face of a prominent ridgeline forming both part of the headwaters of Bungwahl creek and the southern boundary of the catchment. The topography of the southern portion of the study area and the surrounding area is steep with gullies and ridges having gradients in excess of 74%.

Lakes Lookout at Breakneck Hill is also contained within the visual catchment of the proposed quarry. It is located 6.0 km north of the study area and has an RL of 275 metres.

A detailed visual assessment of the proposed expansion was undertaken by Kerry R Steggles (1997) (1997a) (see Appendix D) as part of the process in selecting the final extent of extraction for Block B. The premise used in the process was that any new areas to be cleared should not result in an impact on the visual amenity of nearby residences. The proposed expansion into Block B includes approximately three hectares of previously cleared land that is used for stockpiling, plant storage and

access roads. The deepening of the existing quarry pit in Block A, by its very nature, will be visually unobtrusive.

In making the Block B quarry selection, a detailed sightline and visibility analysis was made using data from:

- consulting surveyors Degotardi, Smith & Partners (Forster);
- State Government 1:25,000 Nabiac topography plan (9333-1-N);
- an air photo sequence of the region flown by BHP Engineering on behalf of Possum Brush Quarry management on 17.12.1996; and
- various site and regional inspections.

The findings of K R Steggles and Associates visual assessment are given in *Appendix D*.

7.2.2 *Mitigation Measures*

The visual assessment determined that the proposed expansion will not have a significant visual impact. Potential impacts are mitigated by the retention of the northern face of the small knoll located along the northern boundary of Block B as well as by the retention of a buffer strip containing dense tree vegetation between the boundary of Block B and the northern boundary of Portion 109.

To ensure the final access road does not become visually significant when viewed from the residences along Possum Brush Road it is proposed that small revegetated benches be established in Block B along the northern edge of the higher (southern) section of the road.

7.3 LANDUSE

The occupied land in the Possum Brush locality is primarily cleared rural land in the lower slopes and flats of the Bungwahl and Talawahl Creeks catchment area. The surrounding hilly country is primarily heavily timbered private rural land. Rural activities in the locality are mainly cattle grazing and hobby farming.

Possum Brush Quarry is bounded by private land held primarily in common ownership with the quarry to the north, and by privately held land to the east, west and south. Kiwarrak State Forest lies further to the north. A power transmission line intercepts the northern section of the study area at two locations.

Opportunities to develop areas for more intensive agricultural uses are limited by the agricultural suitability of the land. In the Agricultural Land Suitability Study prepared for GTCC by the Department of Agriculture (1982), the quarry site has been described as class IV land, in a grading of Class I to Class V, being land suitable for grazing but not suitable for cultivation. (Class V is of poorer agricultural quality than class IV).

The nearest urban residential development area is the village of Nabiac which has a population of approximately 450 and is located approximately 4 km south south-west from the quarry. The village is screened from the quarry by two ridgelines including the ridgeline within the southern boundary of the study area.

Access to the quarry is from Possum Brush Road which also provides access to rural properties along its length. Due to topographical features and the location of the quarry and crushing facilities, potential impacts from quarry activities upon surrounding residents will be restricted to those dwellings located along Possum Brush Road. Dwellings to the south, east and west of the quarry will be screened from a view of the quarry by the landform and existing vegetation.

The properties that have the potential to be directly impacted by quarry activities are all located within the buffer area identified in Greater Taree Development Control Plan 1995. This buffer ensures that any proposed development that is permissible under the provisions of LEP 1995 is required to consider the impacts that the quarry will have upon the development and that the development would have on the quarry. The purpose of the buffer area is to provide protection of the extractive resources that exist in the Possum Brush quarry by ensuring that landuse conflicts do not occur as a result of new development.

The proposed expansion of quarrying into Block B has the potential to affect the amenity of residents living on Possum Brush Road due to noise, dust generation and visual impacts. These issues are addressed further in Sections 7.1, 5.4 and 7.2 respectively.

There will be no adverse impacts upon surrounding landuses as a result of extended quarry operations.

7.4 SOCIO-ECONOMIC ISSUES

7.4.1 Population

The quarry product is to be marketed primarily throughout the City of Greater Taree and Great Lakes Local Government Areas (LGAs). The demand for the quarry

product will be related largely to the need for road construction materials for the substantial Pacific Highway upgrading within the two LGAs. The demand for quarry product to a lesser degree will relate to population growth in these two LGAs and the accompanying demand for housing and infrastructure.

The *Hunter Coastal Urban Settlement Strategy (Department of Planning 1994)* identifies projected growth trends within the Hunter Region. Both Greater Taree and Great Lakes LGAs are located in the upper part of the coastal area of the Hunter region.

The Strategy notes that the coastal area is the strongest growing part of the region. The improvements in transport accessibility to the Sydney Region such as the Pacific Highway upgrading and perceived lifestyle advantages are predicted to result in continued strong growth trends.

Population growth projections for the coastal area of the Hunter Region are shown in *Table 7.10*

Table 7.10 POPULATION PROJECTIONS FOR THE COASTAL AREA

	1991 ERP*	2016 MEDIUM	2016 HIGH	CHANGE 1991 - 2016		
Greater Taree	41,620	60,300	64,200	18,700	to	22,600
Great Lakes	25,500	49,200	51,400	23,700	to	25,900
Port Stephens	45,130	79,200	82,900	34,100	to	37,800
Newcastle	136,170	144,000	150,600	7,800	to	14,400
Lake Macquarie	169,710	202,600	211,900	32,900	to	42,200
	418,180	**535,300**	**561,000**	**117,200**	**to**	**142,900**

* Estimated Resident Population

Source: *Hunter Coastal Urban Settlement Strategy 1995.*

As indicated in *Table 7.10*, substantial population growth is expected in the Greater Taree and Great Lakes LGAs over the next twenty years. Such population growth will result in a demand for infrastructure that will require road construction materials.

Both LGAs experience large seasonal increases in population. The demand for tourist development, and its associated infrastructure, will create greater demand for extractive resources than is reflected in resident population growth statistics.

7.4.2 *Employment*

Employment in the Greater Taree LGA is dominated by the Manufacturing, Retail/Wholesale and Community Services industries which account for 53% of total employment. It is expected that these industries will continue to dominate as Taree establishes itself as a regional centre providing a diverse range of services and facilities. Traditional areas of employment in the rural sector have diminished substantially with a swing towards secondary and tertiary industry (GTCC 1996).

Employment in the Great Lakes LGA is dominated by the Retail/Wholesale, Community Services, Recreation and Construction industries which account for 56.6% of total employment. Tourism has been largely responsible for the growth of urban centres in the LGA and consequently the growth of industries and services.

Both these local government economies will significantly benefit from the upgrading of the Pacific Highway through direct employment of people from the area and use of associated industries. The quarry will support the construction industry by providing essential road construction materials. In addition, the quarry will continue to employ 9 full time employees.

7.5 HERITAGE AND CULTURAL ISSUES

7.5.1 *Background*

The study area lies in one of the less well known archaeological areas of the New South Wales Coast (Brayshaw and Associates 1984) and is located in the Biripai tribal territory. According to Brayshaw and Associates (1984) the nearest archaeological sites have both been destroyed. These sites are listed on the National Parks and Wildlife Service Register and occur within a 10 kilometre radius of the study area. These sites were:

- a carved tree and ceremonial ground (NPWS 38-2-16) located at Nabiac and reported in 1959 (since destroyed)
- a stone arrangement (NPWS 38-2-19) located on Breakneck Hill and reported in the 1930's (since destroyed).

An archaeological survey (Brayshaw and Associates, 1984) was undertaken for the study area as part of the original EIS.

7.5.2 *Previous Survey*

i. Brayshaw and Associates

An archaeological survey for all potential quarry areas (including Block B) was carried out in October 1994 by Brayshaw and Associates Consultant Archaeologists. The results of this survey in relation to Block B are summarised below.

The most likely archaeological occurrence within the subject site would be an open site consisting of scattered flake stone artefacts (Brayshaw and Associates, 1984). Such sites are likely to occur on ridgetops and spurs because the flat hills and saddles would provide suitable camps or stopovers for aboriginals when moving through the hills (Byrne 1983, in Brayshaw and Associates, 1984).

During the course of the survey no sites or isolated finds of flaked-stone artefacts were discovered. Along some of the tracks dissecting the study area sharp edged stones were found with some characteristic features of artefacts such as conchoidal fractures, but these were attributed to the impact of bulldozers and other machinery. No stones were found with identifiable points of percussion or striking platforms characteristic of artefacts (Brayshaw and Associates, 1984).

ii. Koe-Inba Aboriginal Sites Protection Committee

Representatives of the Koe-Inba Regional Aboriginal Sites Protection Committee inspected the study and found two marked trees and a few flakes. Brayshaw and Associates (1984) indicated that the proposed development would not threaten these trees.

A report from the Koe-Inba Regional Aboriginal Sites Protection Committee indicated that the study area does not contain a rock platform watercourse normally required by aborigines to establish a tool making site. Such a site is a place where suitable rock or chert could be percussed and fashioned into cutting tools and weapon tips.

7.5.3 *Conclusions*

Brayshaw and Associates (1984) indicate that there is no obstacle to development on archaeological grounds, and the Koe-Inba Regional Aboriginal Sites Protection Committee recommended that "no Aboriginal impediment be placed on the proposed development of the area."

If any sites are discovered during the course of quarrying operations then the National Parks and Wildlife Service will be informed, and if necessary, approval will be sought to disturb or destroy any sites.

7.6 TRAFFIC AND TRANSPORT

A traffic assessment of the existing quarry and potential impacts of the proposed expansion is provided in *Appendix F*. The assessment determined that traffic impacts of the proposed expansion will be minimal as peak hourly and total traffic volumes generated as a result of future quarry operations will be similar to levels of traffic experienced over the past five years. Traffic flows generated by the quarry will be primarily truck traffic with minor car movements related to employees arriving and leaving the quarry.

The existing road network has substantial spare capacity and traffic generated by the quarry will not result in any changes in the operation of nearby roads and intersections. Nonetheless, it is proposed that a number of mitigation measures be implemented to improve road safety on Possum Brush Road. These mitigation measures include:

- maintenance of design sight distances at the intersection of Possum Brush Road and the internal access road by the removal of obstructing roadside vegetation; and
- provide material to GTCC for ongoing maintenance of Possum Brush Road pavement.

In addition to these mitigation measures the proponent has agreed to address residents' concerns raised at the community consultation meeting (see Chapter 4) by undertaking the following actions:

- provide material to Council for construction of a bus stop and set down area for children to await buses;
- construct a suitable arrestor bed at the bottom of the hill where the access road intersects with Possum Brush Road; and
- continue to remind haulage contractors to comply with traffic safety requirements.

Chapter 8

ENVIRONMENTAL PROTECTION AND MITIGATION MEASURES

8.1 SUMMARY OF MITIGATION MEASURES

Certain measures have been identified in this EIS to mitigate the impacts of the proposed extension of the existing quarry operation. The implementation of these measures will allow the quarry to operate within the specifications and requirements of public authorities and without causing unacceptable loss of amenity for surrounding landowners, or causing unacceptable impacts in the bio-physical environment. These mitigation measures are summarised below.

8.1.1 The Physical Environment

i. Control of Surface Water

All run-off from disturbed areas will be directed to the existing sedimentation ponds which will continue to operate in accordance with existing operations.

Surface flows from groundwater discharge will be directed into the main gully downstream of Block A. Once the quarry becomes non self draining, excess water will be collected in a sump and pumped into the main gully.

ii. Control of Dust Emissions

Emissions of dust from the quarry will be controlled by:

- the use of a water cart to dampen the haulage and access roads and working areas during dry periods;
- ensuring hydraulic rock drills are fitted with industrial exhaust extraction and control systems;

- avoiding, where possible, drilling or blasting or using dust extraction facilities during high winds; and

- prompt revegetation of exposed areas, bunds and topsoil stockpiles.

Short term episodes of increased dust generation will be controlled by sensible management practices such as cessation of stockpile reshaping or dry crushing during periods of high winds after long dry periods.

iii. Revegetation

A revegetation program will be implemented and will include consideration of site preparation, planting and maintenance. The main structures that will be vegetated include:

- temporary bunds ;

- permanent bunds (including access road batters and pond walls); and

- quarry benches.

Temporary and permanent bunds will be revegetated immediately following construction in accordance with the revegetation program prepared by Resource Planning (1989). Quarry benches will be progressively revegetated in accordance with Landless (undated). Revegetated areas will be routinely monitored and maintenance undertaken as required. Additional watering of vegetation will be undertaken should adverse weather conditions inhibit growth during the establishment phase.

8.1.2 The Biological Environment

i. Flora and Fauna

Comprehensive details of the proposed mitigation measures necessary to protect fauna are outlined in the SIS. The ameliorative measures which are to be implemented to mitigate potential impacts of the proposed quarrying operation include:

- revegetation of the quarry which will be undertaken progressively wherever possible to minimise the impact of loss of habitat;

- speed limits of 40 kilometres per hour are to be imposed on internal roads to minimise road kills;

- wildlife crossing signs are to be erected to alert drivers that fauna may be crossing the road.
- blasting, quarrying and primary crushing are to be limited to daylight hours;
- a monitoring program is to be implemented on a yearly basis to determine the effectiveness of the mitigation measures, the suitability of the revegetation techniques used and any changes to the fauna assemblage of the area;
- timed clearing will be implemented to reduce direct mortality of hollow-dependent fauna; and
- habitat enhancement involving such measures as fencing off bushland, baiting programs for cats and dogs, provision of nest boxes and the extermination of feral bees will be undertaken to increase the carrying capacity of bushland remaining in the study area.

8.1.3 *The Human Environment*

i. Noise and Blasting

As indicated in Section 7.1, the quarry extension can operate within the specified noise and blasting criteria and no specific mitigation measures are required to reduce noise or overpressure levels.

ii. Visual Screening

The quarry has been confined to the northern side of the site to avoid any disturbance to the existing tree growth along the heavily timbered ridge at the southern boundary of the quarry. This ridge line forms an important component of the landscape in this locality and will not be disturbed.

The northern extent of the quarry has been positioned 50m from the northern boundary of the property (with Lot 66) to retain existing dense tree growth. This buffer will be protected from site works to maintain a complete belt of existing natural forest thus keeping visual impact to the lowest possible level. Additional tree planting could be provided in Lot 66 to develop sight screens for the occupants of the existing dwellings to the north and for motorists on Possum Brush Road if required.

iii. Aboriginal Heritage

If any sites are discovered during the course of quarrying operations then the National Parks and Wildlife Service will be informed, and if necessary, approval will be sought to disturb or destroy any sites.

iv. Traffic and Transport

The following measures will be undertaken to improve the road safety of Possum Brush Road:

- widening of Possum Brush Road to 3.5 metre lane widths and 1.5 metre shoulder widths;
- maintenance of design sight distances at the intersection of Possum Brush Road and the internal access road by the removal of obstructing roadside vegetation; and
- provide material to GTCC for ongoing maintenance of Possum Brush Road pavement.

8.2 ENVIRONMENTAL MANAGEMENT AND SITE REHABILITATION PLAN

An environmental management and site rehabilitation plan will be prepared at the detailed design stage of the project. The objectives of the plan will be to:

- specify the engineering and operational details of all environmental safeguards;
- develop a detailed maintenance schedule for all environmental controls;
- produce a detailed rehabilitation plan; and
- establish an environmental monitoring program.

An important consideration in the plan's preparation will be the need for flexibility to respond to changing environmental conditions, community needs and government and council regulations. The plan will be reviewed and updated as necessary over the life of the project.

A component of the management plan will be a monitoring program.

Chapter 9

PROJECT JUSTIFICATION

9.1 ALTERNATIVES TO THE PROPOSAL

As discussed in Section 2.1.2 the availability of suitable aggregate from existing quarries in the market region to supply future Pacific Highway upgrading projects is limited. **The demand for high quality material will exceed supply at least in the short to medium term.** Quality assured products are essential for high quality construction of the Pacific Highway and if they are not available locally, they must be imported using costly road transportation.

Only a limited number of other quarries in the region are able to produce high quality premium grade aggregates to meet current RTA specifications. Collectively they will be unable to supply the quantities of demand expected to be required by the Pacific Highway upgrading and local market demands.

An alternative to the proposal would be to continue the extraction sequence in accordance with the existing development consent. This approach would not allow the quarry to supply high quality material required for Pacific Highway upgrading in the short term.

9.2 CONSEQUENCES OF NOT PROCEEDING

The consequences of the extension of Possum Brush quarry not proceeding will be a potential short to medium term shortage of premium aggregate material for use as quality assured aggregates and road pavement material for upgrading the Pacific Highway within the region between Johns River and Bulahdelah.

Demand for this material will exceed available supply unless new reserves are secured now. A shortage of supply will stimulate interest in developing other deposits in the region. the approval process to enable extraction of such deposits will not be adequate to ensure the supply of high quality material in the short term.

The inability to secure satisfactory reserves, particularly in the short term, will increase market prices for these products and dampen growth. **Upgrading the Pacific Highway will become more costly and could be delayed.**

9.3 CUMULATIVE IMPACTS

The existing development consent contains numerous conditions to ensure the impacts of operations are kept to acceptable levels. This extended proposal has taken into account the impacts and mitigation measures for Block A, together with anticipated impacts of the proposed extension. **The results of this environmental impact assessment have determined that provided the nominated mitigation measures are implemented the impacts of deepening Block A and extending into Block B will meet all relevant environmental criteria.**

9.4 PROJECT JUSTIFICATION

9.4.1 Biophysical Considerations

The extension to existing quarry operations will not create an adverse impact upon downstream waterways or cause a decrease in air quality that will adversely affect the surrounding environment.

Appropriate mitigation measures will be introduced to ensure that the operations will not cause significant adverse impacts on threatened flora and fauna species in the study area. Rehabilitation of the quarry will be undertaken progressively to restore native vegetation to the area and the quarry site will function as a sustainable ecosystem which reflects the natural ecology of the area.

9.4.2 Economic Considerations

The upgrading of the Pacific Highway is the largest post war civil construction project to be undertaken in Australia. The upgrading and reconstruction of sections of the highway between Bulahdelah and Johns River contribute a significant proportion of the work to be undertaken. **The extension of the existing operations at Possum Brush quarry will secure a substantial reserve of high quality material that will enable the long term supply to Pacific Highway construction projects in the Region.** The quarry owners have already been approached to supply material to impending construction works. The highway upgrading will provide significant economic benefits and opportunities in the local, state and national economies.

The quarry will provide direct ongoing employment for nine persons, significant employment for a large number of associated workers such as truck drivers and will assist employment in the housing, tourism and construction industries by providing essential materials at affordable costs.

9.4.3 *Social Considerations*

The operation of the quarry will have impacts upon surrounding residents. Careful management and control of these impacts, including noise, vibration and dust will allow the quarry to operate with acceptable levels of impact. As indicated in Section 7.1 of this report, the operation of the quarry extension can operate within the specified noise and blasting criteria and no specific mitigation measures are required to reduce noise or overpressure levels.

Current quarry management has shown its willingness to resolve the concerns of neighbours and has the experience to implement responsible quarry management so that the interests of neighbours and the public are protected.

The proposed development is justified because it will allow supply of essential materials to a civil works project that is of major state and regional importance and will contribute to an increase in safety for future Pacific Highway motorists.

9.4.4 *Principles of Ecologically Sustainable Development*

The national strategy for ecologically sustainable development (ESD) details the Federal Government Policy which seeks to achieve economic development in an environmentally sustainable manner. The four principles of ESD are listed in Schedule 2 of the Environmental Planning and Assessment Regulation (1994) as follows:

- the precautionary principle, namely that if there are threats of serious or irreversible environmental damage, lack of full scientific certainty should not be used as a reason for postponing measures to prevent environmental degradation;
- inter-generational equity, namely that the present generation should ensure that the health, diversity and productivity of the environment is maintained or enhanced for the benefit of future generations;
- conservation of biological diversity and ecological integrity; and
- improved valuation and pricing of environmental resources.

The manner in which these four principles apply to Pacific Blue Metals' Possum Brush Quarry operation are as follows:

i. The Precautionary Principle

The proposal will be consistent with the *precautionary principle* to the extent that all potential threats to the quality of the environment, such as sedimentation, erosion, entry of pollutants to the catchment, loss of habitat of endangered flora and endangered fauna and noise pollution, have been identified and mitigation measures are proposed that will prevent significant adverse impacts.

ii. Inter-generational Equity

The proposal will be consistent with the principle of *inter-generational* equity as it will assist future generations to be supported by provision of a high standard Pacific Highway, whose value will extend well into the future; and the quarry site will ultimately be rehabilitated to form part of a viable ecosystem.

iii. Conservation of Biological Diversity and Ecological Integrity

The proposal will be consistent with the principle of *conservation of biological diversity and ecological integrity*. Measures are proposed to rehabilitate and revegetate the study area during and after quarrying. Impacts on threatened fauna will be ameliorated by providing, among other measures, compensatory habitat, nesting boxes and fauna exclusion fencing. Impacts on plants of conservation significance that would be affected by the proposed operations, particularly *Eucalyptus rudderi* would be ameliorated by planting of seedlings.

Other measures have been recommended in Section 8.2 to reduce the impacts of the operation on adjoining natural areas. Those measures include fencing, dust suppression and preventing spill or flyrock entering vegetated areas.

iv. Improved Valuation and Pricing of Environmental Resources

Environmental resources can be defined to include natural resources such as flora, fauna, rivers, sand and gravel and the human built environment such as roads and railways. As stated by James (1995) the *valuation and pricing* [of extractive materials] *is related to the customer's perception of the value of the product and their willingness to pay. In general, extractive materials are considered to be low value, low cost materials so there is little opportunity for improved valuation and pricing of the environmental resources.*

While this is a valid perception, the final cost of the extractive materials includes the total cost of extraction and delivery. Extraction and delivery includes costs associated with:

- environmental assessment;
- rehabilitation;
- environmental management and monitoring; and

- road use contribution.

Due to increasingly tight legislative and environmental controls by State and Local governments, it is reasonable to expect that quarry products, including those from Possum Brush will increase in value, although improved productivity may balance long term value increases. The hard rock resource in this site will be utilised to assist achievement of a project of national importance (the Pacific Highway upgrading), thereby putting that resource to an optimum use for the benefit of the community.

The value of the natural resources of the site is being recognised by the protection, mitigation and environmental rehabilitation measures proposed for the extended quarry site.

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APPENDICES

Appendix A

DIRECTOR GENERAL'S REQUIREMENTS

New South Wales Government
Department of Urban Affairs and Planning

Mr Chris Power
ERM Mitchell McCotter
6/221 Victoria Street
TAREE NSW 2430

Contact: Gordon Kirkby

Our Reference:

Your Reference: 36005

ERM Mitchell McCotter Quality System

Date received	14.6.96		
Referred to	C. Power	Ref. No	36005

☐ refer to verification record
☑ verification not required

Signature: _____ Date: 17/6/96.
Project Manager

Dear Mr Power,

PROPOSED BLUE METAL QUARRY, POSSUM BRUSH ROAD, POSSUM BRUSH - LOT 3 DP701903, LOT 66 DP 608967, PORTION 109 PARISH OF TALAWAHL.

Thank you for your letter of 6th June 1996 seeking consultation with the Director-General for the preparation of an environmental impact statement (EIS) for the above development.

Under clause 52 of the Environmental Planning and Assessment Regulation 1994 (the Regulation), the Director-General requires that the key issues outlined below be specifically addressed in the EIS.

- Environmental performance of existing operations and the likely cumulative impact of the extended operation
- Potential for surface and groundwater contamination and proposed mitigation measures
- Flora and fauna impacts and an assessment of the need for a species impact statement to be prepared
- Applicability of State Environmental Planning Policy No. 46 - Protection and Management of Native Vegetation
- Erosion and sediment controls
- Noise and dust generation and proposed mitigation measures
- Potential impacts of increased traffic generation
- Community consultation

Attachment No. 1 contains a advice on the type of information most likely to be relevant to the proposed development.

Governor Macquarie Tower
1 Farrer Place, Sydney 2000
Box 3927 GPO, Sydney 2001

Telephone: (02) 391 2000
Facsimile: (02) 391 2111

The EIS shall be prepared in accordance with clauses 50 and 51 of the Regulation. Statutory requirements for the form and content of the EIS are outlined in Attachment No.2.

The issues emerging from consultation with relevant local, State and Commonwealth government authorities, service providers and community groups are to be addressed in the EIS. You should also identify and consult with any other parties who may have an interest in the proposal.

Should you have any further enquiries please do not hesitate to contact Gordon Kirkby on phone 02 391 2071.

Yours sincerely,

SHaddad

Stephen Brown
Manager
Major Assessments and Hazards Branch
As Delegate for the Director-General

13.6.1996.

DEPARTMENT OF URBAN AFFAIRS AND PLANNING

Attachment No. ..2..

STATUTORY REQUIREMENTS FOR PREPARATION AND EXHIBITION OF AN ENVIRONMENTAL IMPACT STATEMENT UNDER PART 4 OF THE ENVIRONMENTAL PLANNING AND ASSESSMENT ACT 1979

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

Content of EIS

Pursuant to Schedule 2 and clause 51 of the *Environmental Planning and Assessment Regulation 1994* (the Regulation), an EIS must include:

1. A summary of the environmental impact statement.
2. A statement of the objectives of the development or activity.
3. An analysis of any feasible alternatives to the carrying out of the development or activity, having regard to its objectives, including:
   (a) the consequences of not carrying out the development or activity; and
   (b) the reasons justifying the carrying out of the development or activity.
4. An analysis of the development or activity, including:
   (a) a full description of the development or activity; and
   (b) a general description of the environment likely to be affected by the development or activity, together with a detailed description of those aspects of the environment that are likely to be significantly affected; and
   (c) the likely impact on the environment of the development or activity, having regard to:
      (i) the nature and extent of the development or activity; and
      (ii) the nature and extent of any building or work associated with the development or activity; and
      (iii) the way in which any such building or work is to be designed, constructed and operated; and
      (iv) any rehabilitation measures to be undertaken in connection with the development or activity; and
   (d) a full description of the measures proposed to mitigate any adverse effects of the development or activity on the environment.
5. The reasons justifying the carrying out of the development or activity in the manner proposed, having regard to biophysical, economic and social considerations and the principles of ecologically sustainable development.
6. A compilation, (in a single section of the environmental impact statement) of the measures referred to in item 4(d).
7. A list of any approvals that must be obtained under any other Act or law before the development or activity may lawfully be carried out.
8. For the purposes of Schedule 2, **'the principles of ecologically sustainable development'** are as follows:
   (a) The precautionary principle - namely, that if there are threats of serious or irreversible environmental damage, lack of full scientific certainty should not be used as a reason for postponing measures to prevent environmental degradation.
   (b) Inter-generational equity - namely, that the present generation should ensure that the health, diversity and productivity of the environment is maintained or enhanced for the benefit of future generations.
   (c) Conservation of biological diversity and ecological integrity.
   (d) Improved valuation and pricing of environmental resources.

Note

The matters to be included in item (4)(c) might include such of the following as are relevant to the development or activity:

(a) the likelihood of soil contamination arising from the development or activity;
(b) the impact of the development or activity on flora and fauna;
(c) the likelihood of air, noise or water pollution arising from the development or activity;
(d) the impact of the development or activity on the health of people in the neighbourhood of the development or activity;
(e) any hazards arising from the development or activity;

(f) the impact of the development or activity on traffic in the neighbourhood of the development or activity;
(g) the effect of the development or activity on local climate;
(h) the social and economic impact of the development or activity;
(i) the visual impact of the development or activity on the scenic quality of land in the neighbourhood of the development or activity;
(j) the effect of the development or activity on soil erosion and the silting up of rivers or lakes;
(k) the effect of the development or activity on the cultural and heritage significance of the land.

An environmental impact statement referred to in Section 77(3)(d) of the Act shall be prepared in written form and shall be accompanied by a copy of Form 2 of the Regulation signed by the person who has prepared it.

Procedures for public exhibition of the EIS are set down in clauses 55 to 57 of the Regulation.

Attention is also drawn to clause 115 of the Regulation regarding false or misleading statements in EISs.

A copy of the Director-General's Requirements should be included as an appendix to the EIS, as well as a table indicating the location within the document where the requirements have been addressed.

– ◊ –

Appendix B

GOVERNMENT AUTHORITY RESPONSES

Greater Taree City Council

ALL COMMUNICATIONS
TO BE ADDRESSED TO
THE GENERAL MANAGER
P.O. BOX 482, TAREE
N.S.W. 2430
DX 7020 TAREE

PHONE: (065) 91 3399
FAX: (065) 91 3311

2 PULTENEY STREET
TAREE

REF: PR 4447
Letter No.600
BB:JW

Responsible Officer: Mr Bruce Byatt

7 August 1996

Mr T Fish
ERM Mitchell McCotter
Suite 6/221 Victoria Street
TAREE NSW 2430

Dear Sir

RE: Possum Brush Quarry - Preparation of Evironmental Impact Statement

I refer to your letter of 25 July 1996 concerning the above and apologise for the delay in replying.

Previously Council has advised of its requirements by letters dated 13 March and 17 June 1996. Following perusal of the draft table of contents and the above letters, I advise that there would appear to be no further matters which, from Council's point of view, would need to be addressed.

Should you have any further enquiries regarding this matter, please contact Bruce Byatt of Council's Planning and Building Department.

Yours faithfully

Bruce Byatt
Manager
DEVELOPMENT CONTROL

ERM Mitchell McCotter
Date received 9-8-96
TF 36045
Date: 9/8/96.

ERM Mitchell McCotter Quality System			
Date received	22.8.96		
Referred to	CLB TF	Ref. No.	36045
☐ refer to verification record ☑ verification not required Signature: _____ Date: 22/8/96 Project Manager			

19 August, 1996

Mr Tony Fish
ERM Mitchell McCotter
PO Box 487
TAREE NSW 2430

Our reference: 1431/96.843/SA
Your reference: 36045 tf:tb

Dear Mr Fish

EXPANSION OF EXISTING QUARRY OPERATION, POSSUM BRUSH QUARRY, PREPARATION OF ENVIRONMENTAL IMPACT STATEMENT

Thankyou for your letter of 25 July 1996 requesting comments on those issues to be covered in the EIS for the above development. Those matters which the National Parks and Wildlife Service (NPWS) considers need to be addressed are detailed in the attachment. Please note that this attachment comprises a general list only, and that these issues may apply to a lesser or greater degree depending on site specifics. The NPWS is particularly interested in the following.

- Areas of native vegetation, with special reference to vegetation communities or plant species which are threatened or are of a local, regional or statewide significance (including ROTAP species).
- Areas of potential significance for native fauna with special reference to habitat likely to be significant for threatened fauna species or fauna of a local, regional or statewide significance.
- Areas of archaeological potential and Aboriginal heritage values as identified by the Aboriginal community.

If any areas within your study area possess attributes such as those identified above, the NPWS recommends that detailed surveys be undertaken to determine the natural and/or cultural values of the area and potential impacts on these values. The NPWS is aware of the recent recording of several threatened species in the locality. Particular attention should be given to cumulative impacts of the proposal in the context of other developments proposed or approved in the area.

NSW NATIONAL PARKS AND WILDLIFE SERVICE

Northern Zone
GIO House
24 Moonee Street
Coffs Harbour NSW
Australia
PO Box 914
Coffs Harbour 2450
Fax: (066) 516 187
Tel: (066) 515 946

Head Office
43 Bridge Street
Hurstville NSW
Australia
PO Box 1967
Hurstville 2220
Fax: (02) 585 6555
Tel: (02) 585 6444

Australian-made 100% recycled paper

Should you wish to discuss any of these matters further, please do not hesitate to contact Sonya Ardill, Environmental Planning Officer, on (066) 598 221.

Yours faithfully

Matt Cameron
Manager Environmental Planning

for DIRECTOR-GENERAL

NSW NATIONAL PARKS AND WILDLIFE SERVICE, NORTHERN ZONE

ENVIRONMENTAL ISSUES TO BE ADDRESSED

INTRODUCTION

The following list is provided to assist preparation of Development Applications. The list details the minimum information that is required by the New South Wales National Parks and Wildlife Service (NPWS) in their assessment of such applications.

Please note that the provision of information in accordance with this list does not negate the applicant's obligations under any legislative or planning instruments. NPWS suggests that the applicant contact the relevant local council, and the Department of Urban Affairs and Planning, to ascertain these obligations.

GENERAL

1. Map(s) showing the locality of the proposed development in a regional and local context. Local context maps should be based on 1:25 000 topographic plans. Photographs of the site's key attributes may provide useful documentation.

2. A description of the existing environment on the subject land and surrounding land, the proposed development and ancillary works, and the manner in which the environment will be modified by the proposal (particularly with regard to the clearing of native vegetation and impacts on fauna habitat).

3. The area subject to development should be clearly identified on an appropriately scaled plan. This includes all ancillary works such as buildings and other structures, parking areas, loading/processing/treatment areas, access roads, and material stockpiling areas.

4. The applicability or otherwise of Local Environment Plans (LEP), Regional Environment Plans (REP) and State Environmental Planning Policies (SEPP) to the site should be determined and detailed. In particular, your attention is drawn to SEPP No. 14 - Coastal Wetlands, SEPP No. 26 - Littoral Rainforest, SEPP No. 44 - Koala Habitat Protection, and SEPP No. 46 - Protection and Management of Native Vegetation.

FLORA

1. A comprehensive description of the vegetation on the site. This will include an assessment of the condition of the plant communities present, including the designation of conservation significance at a local, regional and State level, and the identification of the presence of any threatened species, populations or ecological communities listed under Schedules 1 or 2 of the *Threatened Species Conservation Act 1995* and any Rare or Threatened Australian Plant (ROTAP) species

2. A plan showing the distribution of the Threatened and ROTAP species and the vegetation communities on the site, and the extent of vegetation proposed to be cleared. This plan should be at the same scale as the plan of the area subject to development in order to assist in the assessment of the impact of the proposal on the existing vegetation.

3. Where the assessment concludes that threatened species, populations or ecological communities, or their habitats, exist on or in proximity to the subject land, the effect of the proposed development should be determined in accordance with the eight point test described in Section 5A of the *Environmental Planning and Assessment Act* 1979. An assessment of the impact of the development on the plant communities and/or ROTAP species should also be provided.

4. A description of the measures proposed to mitigate and/or ameliorate the impact of the development on the plant communities and/or Threatened and ROTAP species.

FAUNA

1. A fauna survey to identify the distribution and abundance of fauna species known or likely to utilise the site, including a description of available fauna habitats and an assessment of the conservation status of each of the faunal components at a local, regional and State level.

2. A plan showing the results of the above survey. This plan should be at the same scale as the plan of the area subject to development to assist in the assessment of the impact of the proposal on the identified faunal components.

3. An assessment of the impact of the development on the identified faunal components.

4. An assessment of the existence or likely occurrence of threatened species, populations or ecological communities, or their habitats on the subject land. Where the assessment concludes that threatened species, populations or ecological communities,

or their habitats exist on or in proximity to the subject land, the effect of the proposed development should be determined in accordance with the eight point test described in Section 5A of the *Environmental Planning and Assessment Act* 1979.

5. A description of the measures proposed to mitigate and/or ameliorate the impact of the development on the identified faunal components.

CULTURAL

1. The presence or absence of Aboriginal sites should be identified and the significance of the area to the local Aboriginal population must be determined. Accordingly, a search of the NPWS Aboriginal sites register should be made and the Local Aboriginal Land Council should also be consulted with regard to any Aboriginal heritage issues associated with the proposed development.

2. Aboriginal sites and places of significance to the Aboriginal community are to be detailed on a plan. This plan should be at the same scale as the plan of the area subject to development to assist in the assessment of the impact of the proposal on the identified cultural components.

3. An assessment of the impact of the development on the identified cultural sites.

4. A description of the measures proposed to mitigate and/or ameliorate the impact of the development on the identified cultural sites.

5. A contingency plan that details the measures to be taken in the event that archaeological sites are discovered during the course of operations must be prepared.

NOTES

Surveys and Assessments

1. Conclusions drawn in surveys and assessments must be substantiated by evidence resulting from those surveys and assessments. Those conclusions must be directly translated into the document being supported by the surveys and assessments.

2. All surveys and assessments should refer to the NPWS databases and Schedules 1 and 2 to the *Threatened Species Conservation Act* 1995.

3. Fauna, flora and cultural surveys and assessments should be undertaken by suitably qualified persons and the qualifications and experience of the persons undertaking the work detailed.

4. Dates, site locations, design, methodology, analysis techniques, and weather conditions at the time of the assessments and surveys must be described.

NPWS Databases

5. The NPWS can provide records of flora and fauna held in the Wildlife Atlas and / or Rare or Threatened Australian Plants (ROTAP) databases. In addition NPWS has an Aboriginal Sites Register of which searches can be made. These services generally attract a fee. Enquires should be made to NPWS Hurstville office, telephone (02) 585 6444.

6. It should be noted that the above databases are not comprehensive and should only be used as a guide. They do not negate the need for specific site investigations.

[redacted]

RDA Unit

Our reference: MRB:et
Your reference: 36145 tf:tb
C:\WPDATA\BELLERT\POSSUM.LET

NSW Agriculture

Wollongbar
Agricultural Institute
Bruxner Highway
Wollongbar NSW 2477
Australia

Telephone: (066) 261 200
Facsimile: (066) 281 744

Tony Fish
Environmental Planner
ERM Mitchell McCotter
PO Box 487
TAREE 2430

6 August 1996

Dear Tony

RE: EXPANSION OF EXISTING QUARRY OPERATION, POSSUM BRUSH QUARRY. PREPARATION OF ENVIRONMENTAL IMPACT STATEMENT

Thank you for your letter of 25 July 1996 seeking comment on the above proposal.

The major issues which need to be addressed are:

1. The agricultural quality of the land.
2. The likely impact of the quarrying activity on neighbouring farming activities.
3. The likely impacts and competition for water.
4. Appropriate agreements with neighbouring landholders regarding access, hours of operation, etc.
5. Management of quarried material to ensure that leachate does not impact on neighbouring streams. In particular, attention should be given to the presence of pyrite or other material likely to oxidise and result in acid water discharges.

Should you require further details of these suggestions, please contact Martin Bellert, Agricultural Environment Officer, telephone (066) 261349.

Yours faithfully,

J. D. WILLIAMS
Regional Director of Agriculture

ERM ... Quality System
Date rece... 9-8-96
Refere... TF ...t No 36045
...ation record
... not required
Sign... Date: 9/8/96

MINERAL RESOURCES

Mr Tony Fish
Environmental Planner
ERM Mitchell McCotter
PO Box 487 Taree
NSW 2430

NSW DEPARTMENT OF MINERAL RESOURCES
Level 2, ABS House 97-101 Faulkner Street
(P.O. Box 65), Armidale, NSW 2350, Australia
Phone (067) 70 2100 · Fax (067) 70 2121

OUR REF: L96-3100
YOUR REF:

Dear Sir

Expansion of existing quarry operation, Possum Brush Quarry - Preparation of an EIS

Thank you for your letter requesting information regarding preparation of an EIS for the above quarry.

Attached is a list of requirements that you should consider when preparing the EIS.

In amplification of some of the points, it is important to include in the EIS:
1. a thorough description of the proposal to establish an understanding of it. This section should discuss the planned stages of further quarry development and should include details of topsoil stripping and storage, overburden removal, working faces, stockpile locations, crushing plant location, transport access, dust suppression water supply and extraction methods. This section is essentially a working plan and proposal.
2. A description of the planned approach for progressive and final rehabilitation should be made to establish an understanding of the post mining land form. This section should indicate the differences between pre and post mining topography and should describe the various stages of rehabilitation. This section is essentially a rehabilitation plan and proposal.
3. A description of steps taken to protect neighbouring landowners and the environment from impact from further development should be made. This section should include details of steps taken against the generation of dust, noise, blasting nuisance, erosion and siltation and is essentially an impact protection proposal.

If you have any questions about this matter, please contact Jim Stroud, Senior Geologist at the Department's Armidale office.

S R LISHMUND
For Director-General

12/8/96.

ERM Mitchell McCotter Quality System
Date received: 20.8.96
Referred to: TFH&H Ref. No. 36045
☐ refer to verification record
☑ verification not required
Signature: [signature] Date: 20/8/96

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N.S.W. DEPARTMENT OF MINERAL RESOURCES - NORTH-EASTERN REGION

EIS Assessment for Extractive Industries -

Geology and Engineering

All Environmental Impact Statements for Extractive Operations should contain the following geological and engineering information:

1. a Resource Assessment;
2. an Extraction and Treatment Plan;
3. a Rehabilitation Plan; and
4. a Viability and Marketing Assessment.

Resource Assessment

The Resource Assessment should be sufficiently detailed and illustrated to establish:

- The characteristics of the deposit -location, geology, extent, and internal variations in grade/ quality
- The quantity of material to be extracted.
- Whether other potentially recoverable commodities occur at the site, and whether they can be stockpiled for later recovery

Documentation should be sufficient to justify the above claims and should include a discussion of the assessment methods and results (including reference to any relevant reports).

Extraction and Treatment Plan

The Extraction and Treatment Plan should be sufficiently detailed and illustrated to establish:

- Proposed methods of extraction, plan of operation (including staging)
- Rate of extraction.
- Expected life of the operation.
- Disposal methods for solid and liquid wastes.
- Location and size of stockpiles.
- Transport routes.
- Expected noise, vibration, dust, and visual impacts and proposed measures to minimise these impacts.
- Any likely cumulative impacts of the proposed operation when considered together with similar operations nearby.

Rehabilitation Plan

The Rehabilitation Plan should be sufficiently detailed and illustrated to establish:

- Rehabilitation procedures, both during and after completion of extraction operations.
- A proposed final land form and site use
- Present day cost of final rehabilitation.
- Whether the proposed rehabilitation plan will prevent or inhibit future extraction of any commodity for which recovery is not currently proposed.

Documentation should be sufficiently detailed and illustrated to afford comparison of the existing site with the site as envisaged after the proposed rehabilitation.

Viability and Market Assessment

The Viability and Market Assessment should show:

- That the expected products are marketable.
- That the operation will be sufficiently viable to save the local community needless disruption from commencing then prematurely closing an operation.
- That the operation will be sufficiently profitable to pay for rehabilitation. * Alternative sources, their availability, and market acceptance.
- Justification for the proposal - the need for the proposed operation in a local, regional, or broader context.
- Justification for not utilising or stockpiling all potentially recoverable commodities (where relevant).

Documentation in Environmental Impact Statements

Required documentation can be provided in supporting documents accompanying an EIS, rather than in the EIS, provided that:

- the EIS adequately summarises and cross-references data in the supporting documents; and
- the supporting documents meet all the above requirements.

Warnings - Expect close public scrutiny and prepare carefully!

your ref: 36045 tf:tb
our ref: ER 169

ERM Mitchell McCotter Quality System

Date received	4.9.96		
Referred to	TF	Ref. No	36045

☐ refer to verification record
☑ verification not required
Signature: _____ Date: 4.9.96
Project Manager

LAND & WATER CONSERVATION

MANAGER
ERM MITCHELL MCCOTTER (TAREE)
PO BOX 487
TAREE 2430

FAXED
Date: 3.9.96

Tuesday, 03 September, 1996

ATTENTION: Mr T. Fish

Dear Sir

EXPANSION OF EXISTING QUARRY OPERATION, POSSUM BRUSH QUARRY. PREPARATION OF ENVIRONMENTAL IMPACT STATEMENT.

I refer to your letter dated 25 July 96 requesting this Department's comments in regard to the above proposal. I apologise for the delay with this response but anticipate these comments will be given due consideration.

The Department has now reviewed this matter and provides the following information addressing the principle issues:

GROUNDWATER MANAGEMENT

The EIS should identify issues relating to groundwater regimes at the site, and any impacts on groundwater which may occur as a result of the development. This includes an assessment of:

* groundwater levels and directions of movement
* groundwater quality at the site
* depth of excavation at the site, and any interception of groundwater to occur as a result of the extraction
* predicted increases in electrical conductivity, nutrient levels and impacts related to spillages at the site
* remedial measures to be employed should any groundwater contamination occur as a result of the development.
* ongoing monitoring of groundwater during the development lifetime.
* remediation and rehabilitation of the site to isolate and protect groundwaters.

SURFACE WATER MANAGEMENT

The EIS should present a detailed description of surface drainage of the site. Impacts on drainage channels from the existing operation should be described, along with an assessment of the measures required to detain runoff and trap sediment. A description of the maintenance procedure of any such structures should be included in the document.

The EIS should include a detailed plan of staged rehabilitation of drainage lines on the site. This should include monitoring of surface drainage lines and stabilisation of any erosion which occurs during the lifetime of the development.

464 King Street Newcastle West NSW 2302 PO Box 5166 Newcastle West NSW 2302 DX 4335 Newcastle West
Telephone (049) 291 537 Facsimile (049) 294 387

GENERAL.

The draft table of contents appears to address the important issues. Enclosed herewith is a copy of "Guidelines to meet SCS requirements for EIS- Mining", which lists the principle issues and may be of assistance.

I trust the above information is of assistance in regard to your consideration of this proposal. Should there be any further enquiry in this matter, please contact Mr Jeff Hunt, Catchment Planning Manager, at our Newcastle Office on 049 294346.

Yours Faithfully

Jeff Hunt, CATCHMENT PLANNING MANAGER
for MANAGER, RESOURCE ASSESSMENT AND PLANNING
HUNTER REGION

hell ... System
2.12.96
NB 36045
refer to ... record
verification not required
Project Manager: Date: 2/12/96

EPA

Environment Protection Authority
New South Wales

NSW Government Offices
117 Bull Street Newcastle West NSW 2302
PO Box 488G Newcastle NSW 2300
Tel .049. 26 9971 Fax .049. 29 6712

ERM MITCHELL McCOTTER
PO Box 487
TAREE NSW 2430

Attention: Nicky Barkwill

Our Reference: 271450A1 ST:LV

Your Reference: 36045

26 NOV 1996

Contact: Shane Trengove

Dear Sir/Madam

PACIFIC BLUE METAL QUARRY ENVIRONMENTAL IMPACT STATEMENT

I refer to your letter of 10 October 1996 requesting information on the environmental performance of Pacific Blue Metal Quarry.

In 1995 the Environment Protection Authority (EPA) served two notices on the company in response to complaints of siltation of downstream watercourses. Inspections at that time revealed minor siltation in one watercourse leading into a farm dam on an adjoining property. The notices required stabilisation of abandoned roadworks and imposed a requirement for regular inspections of drainage lines on the quarry property. The company's EPA licence was further amended to require measurement of rainfall and recording of inspections and sediment removed from sedimentation dams. Copies of notices are attached.

In 1996 we received nine (9) complaints relating to operating hours and five (5) relating to one blasting incident. These complaints were investigated and the quarry was found to be operating within the approval and licence granted by the EPA.

Over the last twelve months the premises has been inspected on three occasions. In general we are satisfied that the environmental performance of the quarry has improved significantly and that the quarry operator is now meeting EPA requirements with respect to management of air, water and noise pollution on the premises. Not-withstanding these improvements the EPA will continue to monitor progress with stabilisation and rehabilitation of disturbed areas.

If you have any further enquiries on this matter please contact Shane Trengove on (049) 269 966.
Yours faithfully

PAM DEAN-JONES
Head Regional Operations Unit, Hunter
for Director-General

enc

Appendix C

MINUTES OF COMMUNITY CONSULTATION MEETING

MINUTES OF COMMUNITY CONSULTATION MEETING

organised by Pacific Blue Metal Quarries, held at 5.30 pm on 11 July 1996 at Greater Taree City Council's Taree Office

In Attendance:

Pacific Blue Metal Quarries - John Cornish (Chairman), Don Clarke, Lockey Kennett, Charlie Kennett (CK).
GTCC - Councillor Mick Tuck, Manager Development Services - Bruce Byatt
ERM Mitchell McCotter - Chris Power (CP)
30 local residents and other interested persons

The Chairman explained that the meeting was convened following commitments previously given to local residents that they would be consulted in respect to any proposed changes to the quarry operation. He advised that an EIS was being prepared for expansion of quarrying activities into Area B. The purpose of the meeting was to advise interested people of the proposals and to seek comments on issues to be addressed.

The Chairman indicated the project was being designed to ensure that new extraction areas (other than access and haul road) will not be visible from residences along Possum Brush Road. He noted a number of interested people had already visited the quarry and issued an open invitation for people to go to the quarry and inspect its operations. For safety reasons it was requested that intending visitors should phone CK first on 543206.

CP presented details of previous monitoring, consent conditions proposed to be amended, new EIS procedures and specialist studies underway. Overhead slides were presented showing preliminary quarry plan and preliminary SURPAC sections and views to the RL 138 extraction in Area B from the Warrangong, Rathdowney and Moolap Park residences.

CK outlined the need for expansion into Area B, including increasing materials specifications and need for higher quality road paving materials to provide safer road conditions.

The Chairman invited all present to raise concerns, queries, comments and issues for investigation in the new EIS. The following issues, questions and claims were raised:

- has Area A been exhausted? (CK advised that the material left in Area A alone could not adequately satisfy the new specifications for materials being issued);

- would there be an increase in traffic? (The Chairman advised that at this stage it was not intended to apply for an increase in the quarry extraction limits of 200,000 tonnes per annum and no major increase in traffic was envisaged);

- Bernie McCudden expressed concerns about water quality and siltation impacts on his dam and his inability to get relevant authorities to conduct tests (CK advised that he had arranged for a machine to clean out the dam, but Mr McCudden did not arrive at the agreed time and, despite an invitation, had not subsequently arranged an alternate time for the work);

- extraction operations in Area A were out of sequence with the Court approved plan (CK advised there were some departures due to chasing useable material, quality problems and normal quarry management matters, but he believed there is substantial compliance to the general thrust of the consent.

- crushing frequently takes place on Saturdays (CK advised that the quarry did crush on Saturday during the Rainbow Flat deviation construction due to inability of Jandra quarries to meet the requirements of a joint contract to guarantee supply of materials to the project, but Saturday crushing has been only on rare occasion

- breaches of starting times (CK advised breaches of starting times have not occurred; the plant has operated occasionally after the specified finishing time);

- the three metre high bund wall north of the excavation required by the Court was not provided (CK advised the bund is provided, but was moved about a year ago from RL 150 to RL 140 to allow continued extraction. The area on which the bund was previously located is now being worked);

- the company has breached conditions of consent because the operation is not economically viable; (Chairman totally rejected this);

- at the time of the previous EIS residents were told they would not see quarry operations because the rock was green in colour, matching the vegetation; this has proved to be untrue, (present company was not a part to the original applications and as such has no knowledge of this);

- quarry trucks and truck safety are significant issues of concern. Concerns include the quarry management accepting responsibility for trucking sub-contractors; overloading needs to be monitored; some trucks were unable to stop at the bottom of the hill leading to Possum Brush Road and at the Highway causing them to travel through the intersections; one truck had crashed; 19 children wait for the school bus on Possum Brush Road - there is nowhere for them to wait away from the danger caused by passing trucks; truck brakes are noisy, particularly laden vehicles going down the hill to Possum Brush Road; sight distances are poor at the quarry entrance to Possum Brush Road; the east bound lane along Possum Brush Road is disintegrating due to laden trucks - this also causes trucks to swerve to miss bad sections of pavement; a pedestrian footpath should be maintained along Possum Brush Road away from the trucks; because the tarred section of Possum Brush Road turns into the quarry, it appears to drivers to be the main road; some trucks (one in particular in recent days) travel laden westerly along Possum Brush Road; one truck and trailer which previously worked for the quarry travels too quickly along Possum Brush Road, some trucks have been seen on Tritton Road; a safety ramp should be provided at the bottom of the hill.

(Regarding the truck issue, the Chairman raised the possibility of imposing a special truck speed limit during the times that children were travelling to and

from school. He also advised the quarry does not allow overloading, and could be held responsible in case of an accident; CK advised the truck accident had been caused by a diesel spill from a logging truck; a number of people said they had received great courtesy from truck drivers on Possum Brush Road; the Chairman invited residents to report any "cowboy" drivers and undertook to take corrective action an any reports; the Chairman offered free material from the quarry to Council for maintenance of damage on Possum Brush Road and for paving of a suitable area or areas for children to wait for school buses; CK advised he constantly reminds truck drivers to comply with speed limits, stop signs and safety requirements; the Chairman advised the only quarry trucks which should be travelling west on Possum Brush Road are those whose drivers either live in Possum Brush Road or are delivering materials in the western part of Possum Brush Road; CK advised none of the quarry trucks are allowed to use Tritton Road; the truck driver who no long works for the quarry is not able to be controlled by the quarry management; truck safety is recognised by the quarry management as a significant issue of concern to the residents.)

- trust in the quarry management by the residents is a major issue. Breaches of consent conditions have resulted in a lack of trust from the residents; concerns were expressed that the invitation to this meeting was received only two days ago, which is inadequate warning for an issue of this nature. (The Chairman indicated that maintaining the trust of the residents was very important to the company and suggested introduction of a mechanism which would allow resident participation in periodic review of the quarry's performance);

- Paul Allen stated he believed that his previous job with the quarry had been to act as a liaison between the residents and the quarry management, but management had not responded to issues he raised; (Chairman said this was quite wrong and unfortunately Mr Allen was a disgruntled former employee);

- visual impact is a major issue, including impact when viewed from Breakneck Look out, which is a significant tourist site. There is no visual impact from the Pipeclay Creek Valley;

- rehabilitation is also a major issue, closely related to visual impact. Area A has not been rehabilitated in accordance with the approved rehabilitation plan. There is concern that quarry slopes are too steep to hold topsoil for rehabilitation. Existing timber on McCudden's property provides a significant visual screen. (The Chairman and CK advised that early planting and landscaping techniques involving planting of tube stock and advanced trees and shrubs had been unsuccessful, by the experience had demonstrated that natural seeding works most successfully and rehabilitation is now successfully underway in the completed sections of Area A; as per a series of recent photographs presented to the meeting.)

- operating hours are a concern to residents. Quarry operations on Saturdays would be unacceptable to residents. Concern was expressed that if further latitude were given, the allowable limits would be stretched by the company, eg a limit of five days may be stretched to five and a half days operation. In response to a question about changed quarry machinery the Chairman advised that there may be one or two more machinery items in addition to the current equipment, but these were not expected to make any noticeable difference to noise or other impacts;

- blast noise was a concern to some residents. Blast noise appears to travel along Possum Brush Road, affecting some more than others. Blasts vary in intensity from one blast to the next. Concerns were expressed that quarry management may reduce the blast design if it knows that specific blasts are to be monitored. Generally blast problems are rare, perhaps a couple of times a year. There is a need to ensure the blast warning siren is used prior to every blast. (The Chairman advised that if residents care to nominate three "problem" locations, blasts would be monitored and the results included in the EIS. CK advised that blast designs are not changed in response to monitoring, blast noise is a sign of an inefficient blast, which is undesirable from the quarry operators point of view. CK also advised the blast warning siren is used before each blast. He advised that recently, blasting had occurred approximately one day per month);

- the quarry telephone bell causes significant annoyance to local residents (CK undertook to correct this problem but pointed out that the nearest house is 1 km away);

- A QA program should be in place for quarry operations (CK advised that QA requirements are in place for material quality but not for operations);

- the Chairman undertook to monitor crushing noise at three locations. Residents could nominate problem locations if they wished;

- it was stated that CK always acts when complaints are submitted to him;

- CP was asked why, when previously Council planner he recommended Area A only if approval were to be given and now supports extraction in Area B? (CP advised the original concerns were about a quarry life well in excess of 150 years and visual impacts, but the quarry was now established and in order to meet modern day material specifications it is necessary to extract from Area B. This can be achieved without significant visual impact from Possum Brush Road);

- some secondary breaking has occurred in the quarry in the past. The noise of a rock breaker can be extremely annoying to residents (CK advised that oversize stone is a problem and it is almost essential for a rock breaker to be used on occasions. He suggested he could liaise with locals to undertake this periodically at appropriate times, and locate breaking operations behind bund walls rather than in exposed areas);

- there is a need for establishment of a formal review process with resident representation, and that the review panel has clout. Alternately a formal resident committee could inspect the quarry site periodically. In response to a question Bruce Byatt advised mechanisms are available in approval processes to enable residents to be represented in formal environmental performance review systems; eg the mineral sand mining activities at Diamond Beach; (The

- Chairman said the company would welcome local resident participation and review);

- the possibility of construction changes to Possum Brush Road was raised; eg realignment of some bends. Bruce Byatt advised conditions may be imposed on the development if increases in truck movements were involved. Council would have to consider the consent of the final EIS.

The Chairman concluded that the company called this meeting to listen to and cooperate with residents and will do so. The EIS will address the concerns raised. The company is concerned about the lack of trust issue and will seek to remedy that. He would be happy for the approval process to include a requirement for periodic review of environmental performance and for residents to be represented on a review panel.

Another meeting will be called when the EIS is complete to explain the findings to the residents.

Appendix D

DEPOSIT GEOLOGY, QUARRY DESIGN AND RESERVES

A REPORT FOR

PACIFIC BLUE METAL PTY LIMITED

TO SUPPORT A DEVELOPMENT APPLICATION
AND ENVIRONMENTAL IMPACT STATEMENT
TO BE PREPARED IN 1997
FOR CONSIDERATION BY GREATER TAREE CITY COUNCIL

TITLED

DEPOSIT GEOLOGY, QUARRY DESIGN AND RESERVES

RE EXTENSION OF THEIR QUARRY AT
POSSUM BRUSH NEAR NABIAC NSW

DATED

FEBRUARY 1997

PREPARED BY

KERRY R STEGGLES
CONSULTING GEOLOGIST AND ENGINEER

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Kerry R Steggles

Kerry R Steggles

ABSTRACT

This report discusses the hard rock blue metal quarry operated by Pacific Blue Metal on its 269 ha freehold property at Possum Brush near Nabiac NSW. The previous geological investigations and the production history since Development Consent was granted in 1987 is nominated. The remaining reserves in the existing quarry area of Block A are tabulated and reconciled in quantity and quality with the 1985 reserve estimate. Production problems arising from the terms of the D.C. are noted. Also the resultant difficulties created in respect to accessing significant quantities of the highest grade blue metal, namely stratigraphic Unit B fresh rock are recorded.

The changing market demand for various product types and the emerging of higher quality more stringent specifications are shown as the basis for requiring access to immediately available reserves of Unit B rock in Block B. The urgency of this requirement is due to the enormous program of Pacific Highway replacement and Tollway construction now in progress.

A very thorough analysis of Block B has allowed the definition of a 7 ha part that can be quarried in a manner that provides an exceptional environmentally unobtrusive operation. It also allows a deepening of Block A quarry. Visual parameters are exhaustively detailed. In respect to fauna and flora impact, the area to be cleared over many years is an insignificant 4 ha. Attention in this regard is drawn to the surrounding 120 ha of uncleared tree covered land owned by PBM and the close proximity of 1,500,000 ha of similar forested terrain. Noise, air, and water impacts are also shown to be comparable or less than with the current quarry which is meeting statutory requirements.

The sequencing of extraction is described with the 7 ha divided into a Northern and a Southern Stage. The former is further defined into Zone 1 and Zone 2 with the relevant mining commencement Bench levels stipulated. The Southern Stage is to maintain, for many years, its existing use for road access and quarry support activities. Early work to increase the efficient use of the Southern Stage and to establish tree regrowth small benches in the adjoining roadway corridor is recommended.

Reserves extractable from the detailed quarry design are tabulated in terms of the production from each Bench level divided into the various qualities. The quarry extension reserves are given as 16 M t, 9 M t being Unit B fresh rock. Extraction rate is noted as up to about 0.2 M t.p.a. The Report is summarised into 18 conclusion points from which recommendations are drawn in respect to a proposed Development Application.

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TABLE OF CONTENTS

Report Section		Page Number
1.	INTRODUCTION	1
2.	GEOLOGY AND RESOURCE DATA	2 - 5
2.1	Background	2
2.2	Geology and Rock Quality	2
2.3	Quarry Data and Reserves - Block "A"	3
2.4	Need for Quarry in Block "B"	4
3.	QUARRY DESIGN	6 - 13
3.1	Objective	6
3.2	Environmental and Operational Factors	6
3.3	Design and Environmental Factor Analysis	7
3.4	Mining Procedure for Block "B" Quarry	10
3.5	Mining Procedure for Block "A" Deep Quarry	12
4.	RESERVES	14 - 16
4.1	General Details	14
4.2	Block "A" Deepening Reserves	14
4.3	Block "B" Reserves	15
4.4	Reserves Summary	16
5.	CONCLUSIONS AND RECOMMENDATIONS	17 - 18
5.1	Conclusions	17
5.2	Recommendations	18
6.	REFERENCES	19

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LIST OF TABLES.

Number and Title of Table		Page Location
TABLE 1	Quarry Resource and Reserves Block "A" Current Consent	Facing 3
TABLE 2	Block "B" Development Sightlines from Surveying Data McCudden's House.	After 10
TABLE 3	Block "B" Development Sightlines from Surveying Data Whitton's House.	After 10
TABLE 4	Block "B" Development Sightlines from Surveying Data McLaughlan's House.	After 10
TABLE 5	Block "B" Development Sightlines from Surveying Data Possum Brush Gallery.	After 10
TABLE 6	Quarry Resource and Reserves Block "A"Deepening	Facing 13
TABLE 7	Quarry Resource and Reserves Block "B" North Stage	Facing 14
TABLE 8	Quarry Resource and Reserves Block "B" South Stage, and Summary	Facing 15

Kerry R Steggles

LIST OF FIGURES.

Number and Subject of Figure		Page Location
FIGURE 1	Locality Plan	Facing 1
FIGURE 2	Existing Quarry Operation.	Facing 2
FIGURE 3	Regional Topographic Setting, Visibility Analysis	Facing 8
FIGURE 4	Sightline and Visibility Analysis Block "B" Quarry	Facing 9
FIGURE 5	Optimum Quarry Design Block "B" Part	Facing 11
FIGURE 6	Optimum Quarry Design Block "A" Part	Facing 12

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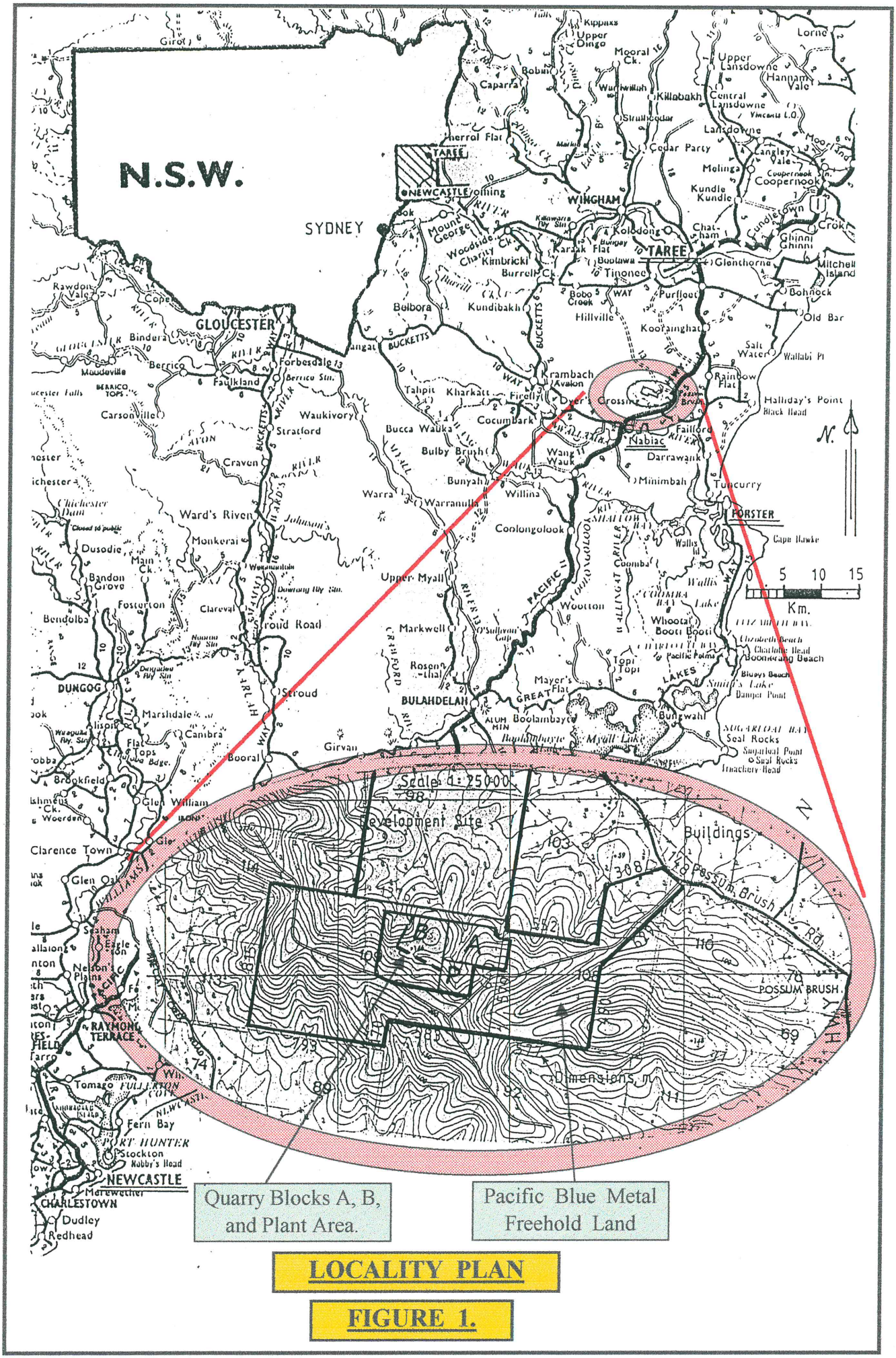

LOCALITY PLAN

FIGURE 1.

1. INTRODUCTION.

Pacific Blue Metal Pty Limited (PBM) operate a hard rock blue metal quarry on their freehold land near Possum Brush, north of Nabiac NSW. The property comprises Lot 3 DP701903, Lot 66 DP608967, and Portion 109 in the Parish of Talawahl, County of Gloucester, in the local government area of the City of Greater Taree. It forms one contiguous holding of approximately 269 hectares (ha.) with two frontages to Possum Brush Road. **Figure 1,** on the facing page, is a **Locality Plan** of this property.

In 1987 Development Consent (the "D.C.") was granted for the use of the above described land for the establishment of a hard rock quarry and crushing plant. The Development Application number was 431/1986 Greater Taree City Council. The D.C. was for a term of 32 years with a Condition restricting extraction to an area defined as Block A, about 7.5 ha. The land area adjoining Block A was detailed for access roadways, crushing plant and associated installations, and stockpiling of materials. This involved the use of about 3 ha of the adjoining Block B and 3 ha adjoining both Blocks. The position of these blocks is marked on the **Figure 1** Plan.

During the past 10 years a successful quarrying and crushing business has been established on the site. An extensive range of hard rock products have been supplied for most Construction Industry applications, and other lesser market sectors. It has become the major quarry in the extensive mid North Coast Region of Taree / Forster. The dominant market application has been roadway construction.

Overall the development has been in good accord with the activity described in the D.C., and the predictions outlined 10 years ago in the documentation. However, the major aspect not adequately envisaged was the development of far more demanding quality specifications and a stringent Quality Assurance regime for most major markets. This situation has necessitated the seeking of a quarry extension into Block B so as to access the reserves of the highest quality hard rock in sufficient quantity to meet current demand.

This report describes the deposit geology and resource significance, proposes a Block B quarry design after assessing relevant environmental parameters, and nominates extractable reserves in A and B from that design. The design and boundaries have been set to achieve an insignificant visual expression of the workings when viewed from Possum Brush Road and the nearest houses.

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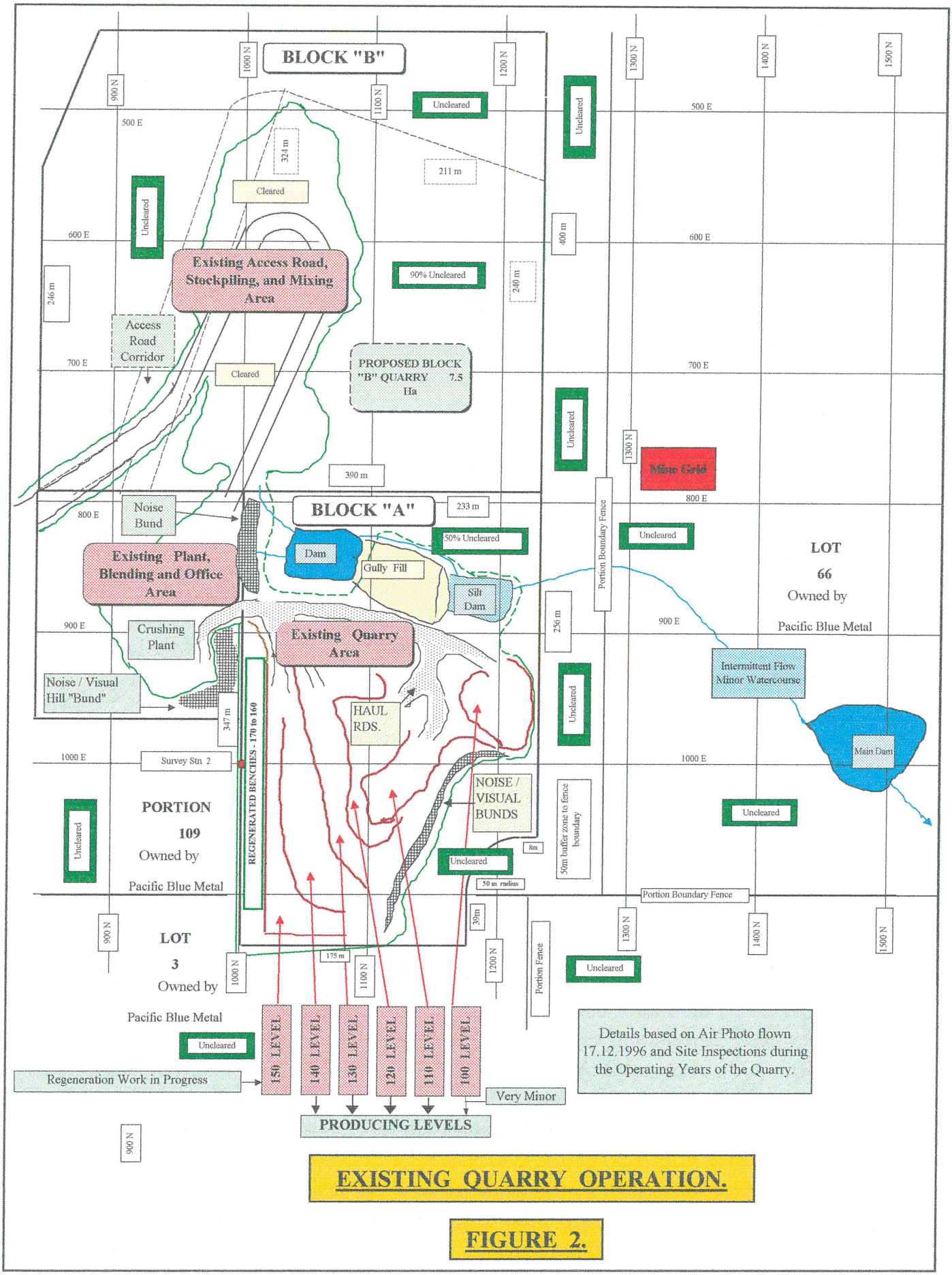

EXISTING QUARRY OPERATION.

FIGURE 2.

2. GEOLOGY AND RESOURCE DATA.

2.1 Background.

The geological and mining character of the deposit was investigated in 1984 by Geological and Resource Development Consultants K. R. Steggles and Associates Pty. This work was presented to the then owners Wyan Holdings Pty. Limited. in a report dated 18.1.1985. The report title was **"Nabiac Blue Metal Deposit - Exploration 1984** (the "1984 Investigations"). Since ownership of the deposit was established in 1988 by Pacific Blue Metal Pty. Limited (PBM), the current owners and quarry operator's, Mr. Kerry Steggles has been retained to provide geological, mining, processing, and product technical services.

About 1,000,000 tonnes of various products have been produced from the deposit to date, all from a section of the deposit defined as Block "A". The 1984 Investigations defined the deposit in three adjoining blocks, A, B, and C, running from east to west. They have areas of 7.5 ha, 15.4 ha and 6.4 ha. The Development Consent (the "D.C.") granted in 1987 nominated Block "A" as the area to be quarried with a depth limit of A.H.D. 85. It also directed that it be quarried from the highest southern part of the block. The 1984 Investigations had recommended the deposit be developed from the lowest level on the northern boundary. **Figure 2**, facing page, titled **"Existing Quarry Operation"** shows the Quarry as at December 17th 1996.

The 1984 Investigations included geological surface mapping, and assessment of 5 solid core diamond drill exploration holes and 43 rotary percussion exploration holes. Coarse and fine classified core chip samples were produced from the latter holes. Two small test pits were created to test the rock and provide material for crushing and quality analysis.

2.2 Geology and Rock Quality.

The deposit is a sequence of metamorphosed fine to conglomeratic greywacke with pyroclastic characteristics, and containing interbedded chert and fine quartzite, divided into lithological units A to I. These Units have a total thickness of approximately 500m. They are stratified Palaeozoic rocks, probably Devonian Age, of the Tamworth Belt in the New England Geosyncline. Quarrying has confirmed the exploration interpretation of the structure as being a sequence dipping at about 45° average to the south east, with a strike ranging from 35° to 70°.

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QUARRY RESOURCE AND RESERVES
BLOCK "A" CURRENT CONSENT

With Depth Limit of A.H.D. 85 as per the D.C.

Rock density estimates: (tonnes / m³)	weathered material	=	2.0
	fresh (unweathered)	=	2.7

Nominal Bench Level	Surface Area, m²	Bench Height, m	Rock Volume, m³	Weathered Rock %	Weathered Rock, Tonnes	Fresh Rock Tonnes	Total Rock Tonnes
150 m	0		0		0	0	0
140 m	3000	10	30000	50%	30,000	41,000	71,000
130 m	10000	10	100000	30%	60,000	189,000	249,000
120 m	25000	10	250000	50%	250,000	337,000	587,000
110 m	40000	10	400000	20%	160,000	864,000	1,024,000
100 m	49000	10	490000	10%	98,000	1,191,000	1,289,000
90 m	49000	10	490000	0%	0	1,323,000	1,323,000
85 m	44000	4	176000	5%	18,000	451,000	469,000
	TOTALS		1,936,000	12%	616,000	4,396,000	5,012,000

COMPARISON WITH 1985 RESERVES ESTIMATE

Item	Weathered Rock, Tonnes	Fresh Rock Tonnes	Total Rock Tonnes
1985 Reserve Estimate	1,000,000	5,400,000	6,400,000
Production to Date (excludes site stock) - Note 1	700,000	300,000	1,000,000
Stockpiles - uncrushed feed, boulders, scalpings	10,000	10,000	20,000
Stockpiles - crushed products	10,000	25,000	35,000
Weathered Rock Surplus: Fill / Bund wall - Note 2	100,000		100,000
Balance of 1985 Estimate	190,000	5,090,000	5,245,000

Note 1: Assessed after discussion with Quarry Manager, early years data uncertain, figure may be out by 100,000.

Note 2: Mainly in Gully and mixed with waste earth; unusable.

Adjustment for Greater Volume of Weathered Rock re Density Difference		151,000
Balance of 1985 Estimate, after above adjustment		5,094,000
Difference between 1985 Estimate and Current Calculation	in Tonnes	-82,000
	as % =	-1%

RESOURCE STATUS

From the Exploration Data and 8 Year 1 Million Tonne Production History of the Quarry, the above Quantities are Assessed as Proved Reserves.

TABLE 1.

Division of the sequence into Units was based on lithological continuity of either coarse or fine rock assemblages using a number coding system to denote coarseness. The coarsest was coded 1, the finest coded 4. Unweathered coarse assemblage rock provides the better quality rock for most applications. Unit A is the basal unit and is the oldest, Unit I is the uppermost and is the youngest. Weathered rock depth is very variable [0 to >20m] with the thickest average being on the higher parts of the deposit (above A.H.D. 140m). Units B, D, F, and H are coarse assemblage units, with the thickest being Unit B at 105m true thickness.

Unit B provides the best rock for consistency of hardness, durability, strength, crushed shape, and inertness. These properties are reflected in Unit B having the least weathered cover. In Block A it outcrops across the north western section which has the lowest part of the deposit [A.H.D. 85m] and carries the main drainage gully. It is the major outcropping Unit in the westerly adjoining Block B. Exploration data indicates that more weathered finer lithology bands develop in Unit B in the western part of Block B.

2.3 Quarry Data and Reserves - Block "A".

Prior to the D.C., reserves in Block A were nominated as 6.4 million tonnes of weathered plus unweathered [fresh] rock. This assumed complete extraction to A.H.D. 85m with a remnant benching pattern of 5m benches and 10m faces at 75°. Using the same criterion, remaining reserves of **5.0 million tonnes** have been calculated. The details are presented in **Table 1** titled **Quarry Resource and Reserves - Block "A" Current Consent** (facing page). This is as at 17.12.96 and is based on quarry survey data, the 1:25,000 Nabiac topographic map, and an air photo flown on December 17th 1996. The Table includes a comparison with the 1985 reserve estimate and gives quantities for each Bench Level. With the nominated adjustments, the figure is in very close accord with the 1985 estimate. The difference is -1%.

The major resource difference has been some 40% more rock in the weathered rock quality classification than predicted. Of more impact on the efficient working of the deposit, as recommended in the 1985 resource analysis, was the extraction changes required by the terms of the 1987 issued D.C. The need to provide small benches along the high southern boundary reduced the yield from that area but it was offset by the positioning of the southern boundary a few meters further south. The placing of major water and silt dams in the main Gully on Block A impeded the access and development of levels below 120 m around them and west of that Gully.

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The commencement of quarrying at the top instead of the bottom of the deposit had the most adverse effect. It meant that instead of encountering a ratio of weathered to unweathered rock that was balanced in terms of product requirements, very large surplus quantities of overburden and weathered rock had to be moved and stowed on the lower lying gully area of Block A. This has created access difficulties in respect to the reserves of Unit B within Block A. East of the gully the reserves below a floor level of A.H.D. 100 are effected, and west of the gully it is the majority of reserves.

Quarry activity, technical aspects of production and market, and quality assurance testing of production during the past 8 years has shown that the deposit to date has been in good overall accord with "the Report" exploration data analysis. As noted previously, the main feature was the 40% higher weathered rock content encountered. Points relevant to this were :-

1. Depth of weathering on Units C to F was in the upper region of the exploration data results, not the average.
2. Joint / shear curved [slippery back] planes were more prevalent than expected and created localised deep weathered zones. Some areas will require larger benches and lower angle faces for operating stability
3. Some unweathered rock types, usually fine grained, have strength and durability features below expectations and need to be restricted to particular product types and treated as weathered rock.

These features are the type of deposit detail that are only revealed when the quarry is fully developed, exploration does not provide such detail.

The 5.0 million tonnes of reserves remaining in Block A would reduce to about **3 million** without the working space provided by development of Block "B". This is because the water dam, major fill and waste earth dump, and fines dam are in the Gully area and the area west of it in A is very narrow. It would not be economic to relocate these within the confines of A and its D.C. limitations.

2.4 Need for Quarry in Block "B".

The available market to date for the quarries products has been heavily biased towards road base types. They have been more than 90% of output. This has been fortunate as it has allowed the use of a high percentage of the weathered rock encountered. With the quarry now extensively developed, the ratio of weathered rock to unweathered rock has reduced. Major technical changes have occurred over the past 10 years and stronger, more durable, lower porosity, more consistent rock is now needed. In particular for aggregates.

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Some 50,000 tonnes of aggregate have been produced to date, most to these more exacting specifications, and almost all from Unit B rock. An example is the **QA Specification RTA 3151 Edition 3** issued by the Roads and Traffic Authority of New South Wales for Quotation - PM/AGG/96. It was a Public Tender for "Cover Aggregate for Sprayed Bituminous Surfacing."

Market requirements are currently moving markedly towards very high specification aggregates and current projections are that output in the immediate future will move from the previous 90:10 to 50:50 [road base to aggregates]. Specific applications for such aggregates are asphaltic cement, skid resistant cover aggregates, concrete pavements for expressway construction, and concrete plants. Production has established the suitable character of Unit B rock for these applications whereas rock from the other Units has not met all the requirements.

Although Block A contains very large reserves of Unit B, they are mainly in the lower levels deep below the current workings and would not be practical to access for a number of years. Also, the D.C. requires the higher levels to be worked first. Other smaller quantities of Unit B occur west of the Gully and in the north east sector. The former has access difficulties as detailed in the above Section 2.3. The latter would require early stripping of all the remaining trees in that sector for a small tonnage, less than 50,000.

To meet this requirement it is necessary to develop a quarry in Block B, both for it's reserves of Unit B and for accessing the Unit B reserves in the adjoining Block A west of the drainage gully. Also, expansion of the quarry area allows the accessing of reserves below the A.H.D. 85 floor area of 4 ha. The self draining A.H.D. 85 m floor level was the functional limit when the quarry had to be developed only on the 7.5 ha of Block A.

This requirement has received added urgency due to the massive scale of Highway construction that is occurring now and planned to continue for some years. PBM Management advise that inquiries for very large quantities of aggregates have arisen in recent months. The major reason is a change in pavement design characteristics for the planned coastal Tollways.

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3. QUARRY DESIGN.

3.1 Objective.

The objective is the ability to immediately produce large quantities of the Unit B rock, a rock that has properties suitable for meeting current high quality aggregate specification. Block A although containing large quantities of Unit B, is unable to supply large quantities for a number of years due to the Conditions of the D.C., as well as access problems of depth below current workings or location in a narrow western area beside the pond and fill zone of the main Gully.

Block B adjoins Block A on its western boundary and has Unit B as the major outcropping unit. A quarry on Block B that develops to adjoin Block A quarry would create a quarry area sufficient to develop an access roadway down to levels below the current extraction limit of the Block A quarry. The dominant rock produced from Block B and the deeper Block A workings would be from Unit B.

The above would satisfy the rock quality and immediate production requirement needs of the quarry. The other requirement is the satisfying of environmental factors in the quarry design, location and operation.

3.2 Environmental and Operational Factors.

The environmental parameters to satisfy are:-

a) Visual unobtrusiveness - discussed in Sections 3.3 and 3.4.
b) Flora and fauna species non endangering - discussed in Section 3.3.
c) Noise limitation in accord with statutory need - discussed in Section 3.4.
d) Air and water pollution controls - discussed in Section 3.4.

Quarry operation method needs to meet the above environmental parameters and be economically viable. Fortunately the topography of the site and the large land holding provides a capacity to achieve these objectives. The existing enterprise has confirmed the ability to operate a quarry on this site within these parameters.

The rock extracted from the new area will be hauled to the existing Crushing Plant for crushing and blending. This facet of the enterprise does not require a further Development Consent, the existing D.C. being adequate. The quarry operating method and equipment used will be comparable to that used in the current quarry and accordingly is known to meet all requirements.

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The only operational features that require comment are as follows:-

1. Quarrying method will need to include secondary breaking of oversize material that is generated at times from the quarry face blasting. This constitutes a very minor percentage of production. Secondary breaking allows the consumption of such material instead of either wasting it as backfill or stowing it in stockpiles that diminish the capacity to be visually unobtrusive. This activity would be conducted behind suitable deep faces that minimise noise propagation outside the quarry.
2. Highway haulage truck design and capacity continues to change with higher increased legal loads. The current D.C. nominates that trucks entering or leaving the site shall not exceed 24 tonnes. This is functional if the 24 is a reference to the tare weight of the truck, not if it is a reference to loaded truck weight. Accordingly, this development needs to simply nominate quarry product haulage be done in accord with legal limits.

3.3 Design and Environment Factor Analysis.

Based on the previously mentioned considerations, a 7 ha part of the 15.4 ha in Block B has been delineated for quarrying. This together with the deepening of the Block A quarry, below the D.C. level of A.H.D. 85 to A.H.D. 40, is adequate to satisfy all requirements. The 7 ha includes the 3 ha already being used for stockpiles, plant storage, and road access. A small area adjoining the existing Exit Road is also involved for road widening and access from Block B into the Crushing Plant area. Accordingly, the area of new ground to be disturbed is limited to about 4 ha. Such a small area in the holding of 269 ha ensures an insignificant impact on the amenity of the location. Assessment of the environmental parameters noted in Section 3.2 follows.

Visual unobtrusiveness

In making the Block B quarry selection, a detailed Sightline and Visibility analysis was made using data from:-

- consulting surveyors Degotardi, Smith & Partners (Forster),
- State Government 1:25,000 Nabiac topographic plan (9333-1-N),
- an air photo sequence of the region flown by BHP Engineering on behalf of PBM on 17.12.1996,
- various site and regional inspections.

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REGIONAL TOPOGRAPHIC SETTING
VISIBILITY ANALYSIS

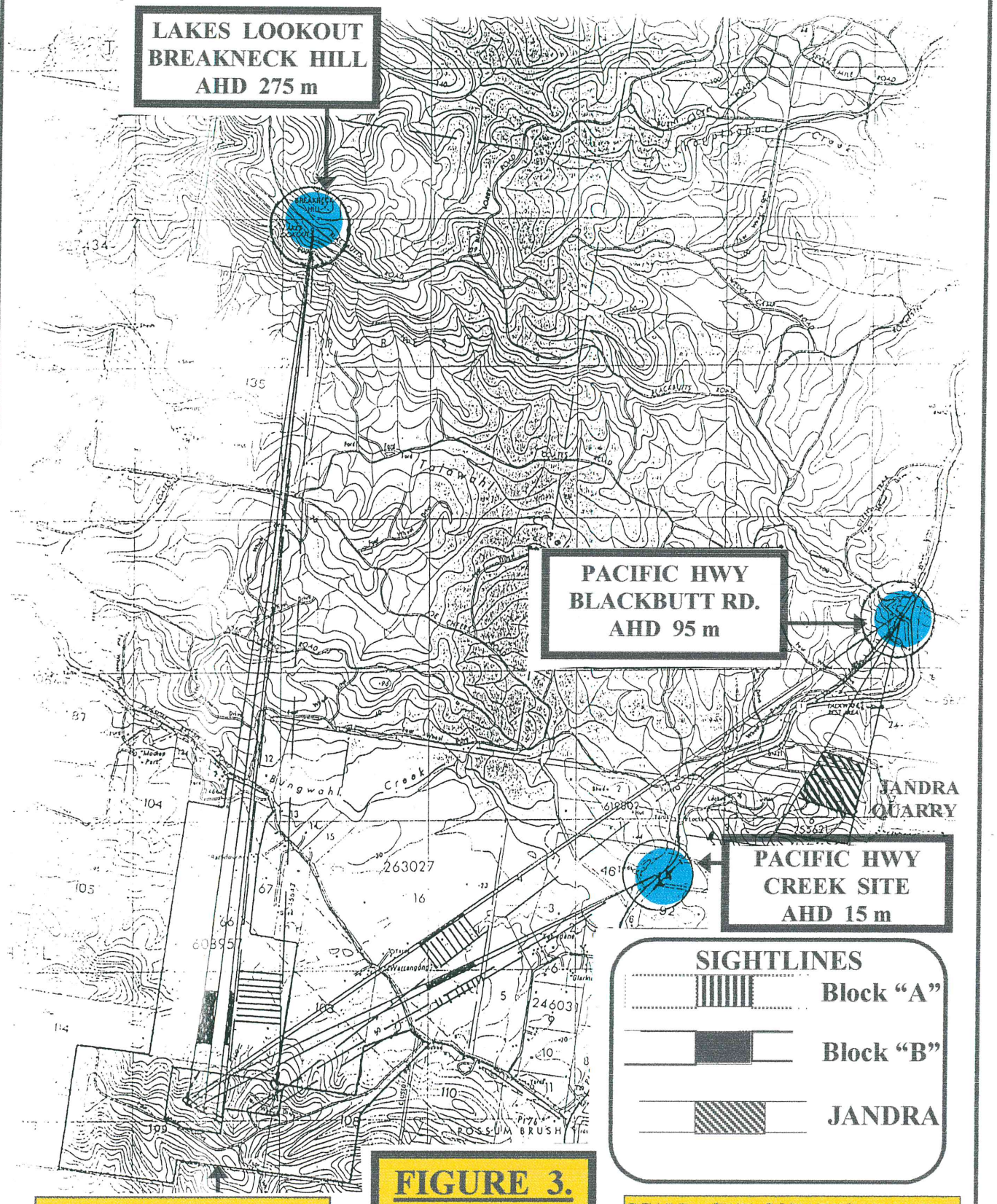

FIGURE 3.

As with the existing quarry, the hill structure and tree cover hides the workings to the east, south, and west. **Figure 3**, titled **Regional Topographic Setting, Visibility Analysis** (facing page) shows this situation and the only potential visibility field. It extends from north to north east. To the north, the potential visibility field has the distant reference point of Lakes Lookout on Breakneck Hill off Blackbutts Road. To the north east, it has the Blackbutts Road turnoff point on the Pacific Highway and the Pacific Highway location between Talawahl and Bungwahl creeks.

Lakes Lookout is 6.0 kilometres (kms) from the quarry and is at an elevation of about A.H.D. 275m. The current quarry on Block A occupies a vision field of 3.1° horizontal (H) and up to 0.2° vertical (V), with about a third having well developed tree regeneration faces. As this quarry develops, depth exposure will increase but this will be offset by the continuation of tree regeneration on the lower final benches. Bench level 150 m is currently being planted. Higher benches to 170 m have advanced tree regeneration. Block B quarry will create a vision field adjoining Block A of 0.5° H and up to 0.1° V, and on the west side of Block B, a field of 1.0°H and 0.1°V. These will diminish with tree regeneration of benches and may even be undetectable with the years of boundary tree growth before mining. The measurements indicate an unobtrusive impact on the field of vision from this location.

The only points on the Pacific Highway where the quarry is in line of sight are the above mentioned Blackbutts Road turnoff and the between creeks location. The former is 5.5 kms from Block A quarry and at about A.H.D. 95m. The vision field is 2.9°H and up to 0.2°V. The tree regeneration, referred to above, impacts on about half this field. Block B quarry will provide a vision field of 0.3°H and up to 0.1°V. Again these measurements indicate an unobtrusive impact on the field of vision from this location. The Block B quarry may be only discernible with a telescope. A good comparison with a quarry development that is obtrusive on the field of vision is provided at this observation point. It is provided by the quarry known as Jandra which is 1.5 kms away and has a field of vision of 17.2°H and 1.5°V.

The other Pacific Highway vision point provides a view of the tree growth restored benches in Block A. It is a very unobtrusive aspect of the landscape, requiring knowledge of the quarry's existence to realise it is a view of quarry benches. The viewing location is at A.H.D. 15 m, 3.2 kms from the quarry. It presents a very narrow window of 1.8°H and up to 0.4°V.

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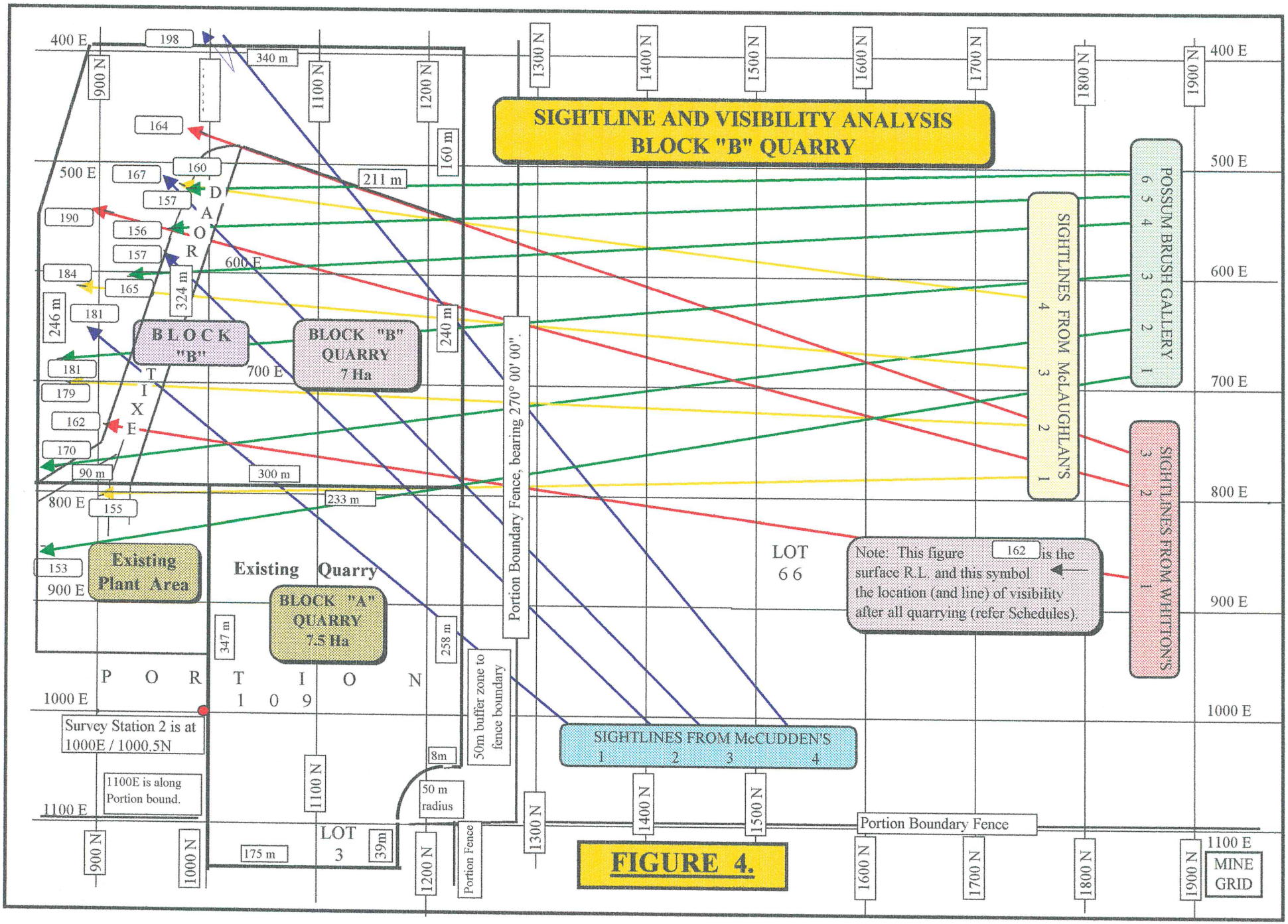
PACIFIC BLUE METAL



As the existing Block A quarry develops, further minor bench views will occur, offset by the bench regeneration. The working of Block B area will remove some of this view and leave a much smaller 1.1°H, 0.1°V view of the south west corner of B from this Highway position.

The land back from the points discussed above and north of Possum Brush Road is dominantly heavily wooded and mainly State Forest land. No points can be found in that zone from which the existing or planned Block B quarry is visible. The only section of public roadway having potential vision of the workings is Possum Brush Road between about McCuddens residence and the Possum Brush Gallery site, an interval of 1.5 kms. Trees generally line the side of this road section which also is partly in cuttings, and hence the view of the land containing the quarry is impeded.

To assess the potential visual obtrusion of the Block B quarry, sightlines have been constructed from observation points beside the four houses on the quarry side of the 1.5 km stretch of Possum Brush Rd. They were:-

- McCudden's house (1.15 kms away).
- Whitton's house (1.13 kms away and the nearest house).
- McLaughlan's house (1.43 kms away).
- Possum Brush Gallery.

It is noted that the quarry on Block A is visible from the last three of these locations over a small field of vision with some impedance of view from tree clumps in the paddocks. In the paddocks, away from the residences, the view is more significant. The paddocks north of Possum Brush Rd. also provide some minor views. The impact of these views have been diminished by the tree regeneration on the high fully extracted benches. As this quarry is further developed some new workings will become visible but this would be more than offset by a continuation of the bench tree regeneration program.

Figure 4, titled **Sightline and Visibility Analysis, Block "B" Quarry** is presented on the facing page. This shows a series of viewing lines from each of the above four sites. The lines cross over the proposed Block B quarry site and are terminated at points that are calculated to be the lowest surface visibility points after all material has been extracted. Some also exclude the vision impedance of existing trees currently in the paddocks near the observation point. The estimated A.H.D. level of each point is shown. As the hill knoll will provide additional vision impedance for many years, the tree growth will further obscure visibility by raising these points to higher levels.

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Tables 2, 3, 4, and 5, contain details of the calculations involved for sightlines from each of the four sites. They are titled **Block "B" Development, Sightlines From Surveying Data** and follow this page. This analysis was used to position the Block B quarry, and the associated widened exit road and road to the Plant area. They are essentially invisible on the basis of the fully extracted resource. The mining sequence procedure to ensure visual unobtrusiveness is discussed in Section 3.4.

Flora and Fauna Species Non Endangering.

There is only some 4 ha of tree covered land involved in the proposed quarry extension. Details obtained in the early 1980's indicated that the tree cover was dominantly regeneration from earlier campaigns of timber cutting on the property. The same flora can be found on the surrounding tree covered part of the property which is some 30 times that area. The topography and geological character is the same. This assessment has been made from inspection of the site and photogeological examination of the 17.12.1996 air photo sequence.

The 4 ha will be cleared in no less than 3 campaigns over many years. Any species of animal occupying the site would migrate to the adjoining areas which provide the same habitat opportunities. The site is on the Nabiac topographic 1:25,000 map which shows that about half the surrounding land, particularly to the north and west, is medium to heavily wooded. The trees in that wooded area of 150 square kilometres are many millions. Geological and topographic data indicates the same flora and fauna as found on the 4 ha would be well represented in that area.

The proposed Block B quarry obviously poses no threat to any flora or fauna. In the context of the surrounding country side, the area is insignificant.

3.4 Mining Procedure for Block "B" Quarry.

The working of Block B would be in 2 stages, a North and a South. The former is north of the current quarry access road and is generally timbered. The latter is south of that road and is generally cleared, being the area on which materials are currently stockpiled. This would continue for many years to be used for stockpiling and blending activity, probably more than 20. Quarrying would commence immediately in the **Northern Stage**. It would be the dominant provider of high grade Unit B aggregate rock. The weathered rock from this Stage occurs mainly above A.H.D. 140 m, and would be used in road base and associated material..

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BLOCK "B" DEVELOPMENT
SIGHTLINES FROM SURVEYING DATA
McCUDDEN'S HOUSE

Station 2100 - behind McCuddens House. Level, m = 43.03

Assume observer eye level, m = 1.5

Note: Correction of 6° 14' 10" applied to Surveyor's erroneous Mine Grid, Surveyor's assumed R.L. Datum retained - it is about AHD + 2m.

Observer Co-ordinates: 1606.4 E / 2032.0 N.

Line Bearing (nearest 15')	Tree Height, Level, Distance and Gradient % of view impeding reference.					Line No.	Sightline Levels over Quarry Areas								Comments re Proposed Quarry Workings Visibility in Block "B".
	Base R.L.	Height, m	Crown R.L.	Distance	Gradient to Crown		Nth boundary - A or B blocks		Block "A"or "B" S limit.		Block "B" at Exit Road (S).		View Point after Mining		
							Distance	Level	Distance	Level	Distance	Level	Distance	Level	
209°	85.2	31	116.2	740	9.7%		992	140.6	1184	159.2	n.a	n.a.	n.a	n.a.	Top 15m of small replanted benches visible in "A".
220° and over 1st tree clump.	62.9	29	91.9	628	7.5%		1040	122.9	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	Sight line over 1st tree clump gives 122.9 level at "A" where level is about 120 + 20 tree height = 140. Hence, the following is relevant sightline.
220° and over 20m trees on "A" boundary.	120.0	20	140.0	1040	9.2%	1	1040	140.0	1400	173.0	1412	174.1	1490	181.3	No workings visible in "A" or "B", sight line is 174.1 over the exit road which is about 153 [STN 21 above road 10m E is 157.24] and 173.0 over quarry S limit which is about 150m.
223° 30' and over 1st tree clump.	65.8	29	94.8	660	7.6%	2	1101	128.4	1439	154.2	1455	155.4	1481	157.4	No working visible in "A" or "B". Line is 155.4 over the exit road which at about 150 is 7m below, and 154.2 over the quarry S limit (about the same). Line enters "A"at about the lowest North boundary visibility point (line maybe higher re trees to N).
225° 45' and over 1st tree clump.	64.8	26	90.8	680	6.8%		1148	122.6	1504	146.8	n.a.	n.a.	1148	122.6	Line over 1st tree clump gives 122.6 level at "B" where level is at least 115 + 20 tree height = 135. Hence, the following is relevant sightline.
225° 45' and over 20m trees on "B" boundary	116.0	20	136.0	1146	8.0%	3	1146	136.0	1470	161.9	1506	164.7	1534	167.0	No workings visible in "B", sight line is 163.3 over the flat small area beside the exit road (S) at 148. At least 10m stockpiles would not be visible in this area. Line crosses North boundary of "B" 8m West of "A".
230° and over 20m trees (min.) on "B" boundary	139.0	20	159.0	1244	9.2%	4	1244	159.0	1428	175.9	Same (175.9), as exit road in quarry on west boundary.		1664	197.6	No quarry workings visible. Line exits quarry on west boundary at 175.9, some 50m above surface. Line crosses North boundary 140m West of "A".

TABLE 2

BLOCK "B" DEVELOPMENT
SIGHTLINES FROM SURVEYING DATA
WHITTON'S HOUSE

Note: Correction of 6° 14' 10" applied to Surveyor's erroneous Mine Grid, Surveyor's assumed R.L. Datum retained - it is about AHD + 2m.

Station 2101 - behind Whitton's House. Level, m = 48.07

Assume observer eye level, m = 1.5

Sightline Levels over Quarry Areas

Observer Co-ordinates: 923.6 E / 2351.8 N.

Line Bearing (nearest 15')	Tree Height, Level, Distance and Gradient % of view impeding reference.					Line No.	Nth boundary - A or B blocks		Block "A"or "B" S limit.		Block "B" at Exit Road (S).		View Point after Mining		Comments re Proposed Quarry Workings Visibility in Block "B".
	Base R.L.	Height, m	Crown R.L.	Distance	Gradient to Crown		Distance	Level	Distance	Level	Distance	Level	Distance	Level	
176° 46' 00" and over 1st tree clump	47.3	21	68.3	344	5.5%		1116	110.5	1354.00	123.4	n.a	n.a.	n.a	n.a.	Sight line over 1st tree clump gives 110.3 level at "A" where level is about 120 + 20 tree height = 140. Hence, the following is relevant sightline.
176° 46' and over 20m trees on "A" boundary	120.0	20	140.0	1116	8.1%		1116	140.0	1354	159.3	n.a.	n.a.	n.a.	n.a.	Top 14m of small replanted benches visible in "A" (only 8m if trees 25m not 20m). This is Sightline to Survey Station 2 on the highest point of quarry area "A" (South boundary), grid 1000N / 1000E, RL 173.66.
187° 15' and over 1st tree clump.	49.7	27	76.7	348	7.8%		1127	137.5	1415	160.0	1455	163.1	1473	164.5	No workings visible in "B". Sightline is just over the estimated 20m high trees on N boundary (10m West of "A"), and is 5m+ above the level of the exit road above the workings and >7m over the quarry.
187° 15' and over 20m trees on "B" boundary	116.0	20	136.0	1127	7.7%	1	1127	136.0	1415	158.1	1455	161.2	1459	161.5	This considers the view if the 1st clump of trees did not exist. It shows little change, the increased visibility is < 2m. Quarry workings and exit road remain hidden.
194° 45' over 1st tree clump.	54.4	30	84.4	356	9.8%		1156	162.5	1396	186.0	1402	186.5	Line probably goes above the mountain range.		No workings visible in "B", sight line is more than 35m above the exit road [STN11 above the road is 154.13] Line is 160m West of "A" at North boundary.
194°45' and over 20m trees on "B" boundary	137.0	20	157.0	1156	9.3%	2	1156	157.0	1396	179.3	1402	179.9	1498	188.8	This considers the view if the 1st clump of trees did not exist. The increased visibility is about 7m. Quarry and exit road remain hidden - sightline is about 30m above both.
198° 15' and over 25m trees on boundary.	123.0	20	143.0	1178	7.9%	3	1178	143.0	1389	159.7	1400	160.6	1430	163.0	This considers the view if 1st clump of trees did not exist. Quarry and exit road still hidden. Line is >10m over quarry S limit, and >10m over planned exit road. This line is along the Western limit of quarry.

TABLE 3

BLOCK "B" DEVELOPMENT
SIGHTLINES FROM SURVEYING DATA
McLAUGHLAN'S HOUSE

Station 2102 - behind McFarlane's House. R.L., m = 49.22

Note: Correction of 6° 14' 10" applied to Surveyor's erroneous Mine Grid, Surveyor's assumed R.L. Datum retained - it is about AHD + 2m.

Assume observer eye level, m = 1.5

Sightline Levels over Quarry Areas

Observer Co-ordinates: 763.4 E / 2667.6 N.

Line Bearing (nearest 15')	Tree Height, Level, Distance and Gradient% of view impeding reference.					Line No.	Block "B" N boundary.		Block "A"or "B" S limit.		Block "B" at Exit Road (S).		View Point after Mining		Comments re Proposed Quarry Workings Visibility in Block "B".
	Base R.L.	Height, m	Crown R.L.	Distance	Gradient to Crown		Distance	Level	Distance	Level	Distance	Level	Distance	Level	
179° 15', over crown of nearest tree clump - TC 1.	52.4	29	81.4	240	12.8%		1434	234.2	1667	264.0	n.a.	n.a.	Line goes over mountain range		Tree Clump (TC 1) blocks view of all the quarry hill. View line goes over the corner of "A" and "B" on north boundary.
179° 15', if TC 2 was 1st tree clump.	60.3	26	86.3	660	5.4%		1434	128.0	1667	140.6	n.a.	n.a.	n.a.	n.a.	Sight line over tree clump TC 2 gives 128 level at North boundary where level is not less than 115 + 20 tree height = 135. Hence, the following is relevant sightline, if Tree Clump TC 1 didn't exist.
179° 15' and over 20m trees on "A/B" boundary.	115.0	20	135.0	1434	5.9%	1	1434	135.0	1667	148.7	n.a.	n.a.	1767	154.6	If TC 1 didn't exist, the sightline would still be more than 20m above the south boundary of "A", and 155 at the back of the Plant area. No quarry area is visible.
182°, over TC 1 crown.	54.3	29	83.3	300	10.9%		1435	206.6	1707	236.1	1733	238.9	Line goes over mountain range		Tree Clump TC 1 blocks view of all the hill.
182° and over 20m trees on "B" boundary	133.0	20	153.0	1435	7.1%	2	1435	153.0	1707	172.4	1733	174.2	1795	178.7	No quarry workings are visible. The sightline is nearly 20m above the exit road which is about 155 and >20m above the south quarry limit (<152).
184° 45' and over 20m trees on "B" boundary.	138.0	20	158.0	1439	7.5%	3	1439	158.0	1687	176.5	1715	178.6	1792	184.3	This assumes Tree Clump TC 1 doesn't exist. No quarry workings are visible. The sightline is almost 30m above the exit road and 28m over the south limit of the quarry. No hill can be seen over the crown of TC 1.
188° 15' and over 25m trees on "B" boundary.	123.0	20	143.0	1450	6.4%	4	1450	143.0	1674	157.3	1707	159.4	1718	160.1	This assumes Tree Clump TC 1 doesn't exist. Even then the quarry is invisible. The line is > 9m above the exit road and quarry limit. No hill can be seen over the crown of TC 1. This line is over the western limit of quarrying on the north boundary.

TABLE 4

BLOCK "B" DEVELOPMENT
SIGHTLINES FROM SURVEYING DATA
POSSUM BRUSH GALLERY

Station A - Possum Brush Gallery. R.L., m = 41.72

Assume observer eye level, m = 1.5

Note: Correction of 6° 14' 10" applied to Surveyor's erroneous Mine Grid, Surveyor's assumed R.L. Datum retained - it is about AHD + 2m.

Approx. Observer Co-ords. 479 E, 3213 N

Line Bearing (nearest 15')	Tree Height, Level, Distance and Gradient % of view impeding reference.					Line No.	Sightline Levels over Quarry Areas								Comments re Proposed Quarry Workings Visibility in Block "B".
	Base R.L.	Height, m	Crown R.L.	Distance	Gradient to Crown		Block "B" N boundary.		Block "A"or "B" S limit.		Block "B" at Exit Road.		View Point after Mining		
							Distance	Level	Distance	Level	Distance	Level	Distance	Level	
171° and over 20m high trees on "B" boundary.	115.0	20	135.0	2004	4.6%	1	2004	135.0	2240	145.8	n.a.	n.a.	2390	152.7	No quarry workings visible, line runs through "A" from corner with "B". Sightline is more than 15m above Plant area floor (N) and South limit of "A" quarry, and about 10m above back Plant area cutting.
172° 45' and over 20m high trees on "B" boundary.	130.0	20	150.0	1998	5.3%	2	1998	150.0	2296	165.9	2350	168.8	2368	169.8	No view of quarry workings. Line passes >15m above south limit of quarry, and about 9m above the exit road (160).
175° 15' and over 20m high trees on "B" boundary.	139.0	20	159.0	1988	5.8%	3	1988	159.0	2256	174.6	2269	175.4	2358	180.5	No view of quarry workings. Line is > 20m above the exit road level (152) and about 25m above the south limit of quarry (150).
177° and over 20m high trees on "B" boundary.	130.0	20	150.0	1980	5.4%	4	1980	150.0	2200	161.9	2230	163.5	2264	165.3	No view of quarry workings. Line is about 15m above the exit road level (149) and the south limit of mining (147).
178° and over 20m high trees on "B" boundary.	123.0	20	143.0	1960	5.1%	5	1960	143.0	2168	153.6	2204	155.4	2212	155.8	No quarry workings visible. Current stockpiles may be just visible now but would go with quarry development. Line is >4m over south quarry limit and >6m over exit road (both <149). This line assumes no view impediment in the 2km N from "B" boundary.
179° and over 25m high trees in "B" gully on west boundary.	123.0	25	148.0	2066	5.1%	6	2066	148.0	2194	154.5	2227	156.2	2234	156.5	No quarry workings visible, top face at 150 is 1m below calculated sight line. This line assumes no view impediment in the 2km north from "B" boundary, which would hide the area even more.N10

TABLE 5

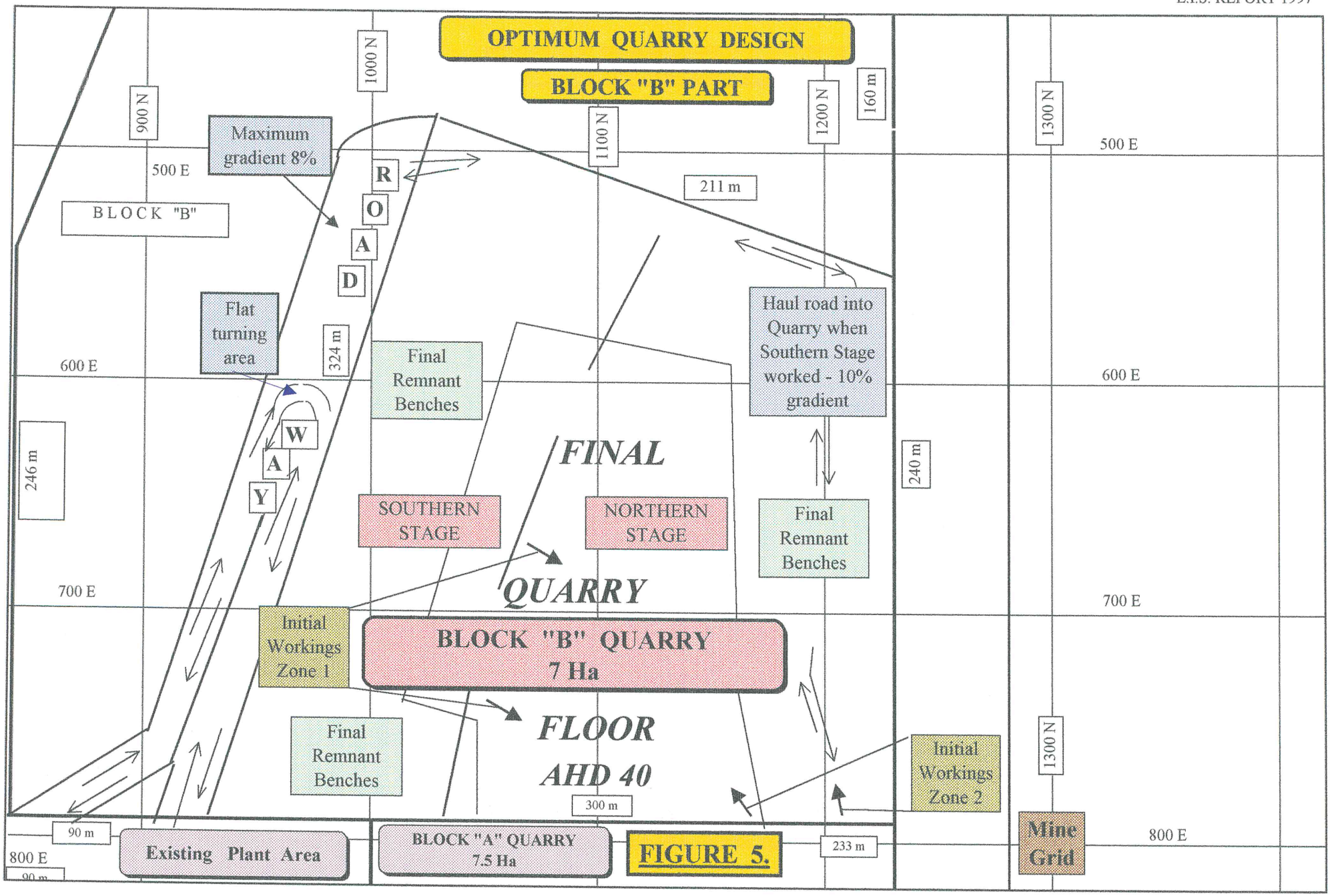
OPTIMUM QUARRY DESIGN
BLOCK "B" PART
900 N
1000 N
1100 N
1200 N
1300 N
160 m
500 E
Maximum gradient 8%
R
O
A
D
211 m
BLOCK "B"
Flat turning area
324 m
Final Remnant Benches
Haul road into Quarry when Southern Stage worked - 10% gradient
600 E
W
A
Y
246 m
FINAL
240 m
SOUTHERN STAGE
NORTHERN STAGE
Final Remnant Benches
QUARRY
700 E
Initial Workings Zone 1
BLOCK "B" QUARRY
7 Ha
FLOOR
AHD 40
Final Remnant Benches
300 m
Initial Workings Zone 2
90 m
Existing Plant Area
BLOCK "A" QUARRY
7.5 Ha
233 m
Mine Grid
800 E

FIGURE 5.

Figure 5, titled **Optimum Quarry Design, Block "B" Part** is on the facing page. It shows the optimum final extraction plan, with the final operating roadways. The latter includes the Site exit road and the material haul road to the Plant Area from both Quarry B and the deep Quarry A. Final remnant benches are shown as 5 m wide, faces 10 m deep at 75°. Where appropriate, near the surface and in unstable ground, bench width would be widened and or the depth reduced and angle varied. The upper benches would be regenerated with suitable tree plantings when required. The approximate division between the Northern and the Southern Stage is shown.

Northern Stage.
In the first few years the Northern Stage would be worked in two Zones. **Zone 1** would be developed off the existing access road near the stockpiling area. This is behind the hill structure and would allow mining to generally proceed without being visible from Possum Brush Road or from the various residences previously discussed. The working face would probably need to be oriented slightly north of east so as to allow natural drainage of workings to the main Gully. Levels 140, 130, and 120 would drain to the main quarry water dam. They would be the first to be established.

Zone 2 workings would be in from the north west corner of Block A quarry west of the Gully. This would initially involve level 100, 110, and 120. Workings would develop west and south with a maximum face height of 130 m. This would keep the mining below the sightlines previously detailed. The two zones would join as Zone 1 develops northward to work off the visible northern face of the hill from behind a buffer of trees and remnant hill.

Southern Stage.
It is unlikely that this area will be worked for at least 20 years. It is more functional in its current stockpile / roadway use until extraction in the Northern Stage is sufficiently advanced to warrant relocating the roadway. The only early extraction currently favoured on the Southern area is associated with lowering the area adjoining the Plant Area. This would allow more efficient moving of materials into stockpile. Work should also be undertaken in the early years to establish small replanted benches along the near surface route of the final access and quarry haul road as shown in Figure 5 (facing page).

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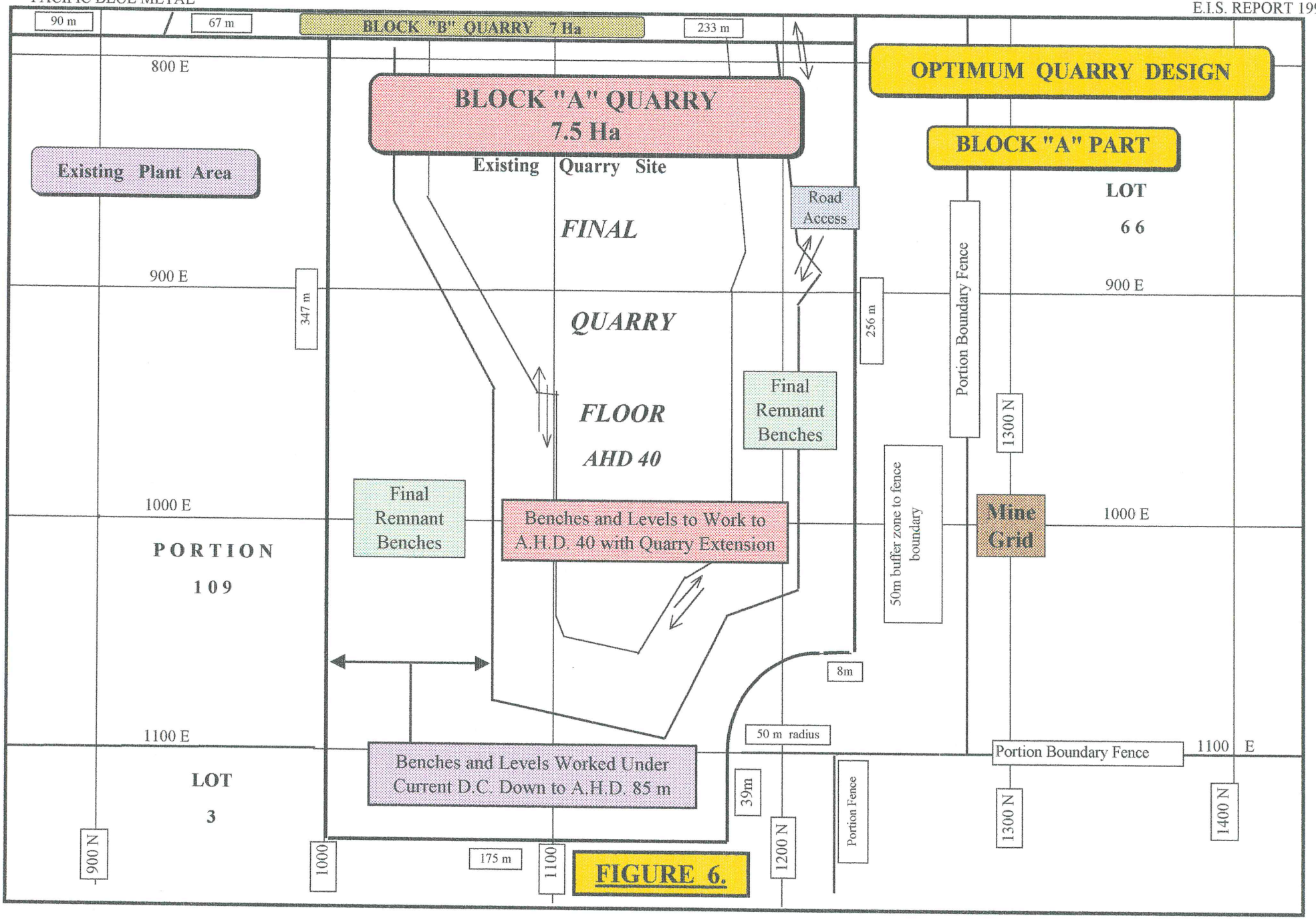
90 m
67 m
BLOCK "B" QUARRY 7 Ha
233 m
800 E
OPTIMUM QUARRY DESIGN
BLOCK "A" QUARRY
7.5 Ha
Existing Quarry Site
BLOCK "A" PART
LOT
66
Existing Plant Area
FINAL
Road Access
900 E
347 m
QUARRY
256 m
Portion Boundary Fence
900 E
FLOOR
AHD 40
Final Remnant Benches
1300 N
50m buffer zone to fence boundary
Final Remnant Benches
Benches and Levels to Work to A.H.D. 40 with Quarry Extension
Mine Grid
1000 E
1000 E
PORTION
109
8m
50 m radius
1100 E
Benches and Levels Worked Under Current D.C. Down to A.H.D. 85 m
Portion Boundary Fence
1100 E
LOT
3
39m
Portion Fence
1300 N
1400 N
900 N
1000
175 m
1100
1200 N

FIGURE 6.

Visual unobtrusiveness.
The discrete hill structure allows the mining operations to be normally invisible by working the high ground from the southern side off the current access road to the Plant area. The remnant hill structure and tree cover ensures the workings are shielded and allows the working of ground below AHD 130 from the gully structure.

Noise limitation in accord with statutory need.
The existing quarry in Block A meets all noise limitation requirements. The quarrying in Block B will involve the same mining methods and machinery as used in Block A. The topography is more favourable for noise minimising techniques of mining than was the case with the early stages of Block A quarry. There is no adverse noise impact from the proposed Block B quarry.

Air and water pollution controls.
The same logic as above applies to air and water pollution. The controls in place for the existing quarry would also apply to the proposed Block B quarry. The water catchment and drainage pattern will be almost unchanged by the extraction. All except 2 ha currently drain into the main gully in Block A. After many years the quarry will extend to its western limit and the 2 ha that currently drain into the next shallow gully will drain into the quarry main gully system. Both systems are on the Pacific Blue Metal property and they join a short distance into the adjoining property. This situation allows all run off from the proposed quarry to be handled by the existing system of silt trap dams. The catchment is about 20 ha, so it is a low impact 10% increase.

3.5 Mining Procedure for Block "A" Deep Quarry.

The extraction of this resource will not occur until late in the life of the quarry. It is simply an extension of the existing Block A quarry below the AHD 85 m base nominated in the D.C. to a depth of AHD 40. The enlargement of the quarry floor area at AHD 85 that results from the Block B quarry, provides a capacity to work and haul from the deeper levels. No increase in surface area is involved and it is deep below the surface. There would be no adverse impacts regarding visibility, noise, or flora and fauna.

Figure 6, titled **Optimum Quarry Design, Block "A" Part,** is on the facing page. It shows the optimum final extraction plan. The current D.C. limit to AHD 85 m is also shown. It is highly probable that during the life of the quarry it will be necessary to design and install a new replacement Crushing Plant. This may require a future Development Application.

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A number of activities now located on the surface could be relocated on the floor of the quarry when extraction is advanced. For example, it would have adequate size with the extension into Block B for installation of a new Crushing Plant. Such a location would provide excellent vision and noise isolation.

The only feature of extraction that is different to the current operation, is the need to pump out the workings below natural drainage level. Currently this level is approximately AHD 85 m. The gully drops quickly beyond the northern boundary of the quarry before reaching the major catchment Dam on the property. It would be possible to deepen this drainage by at least 5 m. However, such would only give a temporary solution. The deep levels would require installation of a suitable capacity pump. The Quarry Manager advises that the drainage gully only flows during rain events and for a few days afterwards. With a catchment of only 22 ha, pumping the accumulated water quantity is not a difficult or costly operation. It will simply require an appropriate capacity sump facility.

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QUARRY RESOURCE AND RESERVES - BLOCK "A" DEEPENING

Below Current Consent A.H.D. 85 Level to Depth Limit of A.H.D. 40 as per the Quarry Design.

Rock density estimates: (tonnes / m³)	weathered material = 2.0
	fresh (unweathered) = 2.7

Nominal Bench Level	Surface Area, m²	Bench Height, m	Rock Volume, m³	Component Tonnes: Soil & Waste m³	Weath'd Rock m³	Fresh Rock m³	Component Tonnes: Soil & Waste Tonnes	Weath'd Rock m³	Fresh Rock Tonnes	Total Rock Tonnes	Unit "B" Fresh Rock Data: % of Level	Tonnes from Level
80 m	42600	5	213000	0	0	213000	0	0	575100	**575,100**	58%	333558
70 m	40600	10	406000	0	0	406000	0	0	1096200	**1,096,200**	59%	646758
60 m	36100	10	361000	0	0	361000	0	0	974700	**974,700**	67%	653049
50 m	31400	10	314000	0	0	314000	0	0	847800	**847,800**	75%	635850
40 m	26100	10	261000	0	0	261000	0	0	704700	**704,700**	87%	613089
	TOTALS		**1,600,000**	**0**	**0**	**1,600,000**	**0**	**0**	**4,200,000**	**4,200,000**	**69%**	**2,900,000**

RESOURCE STATUS

From the Exploration Data and the overlying Existing Quarry, with an 8 year 1 million tonne Production History, the above quantities are classed as 100% Proved Reserves, if Development Consent is granted.

Note: All Totals rounded to a two numeral order of accuracy.

TABLE 6

4. RESERVES.

4.1 General Details.

Quantities have been calculated from available geological and survey data as detailed in Section 2, Geology and Resource Data. Table 1, Quarry Resource and Reserves - Block "A" Current Consent (facing p. 3), gave a figure of 5.0 million tonnes to the 85 m AHD limit of the D.C. It also reconciled the current calculation with the pre commencement reserve estimate done in 1985, allowing for about 1 million tonnes of sales and other adjustments. The accord was a remarkable -1%. The same calculation method and factors have been used in the calculation of these quantities.

Tabulations are presented that provide quantities in terms of Soil and Waste, Weathered Rock, and Fresh Rock. This information has been calculated for each production Bench. Also nominated is the quantity of Unit B rock and the % that represents of each Bench. The Benches are extracted back to a residual width of 5 m with the face at 75°. They are modified and widened where necessary to accommodate an 8m wide Quarry Haul road with wider passing sections. The gradient is 10% down into the quarry and 8% along the access roadway above the quarry. These features are taken into account with the yield nominated for each Bench. The material in the benching of the current Block A quarry along its boundary with Block B will be extracted with the joining of the two areas. This has not been taken into the figures. Overall it is not a significant quantity.

Soil and Waste is the classification for the material removed from the top of the deposit that is not useable in sales. Generally the nature of the terrain does not develop soils in a manner that allows soil to be worked off the surface without waste rock. However, there is an adequate quantity of this mixture with favourable characteristics to use as a bedding formation for tree propagation along the Benches. Surplus quantities of this material will require rehandling during the life of the operation and, unless a new market develops for such material, it would be finally stowed on the quarry floor.

4.2 Block "A" Deepening Reserves

The quantities are shown in **Table 6**, facing page, titled "**Quarry Resource and Reserves - Block "A" Deepening**. Being deep under the surface, there is only fresh rock involved. The resource is assessed as **4.2 million tonnes** of high grade aggregate production quality hard rock. With D.C. they are all definable as Proved Reserves .

Kerry R Steggles

QUARRY RESOURCE AND RESERVES - BLOCK "B" NORTH STAGE

With Depth Limit of A.H.D. 40 as per the Quarry Design.

Rock density estimates: (tonnes / m³)	weathered material =	2.0
	fresh (unweathered) =	2.7

			Component Volumes			Component Tonnes				Unit "B" Fresh Rock Data	
Nominal Bench Level	Surface Area, m²	Rock Volume, m³	Soil & Waste m³	Weathered Rock m³	Fresh Rock m³	Soil & Waste Tonnes	Weathered Rock, Tonnes	Fresh Rock Tonnes	Total Rock Tonnes	% of Level	Tonnes from Level
150 m	11600	46400	11600	34800	0	23200	69600	0	**69,600**	0%	0
140 m	24000	216000	12400	96000	107600	24800	192000	290520	**482,520**	85%	246942
130 m	29000	290000	10000	43000	237000	20000	86000	639900	**725,900**	60%	383940
120 m	34000	340000	6000	19000	315000	12000	38000	850500	**888,500**	55%	467775
110 m	31000	310000	0	0	310000	0	0	837000	**837,000**	49%	410130
100 m	25000	250000	0	0	250000	0	0	675000	**675,000**	48%	324000
90 m	23000	230000	0	0	230000	0	0	621000	**621,000**	42%	260820
80 m	20000	200000	0	0	200000	0	0	540000	**540,000**	37%	199800
70 m	15000	150000	0	0	150000	0	0	405000	**405,000**	34%	137700
60 m	14000	140000	0	0	140000	0	0	378000	**378,000**	25%	94500
50 m	10000	100000	0	0	100000	0	0	270000	**270,000**	19%	51300
40 m	8000	80000	0	0	80000	0	0	216000	**216,000**	12%	25920
	TOTALS	**2,300,000**	**28,000**	**160,000**	**2,100,000**	**57,000**	**300,000**	**5,700,000**	**6,000,000**	**46%**	**2,600,000**

RESOURCE STATUS

From the Exploration Data and Proximity of the Existing Quarry with an 8 year 1 million tonne Production History, the above quantities are classed as 50% Proved Reserves and 50% Probable Reserves, if Development Consent is granted.

Note: All Totals rounded to a two numeral order of accuracy.

TABLE 7

Unit B is calculated as 2.9 million tonnes, 69% of the quantity. It varies from 58% of Bench 80 m to 87% of Bench 40 m.

4.3 Block "B" Reserves.

This area is divided into two Stages, a Northern and a Southern. The former will be the initial area of working and the quantities are shown in **Table 7**, facing page. It is titled **Quarry Resource and Reserves - Block "B" North Stage.** The latter is currently scheduled to remain in use for stockpiling, mixing and road access for many years. The quantities, and summary of Block B, are shown in **Table 8** facing the next page. It is titled **Quarry Resource and Reserves - Block "B" South Stage** and **Summary.**

North Stage.

A quantity of 57,000 tonnes of Soil and Waste earth is derived from the top four Benches. This is predominantly from the northern half. Initial workings will be in the southern half. Weathered rock is assessed as 0.3 million tonnes, and also is from the top four Benches and mainly from the northern half. Fresh rock is nominated as 5.7 million tonnes to give **6.0 million total useable reserves**. They are classed as 50% Proven Reserves and 50% Probable Reserves, assuming Development Consent is granted.

Unit B is 2.6 million (46%) of the fresh rock figure. It varies from 85% of Bench 140 m to 12% of Bench 40 m. Initial production is scheduled from Benches 130 m and 140 m to give immediate access to fresh Unit B rock.

South Stage.

A quantity of 110,000 tonnes of Soil and Waste earth is derived from the top three Benches. This is predominantly from the first Bench, level 140 m, which has been filled to form a flat area used for Stockpiling and Mixing under the current D.C. Weathered rock is assessed as 0.42 million tonnes, and also is from the top three Benches. Fresh rock is nominated as 5.6 million tonnes to give **6.0 million total useable reserves**. They are classed as 70% Proven Reserves and 50% Probable Reserves, assuming Development Consent is granted.

Unit B is 3.7 million (66%) of the fresh rock figure. It varies from 85% of Bench 130 m to 33% of Bench 40 m.

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QUARRY RESOURCE AND RESERVES - BLOCK "B" SOUTH STAGE

With Depth Limit of A.H.D. 40 as per the Quarry Design.

Rock density estimates: (tonnes / m³)	weathered material	=	2.0
	fresh (unweathered)	=	2.7

Note: No 150 m Bench in this Stage.

Nominal Bench Level	Surface Area, m²	Bench Height m	Rock Volume, m³	Component Volumes: Soil & Waste m³	Weath'd Rock m³	Fresh Rock m³	Component Tonnes: Soil & Waste Tonnes	Weath'd Rock, Tonnes	Fresh Rock Tonnes	Total Rock Tonnes	Unit "B" Fresh Rock Data: % of Level	Tonnes from Level
140 m	21000	4.5	94500	42000	52500	0	84000	105000	0	**105000**	0%	0
130 m	25000	10	250000	12000	125000	113000	24000	250000	305100	**555,100**	85%	259335
120 m	28000	10	280000	2000	33600	244400	4000	67200	659880	**727,080**	80%	527904
110 m	26000	10	260000	0	0	260000	0	0	702000	**702,000**	80%	561600
100 m	25000	10	250000	0	0	250000	0	0	675000	**675,000**	77%	519750
90 m	23000	10	230000	0	0	230000	0	0	621000	**621,000**	74%	459540
80 m	21000	10	210000	0	0	210000	0	0	567000	**567,000**	66%	374220
70 m	21000	10	210000	0	0	210000	0	0	567000	**567,000**	60%	340200
60 m	19000	10	190000	0	0	190000	0	0	513000	**513,000**	52%	266760
50 m	19000	10	190000	0	0	190000	0	0	513000	**513,000**	43%	220590
40 m	18000	10	180000	0	0	180000	0	0	486000	**486,000**	33%	160380
	TOTALS		**2,300,000**	**56,000**	**210,000**	**2,100,000**	**110,000**	**420,000**	**5,600,000**	**6,000,000**	**66%**	**3,700,000**

RESOURCE STATUS

From the Exploration Data and Proximity of the Existing Quarry with an 8 year 1 million tonne Production History, the above quantities are classed as 70% Proved Reserves and 30% Probable Reserves, if Development Consent is granted.

SUMMARY

NORTH "B"	2,300,000	28,000	160,000	2,100,000	57,000	300,000	5,700,000	6,000,000	46%	2,600,000
SOUTH "B"	2,300,000	56,000	210,000	2,100,000	110,000	420,000	5,600,000	6,000,000	66%	3,700,000
DEEPENED "A"	1,600,000	0	0	1,600,000	0	0	4,200,000	4,200,000	69%	2,900,000
TOTAL	6,200,000	84,000	370,000	5,800,000	170,000	720,000	15,500,000	16,200,000	59%	9,200,000

Note: All Totals rounded to a two numeral order of accuracy.

TABLE 8

4.4 Reserves Summary.

Table 8, facing page, shows a Summary of the Reserves in the 7 ha. Section of Block B and the Deep Block A proposed for extraction. They total 16.2 million tonnes, with B divided into a North and a South Stage. Fresh rock is shown as 15.5 million tonnes. The weathered rock is less than 5% of that figure. Market trends are towards higher quality aggregates such as producible from fresh Unit B rock. The tabulation shows this Unit B rock amounts to 9.2 million tonnes, 59% of the fresh rock.

Product design will have to adjust to a very limited availability of weathered rock in future years. This is the opposite to the situation that has prevailed during the past 8 years production from the existing quarry when excessive quantities of weathered rock had to be endured. The weathered rock provides plasticity in the mixtures and it is likely that some use can be made of the soil and waste earth quantities (170,000 tonnes) to achieve a similar effect.

The rate of usage of the above reserves currently is scheduled to range from about 100,000 to 200,000 tonnes per annum. The higher figure is the existing 32 year average allowed to be extracted and processed through the Crushing Plant(6.4 million tonnes over 32 years starting in 1988). The actual quantity would depend on the quantity derived from the existing Block A quarry. When Block B quarry is operating Block A quarry is planned to be the main source of blends requiring a weathered rock content. With the remaining reserves of 5 million tonnes in Block A, the total available becomes **21 million tonnes**. At 200,000 per annum this would give a quarry life of about 100 years.

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5. CONCLUSIONS AND RECOMMENDATIONS.

5.1 Conclusions.

The following Conclusions are derived from the Geology and Resource Data, Quarry Design, and Reserves data provided in this report.

- A 1987 issued D.C. allowed a Quarry Enterprise to be established on a 269 ha freehold land property owned by PBM at Possum Brush near Nabiac N.S.W.
- The D.C. restricted extraction to a 7.5 ha area defined as Block A, and carried conditions that required the deposit to be quarried progressively from the top.
- Quarrying from the top instead of the bottom created extreme production efficiency problems and prevented economic working of the best quality rock.
- More technically complex Specifications now apply to Aggregate quality than when the Resource was assessed in 1985. Very high grade rock is required.
- Market demand has changed from Road Base style products to high quality Aggregates. Very large quantities are required now for major Road Projects.
- Unit B fresh rock is the best in the deposit with exceptional qualities that make it ideal for meeting complex Aggregate Specifications.
- Unit B has a true thickness of about 105 m and outcrops across the north western low part of Block A and into Block B to form a small hill structure.
- Block A contains very large reserves of Unit B but significant quantities are not extractable for many years due to depth and access difficulties.
- Block B has very large reserves of Unit B immediately accessible and workable in a visually unobtrusive manner. It is ideal for siting a quarry.
- The area of Block B required for extraction is 7 ha and involves only about 4 ha of tree covered land that was previously worked for timber.
- Of the 7 ha, the existing quarry uses 3 ha for stockpiling and road access, etc. Also, a road corridor along the existing route is required for road relocation.

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- The larger combined quarry area of 14.5 ha allows accessing a currently unworkable part of Block A quarry and also deepening it by 45 m.

- Reserves of 16 million tonne (M t), including 9 M t of Unit B, have been delineated as extractable from the proposed quarry extensions.

- The existing D.C. allows 6.4 M t to be crushed and dispatched from the 269 ha property over 32 years from 1987. The remaining balance is now 5.4 M t.

- Depending on market needs and quarry efficiency planning, extraction quantity from Block B quarry could range from 0 to about 0.2 M t per annum.

- Flora and Fauna impacts are insignificant as the same species are present in 120 ha of uncleared adjoining owned land and 1,500,000 ha of nearby forest.

- Noise, dust and water environmental aspects are the same or better than the existing quarry which satisfies regulatory requirements.

5.2 Recommendations.

From the above it is recommended that:-

1) A Development Application and supporting Environmental Impact Statement be prepared for an extension to the permitted area of extraction on the 269 ha property which has D.C. for a Quarrying Enterprise including Crushing Plant operation.

2) The subject of the D.A. should be rock quarrying from the delineated 7 ha of Block B and from the 4 ha floor of Block A below the current D.C. limit. The extracted rock would be crushed and blended in accord with the existing D.C. and production limits would be determined by the limits on that operation. Product dispatch truck load limits should be reiterated as in accord with legal load limits and by vehicles with a tare weight maximum of 24 tonne, the 24t maximum being in the current D.C

3) Quarrying method should include secondary breaking of oversized rock as a permissible activity behind shielding quarry faces to minimise noise propagation towards Possum Brush Road

4) Consent should be sought to quarry the defined resource quantity rather than nominate a term of years. The size of the reserves should preclude the need for development of other quarries in this Region of N.S.W. for many decades.

5) The Development be in **general** accord with details in this report.

Kerry R Steggles

6. REFERENCES.

K. R. STEGGLES AND ASSOCIATES PTY. LIMITED (1985)
"Nabiac Blue Metal Deposit - Exploration 1984"
Prepared for Wyan Holdings Pty. Ltd.; 64 Ritchie Crescent, Taree.

ROADS and TRAFFIC AUTHORITY NSW
"QA Specification RTA 3151, Edition 3; February 1992. Cover Aggregate for Sprayed Bituminous Surfacing"
Reference Quotation - PM/AGG/96

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A REPORT FOR

PACIFIC BLUE METAL PTY LIMITED

TO SUPPORT A DEVELOPMENT APPLICATION
AND ENVIRONMENTAL IMPACT STATEMENT
TO BE PREPARED IN 1997
FOR CONSIDERATION BY GREATER TAREE CITY COUNCIL

TITLED

ADDENDUM REPORT TO FEBRUARY 1997 REPORT ON DEPOSIT GEOLOGY, QUARRY DESIGN AND RESERVES

RE EXTENSION OF THEIR QUARRY AT
POSSUM BRUSH NEAR NABIAC NSW

DATED

AUGUST 1997

PREPARED BY

KERRY R STEGGLES
CONSULTING GEOLOGIST AND ENGINEER

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Kerry R Steggles

ABSTRACT

This is an Addendum Report to the February 1997 Report to Pacific Blue Metal Pty Limited (PBM) on Deposit Geology, Quarry Design and Reserves re Extension of their Quarry at Possum Brush near Nabiac NSW. It answers relevant items of the June 1997 response by Greater Taree City Council (Council) to a draft Environmental Impact Statement (EIS) prepared at Taree by Planning Environmental & Engineering Consultants ERM Mitchell McCotter. That EIS dated March 1997 was prepared for PBM and incorporated the February Report.

Council recommended that further data be provided in the document before formal lodging of the EIS and a Development Application. The items requiring attention to allow lay readers to visualise the development better are presented in four Sections after an Introduction. Supporting colour air photos, photographs, plans and sections are given in four Plates and five Figures.

The first topic, given in Section 2, is Quarry Appearance and Design Plan. An August 1997 Air Photo in Plate 1 gives visual expression to data presented in the February Report. Optimum Quarry Design is detailed in a new enhanced plan of the Current and New Extension with additional colour coded data. This Figure 1A joins the two less cluttered plans previously provided. It is placed opposite the Air Photo plate to allow easy recognition of the surface features described. A clear visual appreciation of the extent of the Current Consent operation and the minor nature of the proposed extension emerges from this additional presentation.

The second topic, given in Section 3, is Quarry Visibility. The August 1997 Air Photo, increased to cover a larger land area, is given as Plate 2. It shows the critical sightlines from the four visibility relevant houses on adjoining properties. The most sensitive view line, from McCuddens house, is depicted in a series of three Sections in Figure 2A. The three show the current profile, the profile after the Northern Stage Zone 1 extraction and the profile when quarrying is completed. The Plate and Figure are also placed opposite each other to allow clear recognition of the land surface features and tree cover that enables the proposed development to be essentially invisible. Photographs from beside the house are given in Plate 3 to show the current view looking towards the quarry.

Kerry R Steggles

Topic three in Section 4 is Quarry Extraction Sequence Sections. A Section across the new Block B quarry area is depicted at the same times in the life of the proposed new quarry extension as used in the Visibility analysis. The colour coded detail is given in Figures 3A, 4A and 5A and reference to the Air Photo plates allows this to be positioned and visualised on the existing landscape. An estimate of the time to extract to the profile on these Sections is also nominated.

The forth topic, Section 5, is Regional View of Quarry Environs. A mosaic of colour Air Photos is given in Plate 4 that shows the dominance of tree covered land in the regional setting of the quarry. Aspects of this visual data are discussed and attention is drawn to the small additional area involved with the new quarry extraction over a long time span. The photographic evidence is seen as substantiating the analysis that the proposed new Block B quarry extraction poses no threat to any flora or fauna with an absolutely insignificant environmental impact. Reference is made to recent research data on the brush-tailed phascogale and how that indicates the minor tree clearing would not present an endangering to that species survival.

Kerry R Steggles

TABLE OF CONTENTS

	Report Section	Page Numbers
1.	INTRODUCTION	1
2.	QUARRY VIEW AND DESIGN PLAN	3 - 4
3.	QUARRY VISIBILITY	6 - 7
4.	QUARRY EXTRACTION SEQUENCE SECTIONS	8
5.	REGIONAL VIEW OF QUARRY ENVIRONS	12

LIST OF PLATES.

Number and Title of Plate		Page Location
PLATE 1	Pacific Blue Metal Quarry and Surrounds Air Photo 13.8.1997, Scale 1:5000	Facing 2
PLATE 2	Pacific Blue Metal Quarry and Surrounds Air Photo 13.8.1997, Scale 1:8000	Facing 5
PLATE 3	Quarry Area Photographs from Near McCudden's House, August 1997	Facing 6
PLATE 4	Quarry Regional Setting Showing Dominance of Tree Cover Land	Page 13

Kerry R Steggles

LIST OF FIGURES.

Number and Subject of Figure		Page Location
FIGURE 1A	Optimum Quarry Design Current and New Extension	Page 2
FIGURE 2A	Sightline 2 View Section From McCudden's House	Page 5
FIGURE 3A	Section Along Grid Line 700 m East 1997 Profile with Existing Consent	Page 9
FIGURE 4A	Section Along Grid Line 700 m East Profile of Initial Mining in Northern Stage of Block "B" Quarry	Page 10
FIGURE 5A	Section Along Grid Line 700 m East Predicted Profile of Block "B" Quarry At Completion of Proposed Mining	Page 11

Kerry R Steggles

1. INTRODUCTION.

This Report is an addendum to a Report for Pacific Blue Metal Pty Limited (PBM) dated February 1997 by Kerry R Steggles, Consulting Geologist and Engineer. The title of that report was Deposit Geology, Quarry Design and Reserves re Extension of their Quarry at Possum Brush near Nabiac NSW.

The February report was included as an Appended Report in a draft Environmental Impact Statement (EIS) by ERM Mitchell McCotter in respect to the Quarry Extension. This was presented to Greater Taree City Council (Council) in June to allow any document adjustments prior to formal Development Consent Application (D.A.). Council advised in a letter dated June 20th that "... it would appear that all necessary issues have been examined. There are a couple of minor points which, for completeness, I consider need to be further explained."

One of those points was that the reader would not be able to properly visualise the proposal, as readers would include lay persons. In subsequent discussions with Council's Mr. Bruce Byatt, Manager Development Control, it was agreed that this should be addressed by: -

- Presenting colour Aerial Photography data on the Site, the Surrounds and the Regional Setting.
- Providing a colour coded depiction of the View Section from the most sensitive property residence location,
- Colour photos of the Quarry from the above property residence location,
- A Figure combining the separate plans of the two aspects of the D.A. given in the February Report, with additional highlighting of the shown property boundaries and features of the Quarry layout design.
- A series of Sections along a relevant survey Grid Line running through the New Quarry area in Block "B". These are to depict the 1997 Current Consent profile, the profile with Initial Zone 1 Mining, and the profile at Completion of Extraction.

This Report presents the above data in four following Sections, namely: -

Section 2 Quarry Appearance and Design Plan.
Section 3 Quarry Visibility.
Section 4 Quarry Extraction Sequence Sections.
Section 5 Regional View of Quarry Environs.

Four Plates and five Figures support these Sections.

Kerry R Steggles

Plate 1, opposite Page 2, is a coloured Aerial View of the PBM Quarry and Surrounds as at August 13th 1997. It shows the current operation and the area effected by the new D.A. The scale is 1: 5000.

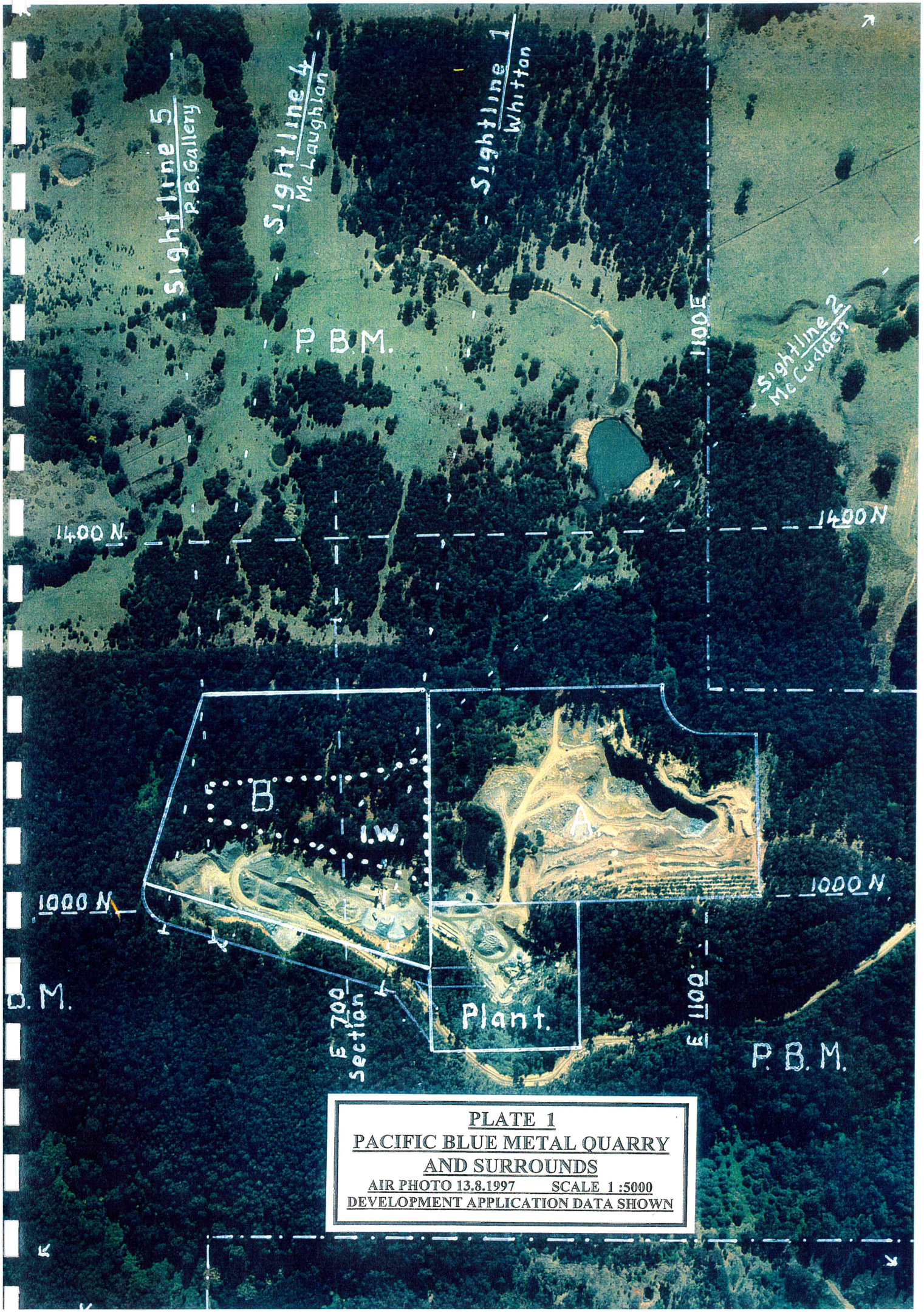
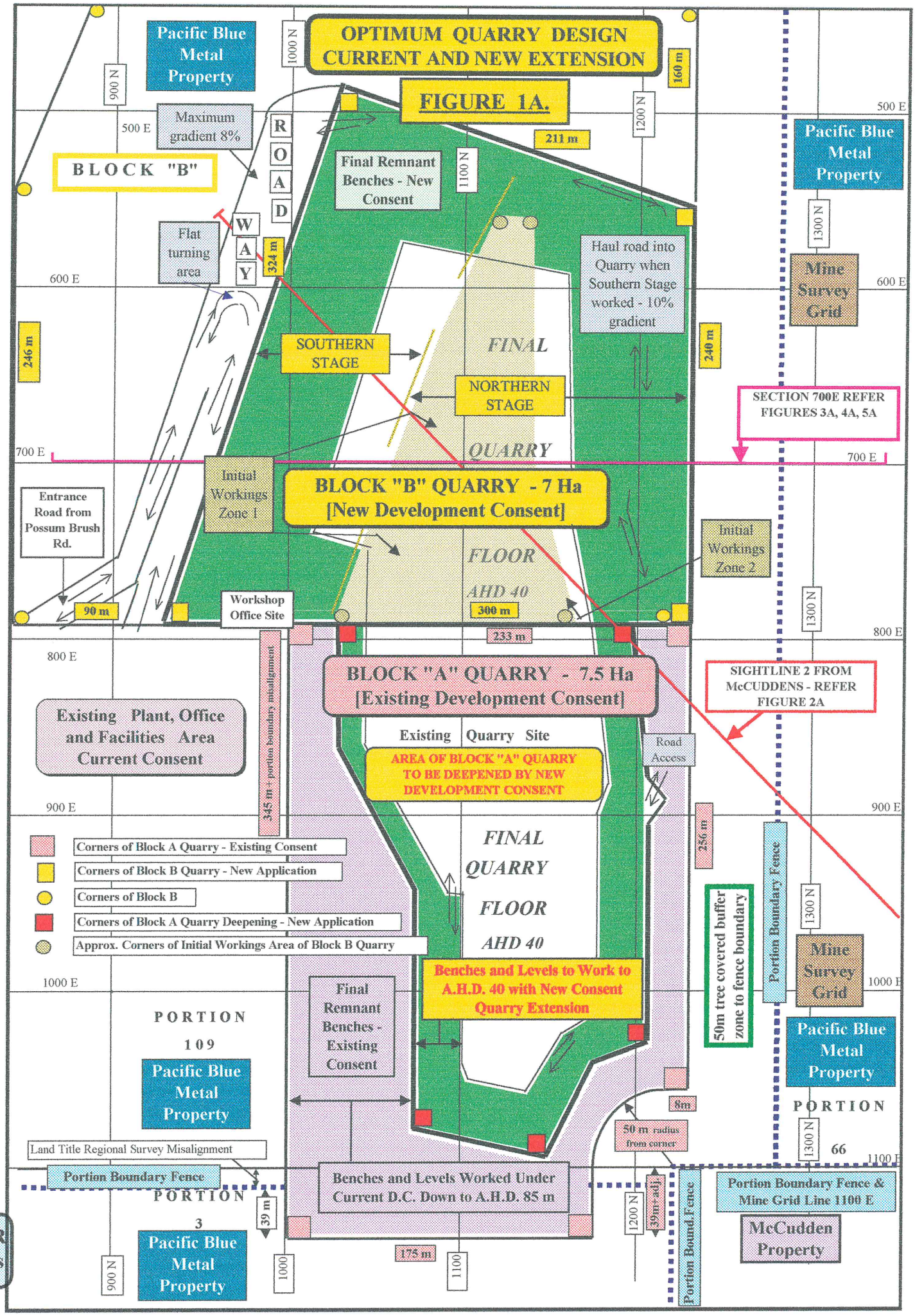


PLATE 1
PACIFIC BLUE METAL QUARRY AND SURROUNDS
AIR PHOTO 13.8.1997 SCALE 1 :5000
DEVELOPMENT APPLICATION DATA SHOWN


OPTIMUM QUARRY DESIGN CURRENT AND NEW EXTENSION
FIGURE 1A.
Pacific Blue Metal Property
Maximum gradient 8%
BLOCK "B"
ROAD WAY
Flat turning area
Final Remnant Benches - New Consent
Haul road into Quarry when Southern Stage worked - 10% gradient
SOUTHERN STAGE
NORTHERN STAGE
FINAL QUARRY FLOOR AHD 40
BLOCK "B" QUARRY - 7 Ha [New Development Consent]
Initial Workings Zone 1
Initial Workings Zone 2
Entrance Road from Possum Brush Rd.
Workshop Office Site
SECTION 700E REFER FIGURES 3A, 4A, 5A
SIGHTLINE 2 FROM McCUDDENS - REFER FIGURE 2A
BLOCK "A" QUARRY - 7.5 Ha [Existing Development Consent]
Existing Quarry Site
AREA OF BLOCK "A" QUARRY TO BE DEEPENED BY NEW DEVELOPMENT CONSENT
Road Access
Existing Plant, Office and Facilities Area Current Consent
345 m + portion boundary misalignment
Corners of Block A Quarry - Existing Consent
Corners of Block B Quarry - New Application
Corners of Block B
Corners of Block A Quarry Deepening - New Application
Approx. Corners of Initial Workings Area of Block B Quarry
Benches and Levels to Work to A.H.D. 40 with New Consent Quarry Extension
Final Remnant Benches - Existing Consent
50m tree covered buffer zone to fence boundary
Portion Boundary Fence
Mine Survey Grid
PORTION 109
Pacific Blue Metal Property
PORTION 66
Land Title Regional Survey Misalignment
Portion Boundary Fence
PORTION 3
Benches and Levels Worked Under Current D.C. Down to A.H.D. 85 m
Portion Boundary Fence & Mine Grid Line 1100 E
McCudden Property
50 m radius from corner
39m adj
39 m
8m
256 m
324 m
246 m
240 m
160 m
211 m
233 m
300 m
90 m
175 m
500 E
600 E
700 E
800 E
900 E
1000 E
1100 E
900 N
1000 N
1100 N
1200 N
1300 N

- The approximate location of a planned Workshop and Office on an area extending from the current office site on the Plant Area Block through to Block B and possibly involving the south west corner of Block A. This would be relocated when advanced extraction of Block B Southern Stage occurs.

Plate 1 is placed facing Figure 1A so that the details in Figure 1A can be identified with the actual ground surface. **Plate 1** titled **Pacific Blue Metal Quarry and Surrounds** is a colour Air Photo taken on August 13th. The scale is smaller than Figure 1A on this photographic aerial view and it is oriented at 90° to Figure 1A. This was necessary to include a visual identification of the surrounding terrain and the sightlines to the nearest houses.

The extent of the current consent Quarry Enterprise is clearly visible in this aerial photo with the Plant area, the Block A quarry, stockpiling area and roadways defined. Also marked on the Plate are some of the Mine Survey Grid lines and the lowest visibility sightlines from the adjoining landowner houses.

It can be seen that a considerable part of the new D.A. quarry extraction area B is already used for the existing Enterprise and part of the Initial Workings area of less than 2 hectares is not timbered. Of particular note is the large buffer tract of land owned by PBM around the Quarry and the very large retention of mature tree growth on that land. Also the extensive restoration regrowth of trees on the benches along the southern boundary of Block A quarry can be seen.

Plate 1 also provides a visual expression of other features of the existing quarry shown on Figure 2 in the February Report. These include the surface water control system of Dams, the noise and visual bunds, and the working levels of the quarry. Regarding the working levels, Figure 2 was based on an Air Photo taken on December 17th 1996. Close scrutiny of Plate 1 (August 13th 1997) indicates by comparison the extent of extraction during the past 8 months.

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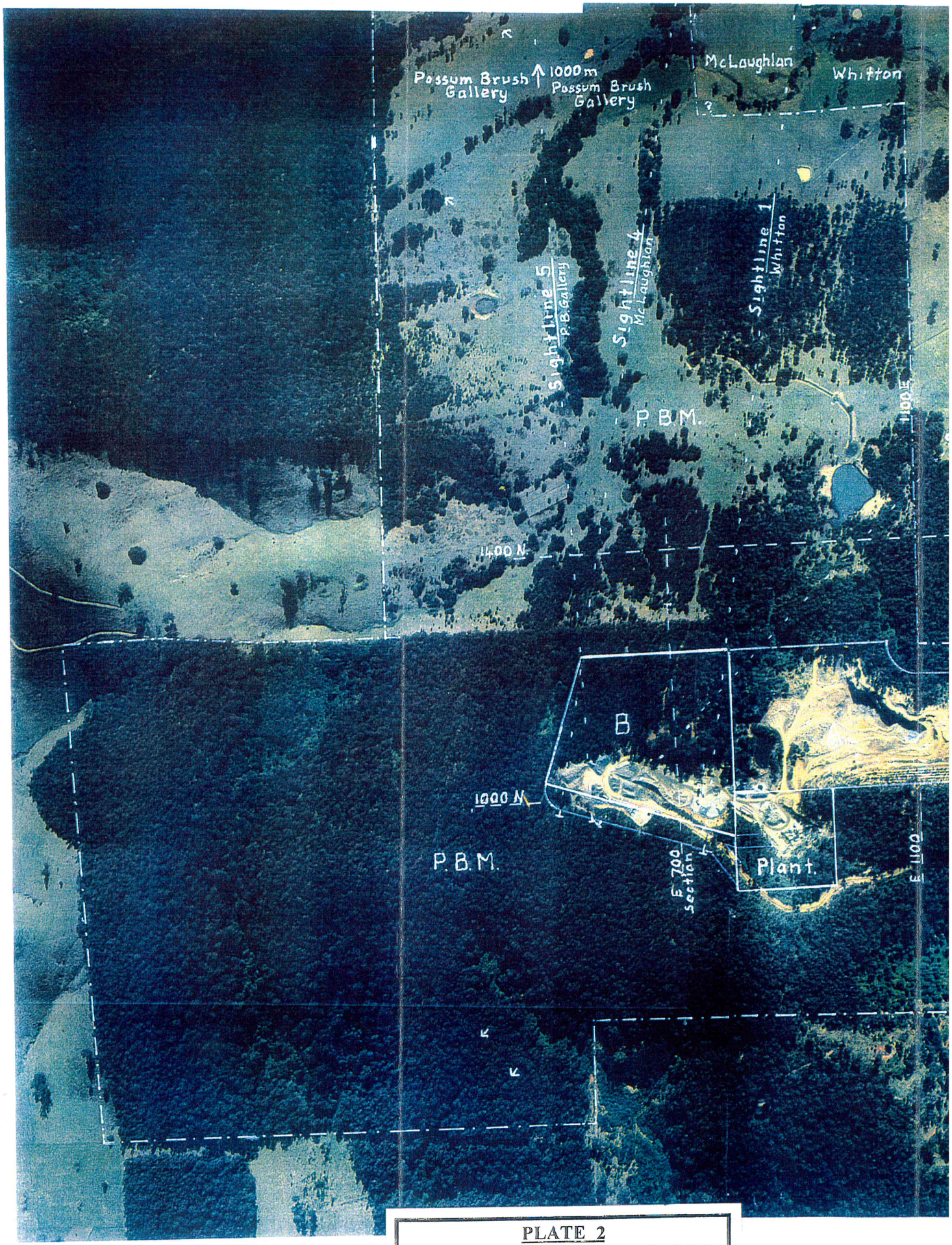

PLATE 2

PACIFIC BLUE METAL QUARRY AND SURROUNDS

AIR PHOTO 13.8.1997 SCALE 1:8000

DEVELOPMENT APPLICATION DATA SHOWN

E	Traffic volumes near or at capacity. Flow is unstable and there may be momentary stoppages.
F	Forced flow operation at low speeds caused by demand exceeding capacity. There is stop/start operation, with long queues and delays. In the extreme, both speed and volume can drop to zero.

Source: Ausroads, 1988b

ii. Pacific Highway

Annual average daily traffic flow (AADT) data are collected by the RTA (RTA, 1990). However, daily traffic volumes on the Pacific Highway are subject to seasonal peak flows at Christmas, Easter and during school holidays which significantly exceed average daily flows. Notwithstanding this, the AADT is the most appropriate benchmark for assessing traffic impacts as it covers typical traffic conditions rather than these exceptional events.

Annual average daily traffic flows from the traffic counting stations on the Pacific Highway nearest to Possum Brush Road (09008, 09107 and 09109) have been used to forecast traffic volumes for 1995, 1996, 2006 and 2016 as shown in *Table* 2. The forecasts are based on linear trend analysis of historical traffic data.

The RTA in its report, *North Coast Road Strategy* (1993a), states that most north coast traffic is localised, with the majority of travel entirely within the region (ie the Hunter/Manning Region) and another 40 percent of travel having origins or destinations in the region. The remaining travel is through the region including Sydney-Brisbane travel.

The RTA advises that on the Pacific Highway the northbound/southbound traffic split at counting station 09109 for 1995 was 49.75/50.25. The *Taree Traffic Relief Route EIS* (Gutteridge, Haskins & Davey, 1990) states that during the peak hour on the Pacific Highway the split is 55/45 favouring the peak direction. The estimated annual average traffic volume on the Possum Brush section of the Pacific Highway is 9,865 vehicles per day (vpd) from linear interpolation between counting stations 09008 and 09107.

Table 2 Traffic Count Volumes and Forecasts (AADT)

Year	**Counting Station**		
	09008[1]	09107	09109[1]
1970	3180[2]	2420[2]	4620[2]
1978	4830[2]	4820[2]	7110[2]
1986	6905[2]	7195[2]	9376[2]
1990	8761[2]	8229[2]	12506[2]
1995	9467[2]	9743[3]	13833[2]
1996	9689[3]	10040[3]	14134[3]
2006	12528[3]	13016[3]	18014[3]
2016	15188[3]	15992[3]	21894[3]

intersection capacity is adequate to accommodate peak hour quarry traffic volumes of eight vehicles per hour well into the future.

Table 5 Level of Service Criteria for Intersections

Level of Service	Average Delay per Vehicle (Secs)	Expected Delay to Traffic
A	0<14	Little or No Delay
B	15-28	Short Traffic Delays
C	29-42	Average Traffic Delays
D	43-56	Long Traffic Delays
E	57-70	Very Long Traffic Delays
F	>70	Extreme Delay

Source: RTA Guide to Traffic Generating Developments, 1993a

Traffic Safety

i. Pacific Highway

The RTA's *Traffic Accident Database* has been examined for the six year period from 1 January 1990 to 31 December 1995 to review general traffic safety in the vicinity of Possum Brush.

A review over a six year period is generally sufficient to identify trends in accidents. A total of four accidents was recorded within two kilometres of the Possum Brush Road intersection, none of which involved quarry traffic This represents an overall accident rate of approximately 0.28 per million vehicle kilometres of travel. This is substantially lower than the accident rate of 33.5 per million vehicle kilometres for two lane dual carriageway, determined by the RTA during the years 1988 to 1990 inclusive (RTA, 1993b). This comparison indicates that there are no unusual safety problems on the Possum Brush section of the Pacific Highway.

ii. Possum Brush Road and the Internal Access Road

Since the commencement of quarry operations at Possum Brush Quarry there has been one accident involving quarry truck traffic. One of the haulage contractors lost control of his vehicle on Possum Brush Road just near the access road intersection. The accident was allegedly caused by a diesel spill on the road. No vehicles other than the contractor's were involved in the accident.

Possum Brush Road has a number of limitations that reduce its safety to road users. These limitations include:

- no provision for bicyclists or pedestrians along the roadside;

estimated peak truck movements are one every seven minutes which is equivalent to eight truck movements per hour. The result of eight truck movements is adopted for this assessment.

As no new traffic data were available for the current period, traffic volumes for 1996 were assumed based on the linear population growth rate. Assuming a growth rate of 2.1% (GTCC, 1996) in non-quarry traffic and zero growth in quarry traffic, the predicted current traffic volume is 430 vpd. This estimate is conservative as the growth in population at Possum Brush Road is likely to be lower than the regional average.

The daily traffic capacity for the varying levels of service on Possum Brush Road were estimated and are shown in *Table 4*.

Table 4 Daily Traffic Volumes for Possum Brush Road Levels of Service

Level of Service	Range of Daily Traffic Volume (AADT)	Summary of Traffic Conditions
A	0 - 410	Free Flow
B	410 - 1,400	Stable Flow
C	1,400 - 2,790	Stable Flow, Restricted Speeds
D	2,790 - 4,280	Approaching Unstable Flow Conditions
E	4,280 - 13,000	Unstable Flow
F	Over 13,000	Forced Flow

Peak hourly traffic volumes generated as a result of future quarry operations would be similar to historical levels over the past five years and will be primarily truck traffic. It is anticipated that truck volumes would be busiest during the morning and tail off during the day. Traffic movements would be intermittent from day to day depending on the demand for quarry material. Quarry traffic will only be between the access road and the Pacific Highway. The current estimated daily volume (430 vpd) is just within Level of Service B.

iv. Intersection of Pacific Highway and Possum Brush Road

Peak hourly volumes on the Pacific Highway are typically between eight and twelve percent of daily volumes. For this assessment peak hourly traffic volumes have been assumed to be ten percent of the average annual daily traffic volume. Typically the maximum truck movements from the quarry turning off Possum Brush Road on to the Pacific Highway would be eight truck movements per hour.

To determine if the intersection of the Pacific Highway and Possum Brush Road performs adequately analysis of its operation against a set of performance criteria developed by the RTA was carried out. These criteria are set out in *Table 5* using the 1996 traffic volumes.

The average delay for peak hourly volume on Possum Brush Road turning on to the Pacific Highway is seven seconds, giving the intersection a Level of Service A. The

intersection capacity is adequate to accommodate peak hour quarry traffic volumes of eight vehicles per hour well into the future.

Table 5 Level of Service Criteria for Intersections

Level of Service	Average Delay per Vehicle (Secs)	Expected Delay to Traffic
A	0<14	Little or No Delay
B	15-28	Short Traffic Delays
C	29-42	Average Traffic Delays
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Source: RTA Guide to Traffic Generating Developments, 1993a

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Possum Brush Road has a number of limitations that reduce its safety to road users. These limitations include:

- no provision for bicyclists or pedestrians along the roadside;

- inadequate sight distances along sections of the road, particularly at the intersection with the internal access road;
- the pavement of the east bound lane is in poor condition; and
- the 100 kilometre per hour speed limit is excessive for a narrow road with a significant proportion of heavy traffic.

Additionally, the road width is inadequate for a rural road with a significant proportion of heavy traffic. Minimum road widths of 3.5 metres and minimum shoulder widths of 1.5 metres are recommended for rural roads carrying a high percentage of heavy traffic (Ausroads 1989).

In addressing these concerns the proponent has approached GTCC to have the speed limit reduced to 80 kilometres per hour along Possum Brush Road. GTCC advises that reducing speed limits on rural roads is not Council policy. Consequently, the proponent has voluntarily imposed a requirement on all haulage contractors to observe all road rules, to abide by RTA load limits and to restrict speed to 70 kilometres per hour along Possum Brush Road and 40 kilometres per hour on the internal access road.

The proponent has also offered to provide Council with material for maintenance of Possum Brush Road. This material is available for road widening and resealing. It is not necessary to seal the shoulders of Possum Brush Road, however sealing would further improve road safety by providing room for vehicles to stop clear of traffic lanes and would reduce edge wear due to improved moisture conditions under the outer wheel path. The provision of widened shoulders would assist in the safe movement of non-vehicular traffic along Possum Brush Road.

Road widening would improve sight distances along Possum Brush Road. At the intersection of Possum Brush Road and the internal access road, design sight distances will be maintained by the removal of obstructing vegetation.

Traffic Impacts and Mitigation Measures

Traffic impacts of the proposed continuation of the quarry will be minimal as peak hourly and total traffic volumes generated as a result of future quarry operations will be similar to historical levels of traffic over the past five years. Traffic flows generated by the quarry will be primarily truck traffic with minor car movements related to employees arriving and leaving the quarry.

The existing road network has substantial spare capacity and traffic generated by the quarry will not result in any changes in the operation of nearby roads and intersections. Nonetheless, it is proposed that a number of mitigation measures be taken to improve road safety on Possum Brush Road. These mitigation measures include:

- widening of Possum Brush Road to 3.5 metre lane widths and 1.5 metre shoulder widths;

- maintenance of design sight distances at the intersection of Possum Brush Road and the internal access road by the removal of obstructing roadside vegetation; and

- provide material to GTCC for ongoing maintenance of Possum Brush Road pavement.

In addition to these mitigating measures the proponent has agreed to address residents' concerns raised at the community consultation meeting (see Chapter 4) by undertaking the following actions:

- provide material to Council for construction of a bus stop and set down area for children to await buses;

- construct a suitable arrestor bed at the bottom of the hill where the access road intersects with Possum Brush Road; and

- continue to remind haulage contractors to comply with traffic safety requirements.

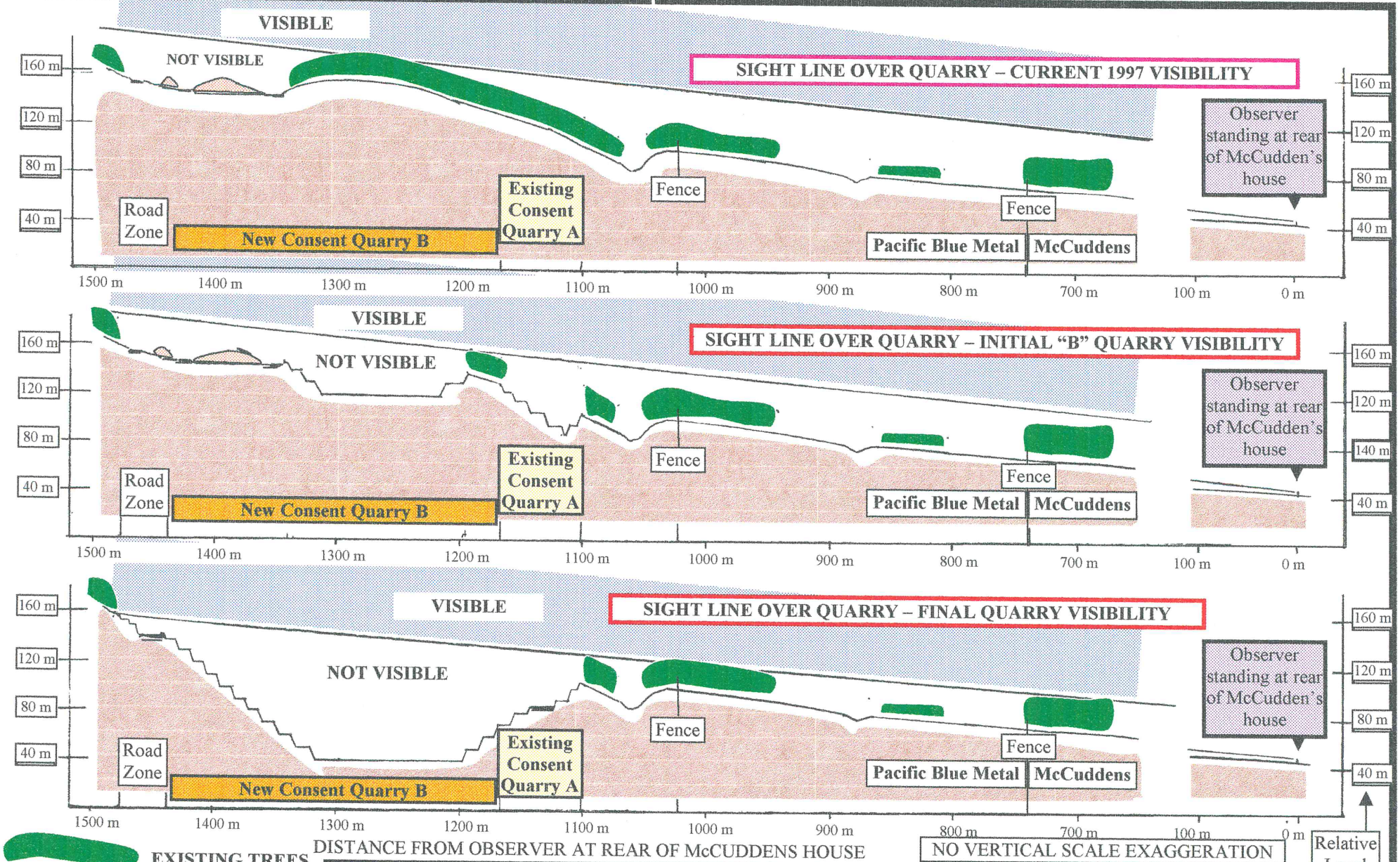
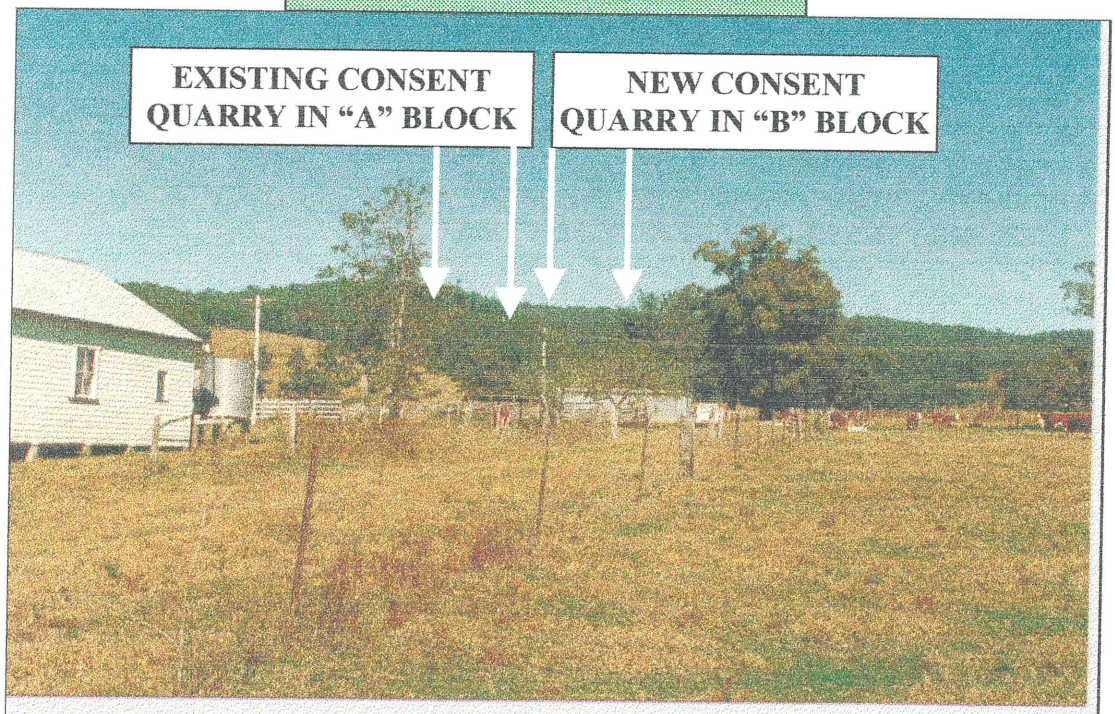
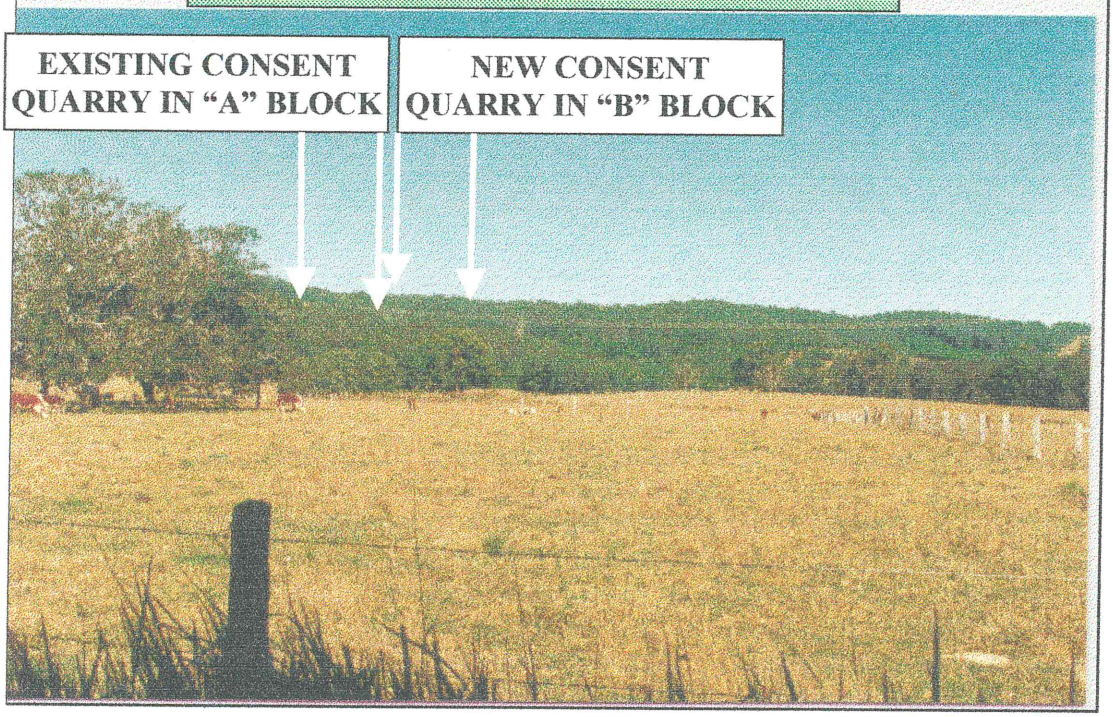


FIGURE 2A - SIGHTLINE 2 VIEW SECTION FROM McCUDDEN'S HOUSE

VIEW FROM BESIDE HOUSE



VIEW FROM IN PADDOCK BESIDE HOUSE



Kerry R
Steggles

PLATE 3

QUARRY AREA PHOTOGRAPHS FROM NEAR McCUDDEN'S HOUSE
AUGUST 1997

3. QUARRY VISIBILITY

The February 1997 Report provided details of the planning to achieve a quarry design and location on Block B that met a parameter of visual unobtrusiveness. Visibility was examined both from distant regional elevated land and from the four adjoining properties that have houses and can see the hill side in which the quarry is located. The former was depicted on an area plan in Figure 3 with supporting text describing the field of vision in exact terms. The latter, involving the closest houses on the same side of Possum Brush Road as the Quarry, were depicted on an area plan in Figure 4. Supporting detailed text and tabulated data was provided in Tables 2,3,4 and 5 (one for each house).

To competently express the visibility from the four houses it was necessary to examine a series of sight lines extending over the proposed Block B location. As the provision of a total picture of the situation required that all these lines be depicted on one plan, colour coding was used to clarify the resultant crowded plan in Figure 4.

This report provides in Figure 2A a visual expression of one of the data lines in one of the Tables. That **Figure 2A,** titled **Sightline 2 View Section From McCudden's House,** is on the previous page 5. The selected house and sightline is considered to be the most sensitive to quarry location. A series of View Sections are given to show the profile as quarrying proceeds.

Plate 2 titled **Pacific Blue Metal Quarry and Surrounds** is placed opposite Figure 2A to allow visual identification of the features along the sightline. It is at a scale of 1:8000 to show a more extensive land area back to the house involved, as well as the other properties considered.

Plate 3 (facing this page), titled **Quarry Area Photographs from Near McCudden's House August 1997**, provides a visual record of the current quarry view detailed in Figure 2A.

Plate 2 has marked on it the most sensitive sightline from each of the four property houses, the current quarry area and the proposed Block B quarry area. It also shows the visual buffers provided by mature tree growth on the retained uncleared land immediately north of the quarry and further away in the paddocks owned by PBM and on parts of the adjoining properties.

Although some small areas of the existing consent quarry on Block A are likely to become visible as the remaining uncleared area is worked, the overall current degree of visibility will diminish as the existing and planned tree restoration plantings grow.

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The Plate 2 colour air photo shows the extensive regrowth on the quarry high benches above the 150 m bench. All quarrying at these elevated levels has been completed. Plate 3 shows the quarry workings are now barely visible.

The three View Sections in Figure 2A show the Current 1997 Visibility, the Initial "B" Quarry Visibility, and the Final Quarry Visibility along sightline 2 from McCudden's house. That sightline has been positioned as the lowest view path over the trees on the quarry north boundary. It is near the gully structure that drains the quarry site. If the line is moved south it is lifted by the rising tree crowns of the spur to the east of the gully, if it is moved westward it is lifted by the rising tree crowns on the spur west of the gully.

The section scaling provides a natural depiction of the view, there being no vertical exaggeration. Colour has been used to enhance the ease of visual understanding of the diagram with tree clumps and fence boundaries relatable to exact visual features on the facing Plate 2 photo. A conservative aspect of these depictions is that the effective tree crowns have been taken as no more than 25 m whereas survey data shows some at 29 m. Also the current tree height analysis has been applied to the Final Quarry Visibility section, whereas considerable tree growth would be expected in the many years before that Stage is reached.

Kerry R Steggles

4. QUARRY EXTRACTION SEQUENCE SECTIONS

Extraction sequence data was provided in the February 1997 Report in the text of Sections 3.4 and 3.5. The Block B workings were sequenced in terms of a Northern Stage and a Southern Stage. The Initial Workings were noted as being in the Northern Stage area and involved two Zones that joined as extraction proceeded. Figure 5, Optimum Quarry Design – Block "B" Part, was placed opposite this text to allow the reader to easily identify the text content with an uncluttered Plan showing the proposed development.

Deepening of the current consent Block A area was presented the same way. Figure 6, Optimum Quarry Design – Block "A" Part, was placed opposite the descriptive text which in this case was less involved. The quarry plans shown in Figures 5 and 6 overlapped each other and carried coloured data blocks to allow the reader to easily identify the relative position of the two areas. The previous Figures 1, 2, 3 and 4 also showed the overall development layout.

The following three Section diagrams provide a further visual expression of the extraction sequence currently envisaged for the Block B quarry. They are presented in **Figures 3A, 4A and 5A**. All are titled **Section Along Grid Line 700 m**, then respectively **1997 Profile with Existing Quarry Consent**, **Profile of Initial Zone 1 Mining in Northern Stage of Block "B" Quarry**, and **Predicted Profile of Block "B" Quarry at Completion of Proposed Mining**. They are on pages 9, 10 and 11. Figure 1A (page 2) shows the position of this Section line which provides a representative depiction of the proposed Block B mining. Plates 1 and 2 allow this location to be identified visually with the existing land surface (photographed August 13th 1997).

The section scaling provides a natural depiction of the workings, there being no vertical exaggeration. Colour has been used to enhance the ease of visual understanding of the diagrams with tree clumps and fence boundaries relatable to exact visual features on the Plate 1 or 2 photo. A conservative visual buffer aspect of these depictions is that the effective tree crowns of existing cover has been taken as no more than 20 m in height whereas survey data shows some in similar terrain at 29 m. Also the current tree height analysis has been applied to all three, whereas considerable tree growth would be expected in the years before the profiles in Figures 4A and 5A are reached.

The Figure 4A style of profile with Initial Zone 1 Extraction is estimated to apply in 3 to 5 years. With Zone 2 extraction and the linking of the two zones to work deeper levels, the need to clear the next program area to the north is estimated to occur in 7 to 10 years. The full extent of the surface clearing shown in Figure 5A is estimated at 20 years, with completion at 100 year.

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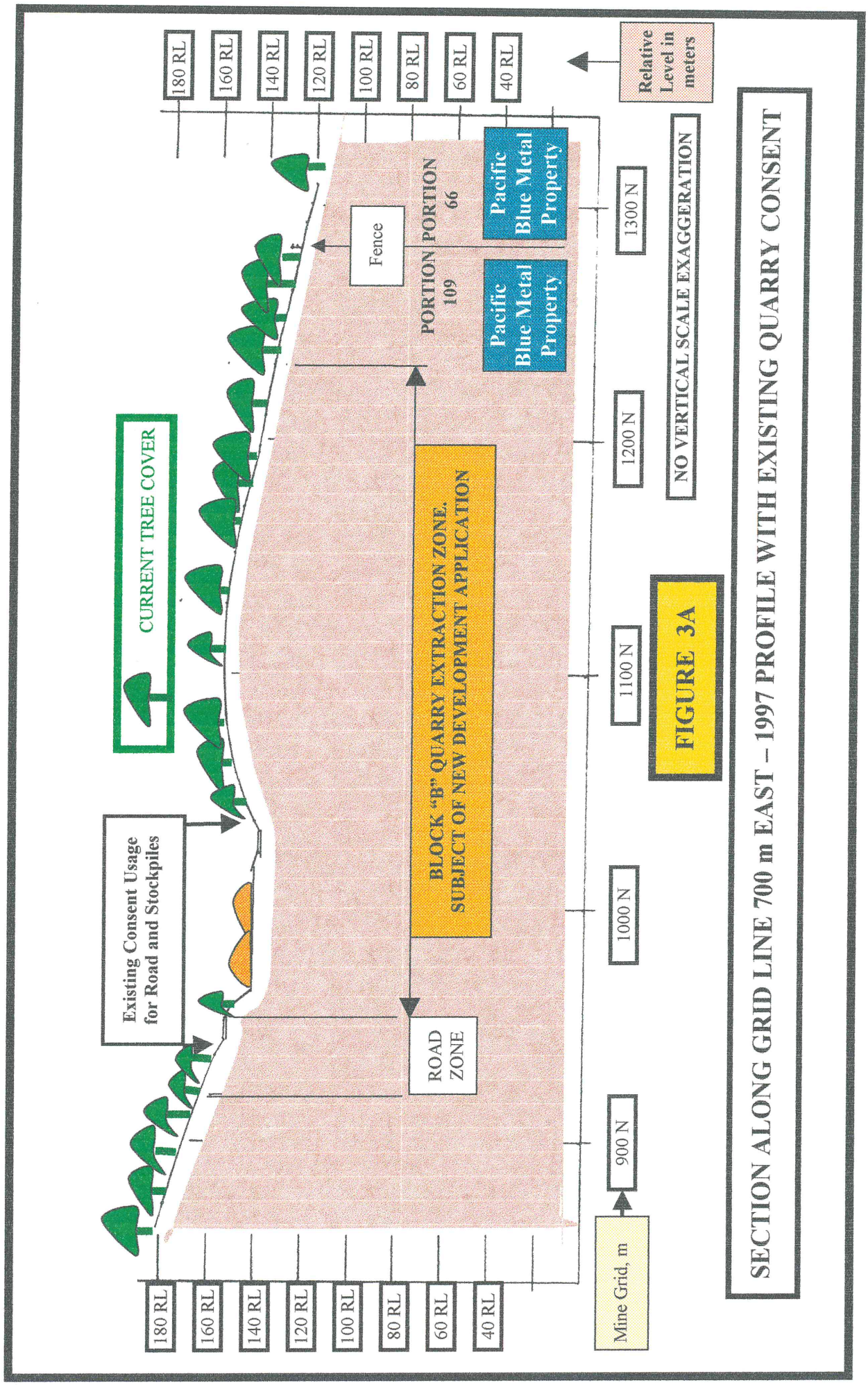

Kerry R Steggles

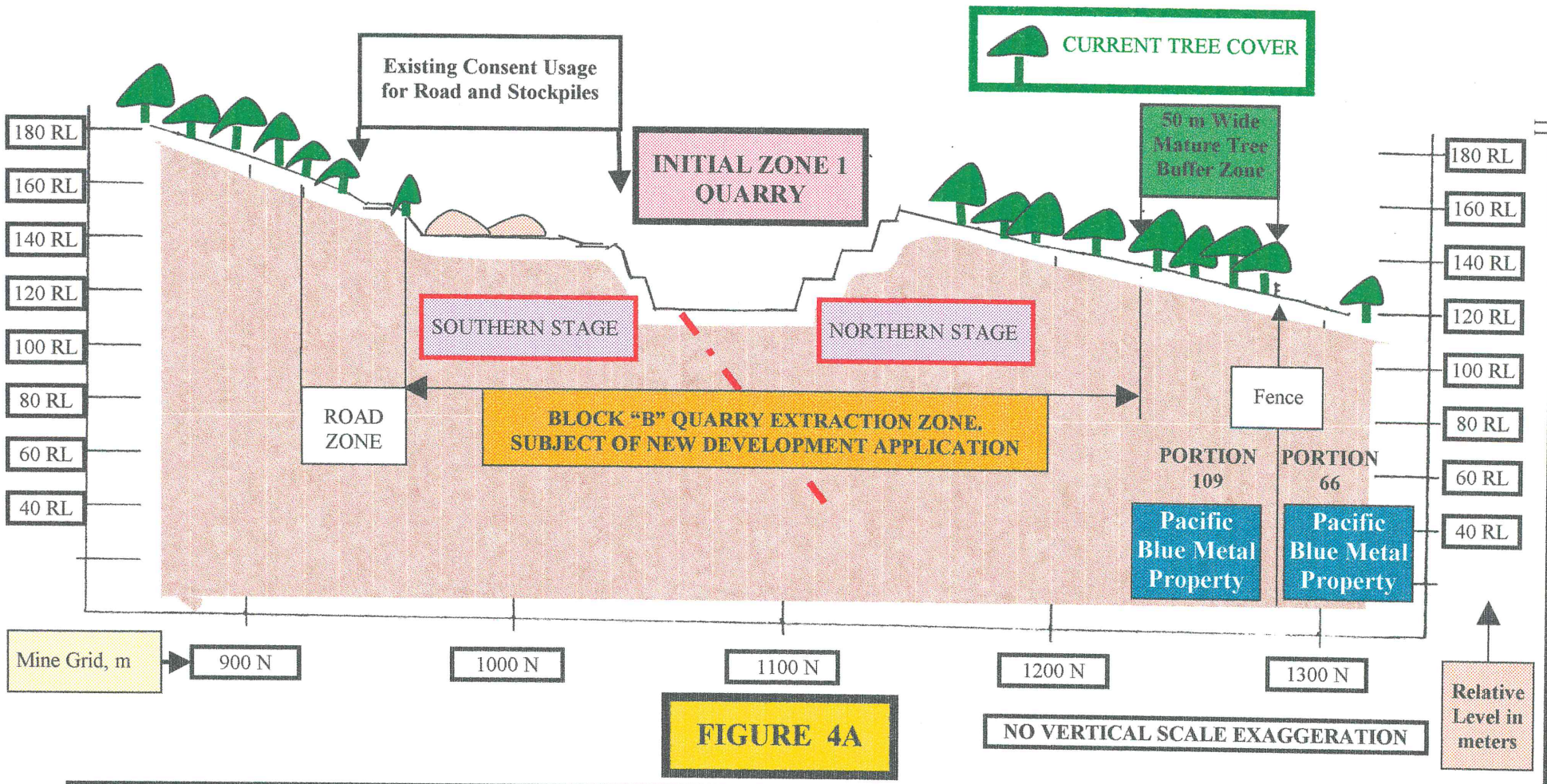

FIGURE 4A

SECTION ALONG GRID LINE 700 m EAST – PROFILE OF INITIAL ZONE 1 MINING IN NORTHERN STAGE OF BLOCK "B" QUARRY

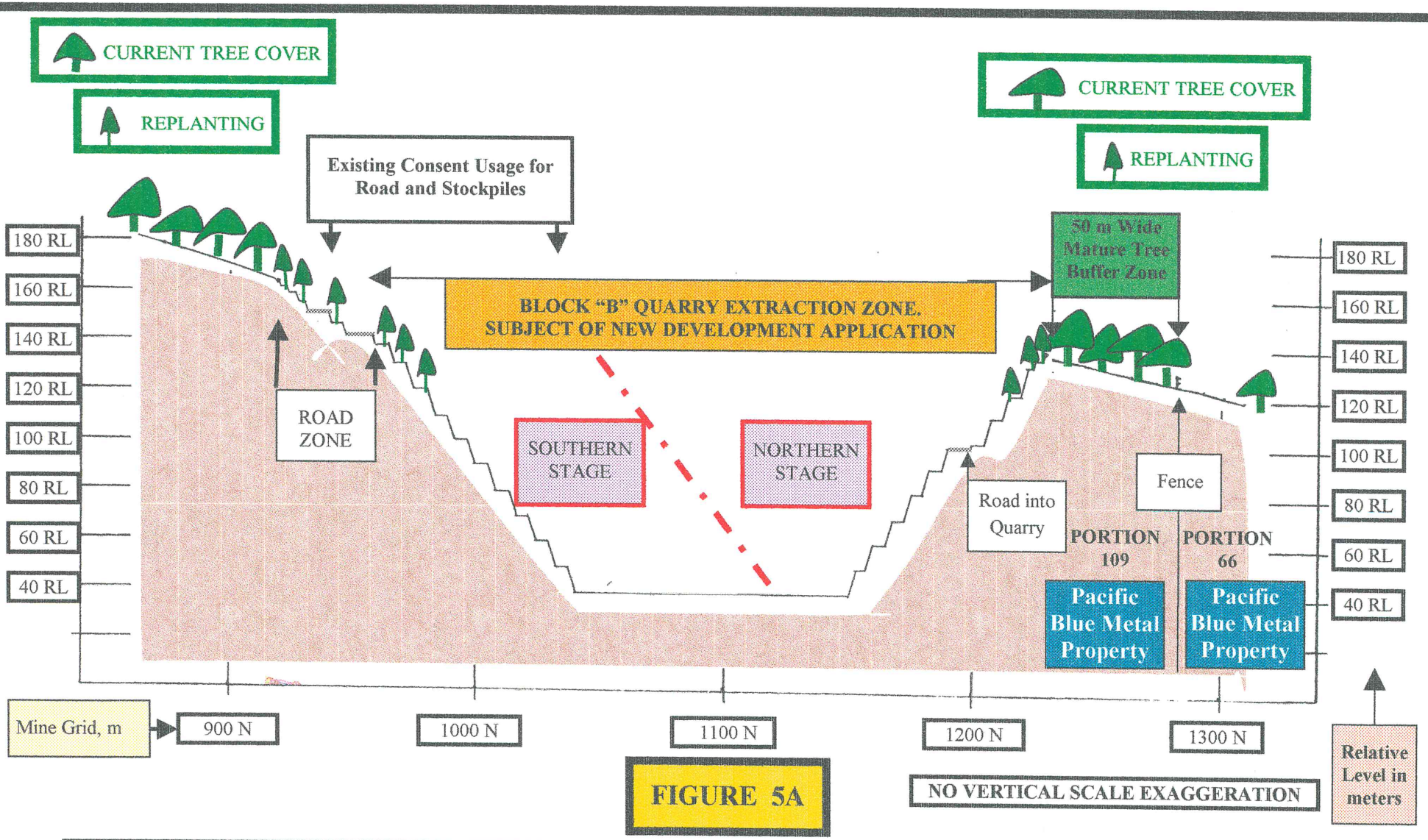

FIGURE 5A

SECTION ALONG GRID LINE 700 m EAST – PREDICTED PROFILE OF BLOCK "B" QUARRY AT COMPLETION OF PROPOSED MINING

5. REGIONAL VIEW OF QUARRY ENVIRONS.

PLATE 4, on the following page 13, titled **Quarry Regional Setting Showing Dominance of Tree Covered Land**, is a mosaic of the Air Photos taken on August 13th 1997. It is at a scale of 1 : 25 000.

This provides a photographic visual expression of the environmental setting of the quarry and the New Development Application extraction extension area in Block B. It supports the February 1997 Report Section 3.3 on Design and Environmental Factor Analysis and provides a visual equivalent of a significant area of Figure 3 in that Report. The actual 269 ha of PBM owned land on which the quarry is located can be identified by referring to the boundaries shown on that Figure 3.

The photographic data gives irrefutable substantiation to the conclusion that the **proposed Block B quarry poses no threat to any flora or fauna.** It is an extension of an existing quarry operation that already utilises more than 40% of the 7 ha area to be worked, as noted over a 100-year period. In its setting its **environmental impact is absolutely insignificant.** Less than 5 ha (about 4.4) of the total existing tree cover will be cleared in three programmes over some 20 years, the Initial Workings area being less than 2 ha (about 1.7 ha). That 1.7 ha area is estimated to last from 5 to 10 years, depending on the relative demand for material types from this quarry area or the existing Block A quarry.

The regional forested terrain setting shown in Plate 4 continues to the north, east and west of the 170 000 ha shown, with the Kiwarrak State Forest being a major feature. Clearly the quarry and its immediate surrounds are not an island of timbered land that restricts the habitat field of tree dwelling marsupial species such as the brush-tailed phascogale. The investigations of the proposed quarry site by ERM Mitchell McCotter last year recorded a pair of that species of marsupial on a tree close to the western boundary.

A three year PhD research study program on the brush-tailed phascogale in Western Australia's south-west forests, supported by the Australian Geographic Society, was completed by Susan Rhind and reported last year in that Society's July September 1996 issue. That article, titled "Out on a Limb" described the animals habitat as Dry Sclerophyll forest and Open Woodland on Australia's coastal fringe. Radio tracking recorded the animals capacity for extensive high speed movement along the ground to other trees, frequently many kms per night. This research indicates the animal has a capacity to migrate or forage across the terrain types from the quarry site to Kiwarrak State Forest. Such a potential migration route is marked on Plate 4. The proposed quarry tree clearing does not present an endangering to that species survival.

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1 Km

Scale: 1:25,000

KIWARRAK STATE FOREST

A POTENTIAL TREE COVERED MIGRATION ROUTE FOR TERRESTRIAL SPECIES FROM QUARRY SITE TO KIWARRAK STATE FOREST –ONLY THREE TREE COVER GAPS OF <25m OCCUR, TWO ARE IN GRASSED PADDOCK, THE OTHER IS POSSUM BRUSH ROAD

POSSUM BRUSH ROAD

NEW DEVELOPMENT APPLICATION AREA TO BE CLEARED DURING NEXT 100 YEARS – INVOLVES LESS THAN 5 HECTARES OF TREE COVERED LAND

PLATE 4

QUARRY REGIONAL SETTING SHOWING DOMINANCE OF TREE COVER LAND

Appendix E

EIGHT PART TEST

Chapter 1

INTRODUCTION

ERM Mitchell McCotter was commissioned by Pacific Blue Metal to undertake an ecological investigation, incorporating an eight part test and Koala habitat assessment to determine if the proposed development is likely to have a significant effect on fauna and flora listed as threatened under the Threatened Species Conservation Act, 1995 (TSC Act). The eight part test has been undertaken for the purposes of the TSC Act and in particular, in the administration of sections 77, 90 and 112 of the Environmental Planning and Assessment Act, 1979 (EP&A Act). The Koala habitat assessment has been undertaken in accordance with SEPP 44 - Koala Habitat Protection. The results and methodology of the eight part test are contained within this report. The results of the SEPP 44 Assessment are contained in the SIS.

Chapter 2

ECOLOGICAL INVESTIGATIONS

A detailed description of the methodology of the ecological investigations is contained in Chapter 2 of the SIS.

VEGETATION ASSESSMENT

Based on structural characteristics and floristic composition, five main plant communities have been identified on the study area. These communities are:

- Dry Open Forest;
- Depauperate Rainforest;
- Acacia Woodland;
- Grassland; and
- Quarry Pit.

Descriptions of the above communities are contained in Section 2.1.2 of the SIS.

The detection and identification of some flora species was limited due to seasonality and a consequent lack of suitable flowering or fruiting material for some species.

FAUNA HABITAT ASSESSMENT

The vegetation communities described in the SIS reflect differences in community structure and plant species composition. The majority of animals choose habitat based primarily on structural differences of vegetation communities, rather than detecting specific plant species differences. This, of course, excludes the Koala, which chooses habitat based mainly upon the presence of particular plant species. Structural characteristics include the height of the dominant layer, the number of distinctive layers and the density of vegetation. Many specialised faunal groups may depend upon availability of water and the presence of particular tree or shrub species and specific micro-climatic characteristics to survive. Any activity that changes the structure or cover of vegetation will, in turn, change the faunal habitat characteristics and may result in modifications to the composition of fauna within an area. Four fauna habitats have been identified on the site, as listed below and shown in *Figure* 2.2 of the SIS.

- Open Forest;

- Woodland;
- Herbland; and
- Quarry pit.

Descriptions of the above fauna habitats are contained in Section 2.2.2 of the SIS.

MOVEMENT CORRIDORS

The forest vegetation of the study area is relatively continuous for approximately 140 ha. It is an island of habitat and there are no forested corridors leading to larger expanses of forest outside of the study area. Hence, there is unlikely to be any sustainable movement corridor leading from the forested part of study area. The GTCC SOE Report has not identified any known wildlife or habitat corridors that traverse the site.

FAUNA SURVEY

A detailed fauna survey was conducted on the study area from 3/9/96 to the 13/9/96. Details of the fauna survey methodology are contained in section 2.3 of the SIS. Results of the fauna survey are provided below.

Night temperatures measured around midnight were in the range of 12 - 17°C, and the minimum daily temperatures from radio reports were not below 10°C during the survey period.

The fauna survey was undertaken during the period 3/9/96 to 13/9/96, and the bat survey during the period 3/9/96 to 7/9/96. The possible presence of threatened fauna was determined primarily on the likelihood of suitable habitat on the subject site and study area. The fauna survey was conducted to the fullest extent possible within the scope of the project, and was intended to focus on the detection of those species considered likely to utilise the habitat.

Birds

A high number of diurnal birds were recorded on the site. A full list of all birds sighted during the survey is provided in *Appendix F* of the SIS.

Mammals

A moderately high number of small terrestrial mammals were captured during the survey. A relatively high number of Sugar Gliders and Common Brushtail Possums were observed on the study area during the survey. Two Brush-tailed Phascogales were sighted together on a single tree in Block B. A full list of mammals detected/captured during the survey is listed in *Appendix F* of the SIS.

Reptiles and Amphibians

The level of reptile and amphibian activity was found to be generally low due to climatic conditions. One reptile was sighted this being the Copper Tailed Skink (*Ctenotus taeniolatus*). Three frog species were identified. There are the Eastern Dwarf Tree Frog (*Litoria fallax*), the Brown Froglet (*Crinia signifera*) and the Striped Marsh Frog (*Limnodynastes peronii*). The Brown Froglet and the Striped Marsh Frog were heard calling from dams on the study area. The Eastern Dwarf Tree Frog was heard throughout the survey (both day and night) in the forested areas, the grassland and from the dam on the study area.

SIGNIFICANT FLORA AND FAUNA IDENTIFIED

Brush-tailed Phascogale: Two Brush-tailed Phascogales were sighted in Block B using a spotlight, while undertaking the fauna survey. These individuals were sighted foraging on the same tree by Nicole Barkwill, one of the environmental scientists undertaking the fauna survey. Two other environmental scientists (Lisa Brown and Don Owner) were present to verify Nicole's sighting. The CVs of Nicole, Lisa and Don may be found at *Appendix A* of the SIS.

Glossy Black Cockatoo: No Glossy Black Cockatoos, or evidence of Glossy Black Cockatoos were sighted during the fauna survey in September 1996. A number of Glossy Black Cockatoos were recorded foraging in the gully transects on the study area by Debus, S. in December 1984.

Rudder's Box: Three large individuals of this species were identified on the eastern boundary of Block B. These were identified by Lisa Brown, one of the environmental scientists undertaking the fauna survey. Two other environmental scientists (Nicole Barkwill and Don Owner) were present to verify Lisa's identification. Griffith, S. also identified this species in the study area during a field survey in December 1984. *Figure* 2.4 of the SIS illustrates the location of the significant flora and fauna identified during the most recent field survey.

Little Bent-wing Bat and Large Bent-wing Bat: These two species were both recorded in the Moist Open Forest during September 1996. These individuals were recorded by

GC Richards. *Appendix G* provides more detail on the methodology used to identify these individuals.

Chapter 3

EIGHT PART TEST OF SIGNIFICANCE

The Threatened Species Conservation Act, 1995 (TSC Act) commenced on the 1st January 1996, and replaced the legislative scheme introduced by the Endangered Fauna (Interim Protection) Act, 1991. The TSC Act made substantial amendments to the National Parks and Wildlife Act, 1974 (NPW Act) and the Environmental Planning and Assessment Act, 1979 (EP&A Act). The new Section 5A of the EP&A Act, 1979 sets out eight factors to be considered in deciding whether there is likely to be a significant effect on threatened species, populations or ecological communities, or their habitats. This assessment will determine whether a Species Impact Statement is required. The issues to be considered are:

a *in the case of a threatened species whether the life cycle of the species is likely to be disrupted such that a viable local population of the species is likely to be placed at risk of extinction;*

b *in the case of an endangered population, whether the life cycle of the species that constitutes the endangered population is likely to be disrupted such that the viability of the population is likely to be significantly compromised;*

c *in relation to the regional distribution of the habitat of a threatened species, population or ecological community, whether a significant area of known habitat is to be modified or removed;*

d *whether an area of known habitat is likely to become isolated from currently interconnecting or proximate areas of habitat for a threatened species, population or ecological community;*

e *whether critical habitat will be affected;*

f *whether a threatened species, population or ecological community, or their habitats, are adequately represented in conservation reserves (or other similar protected areas) in the region;*

g *whether the development or activity proposed is of a class of development or activity that is recognised as a threatening process:*

h *whether any threatened species, population or ecological community is at the limit of its known distribution.*

SPECIES CONSIDERED

In undertaking the eight part test, a number of flora and fauna species have been considered. *Table 3.1* lists these species and documents their habitat and likelihood of occurrence based upon habitat preference and known occurrence on the study area and within the Great Lakes Shire and Greater Taree City local government areas. Only those species given a moderate to high chance of occurrence on the study area have been considered for the eight part test.

Table 3.1 Likelihood of Threatened Fauna and Flora Species

COMMON NAME	SCIENTIFIC NAME	HABITAT	LIKELIHOOD OF OCCURRENCE
Glossy Black Cockatoo	*Calyptorhyncus lathami*	Forest and woodland.	Recorded on site during a 1986 survey, but not during the most recent survey.
Swift Parrot	*Lathamus discolor*	Timbered country containing flowering eucalypt species.	Moderate due to suitable habitat, but frequency of recordings in the region is low and not recorded during the survey.
Turquoise Parrot	*Neophema pulchella*	Open Forest and timbered grasslands.	Moderate due to suitable habitat, but frequency of recordings in the region is low and not recorded during the survey.
Powerful Owl	*Ninox strenua*	Wet and dry sclerophyll forest, with optimum habitat being tall, dense mountainous eucalypt forest.	Moderate due to moderate quality habitat, frequently recorded in region but not recorded during the survey.

Table 3.1 Likelihood of Threatened Fauna and Flora Species

COMMON NAME	SCIENTIFIC NAME	HABITAT	LIKELIHOOD OF OCCURRENCE
Masked Owl	*Tyto novaehollandiae*	Forests, woodlands and caves.	Moderate due to suitable habitat and frequency of recordings in region, but not recorded during the survey.
Square-tailed Kite	*Lophoictinia isura*	Open forest and woodlands.	Moderate due to habitat suitability, but infrequently recorded in the region and not recorded during the survey.
Regent Honeyeater	*Xanthomyza phrygia*	Eucalyptus-dominated woodlands and dry sclerophyll forests with large mature trees.	Moderate due to suitable habitat, but infrequently recorded in region and not recorded during the survey.
Great Pippistrelle	*Falsistrellus tasmaniensis*	Primarily recorded in open, tall wet sclerophyll forests.	Moderate due to sub-optimum habitat, but infrequently recorded in the region.
Little Bent-wing Bat	*Miniopterus australis*	Wet and dry sclerophyll forests and rainforests.	Known to occur.

Table 3.1 Likelihood of Threatened Fauna and Flora Species

COMMON NAME	SCIENTIFIC NAME	HABITAT	LIKELIHOOD OF OCCURRENCE
Eastern Little Mastiff Bat	*Mormopterus australis*	Sclerophyll forest and woodland. Forages in clearings.	Moderate due to suitable habitat and infrequent recordings in region. Also not recorded during the survey.
Greater Broad-nosed Bat	*Scoteanax ruepellii*	Wet and dry sclerophyll forests and rainforests.	Moderate due to suitable habitat and known occurrence in region, but not recorded during the survey.
Large Bent-wing Bat	*Miniopterus schreibersii*	Wet and dry sclerophyll forests and rainforests.	Known to occur.
Yellow-bellied Glider	*Petaurus australis*	Tall, mature forests with a range of eucalypt species.	Moderate due to sub-optimum habitat and frequently recorded in the region, but not during this survey.
Squirrel Glider	*Petaurus norfolcensis*	Dry sclerophyll forests and woodland.	Moderate-high due to suitable habitat and frequency of recordings in the region, but not

Table 3.1 Likelihood of Threatened Fauna and Flora Species

COMMON NAME	SCIENTIFIC NAME	HABITAT	LIKELIHOOD OF OCCURRENCE
			recorded during this survey.
Brush-tailed Phascogale	*Phascogale tapoatafa*	Dry and wet sclerophyll forests, usually in areas with sparse ground cover.	Known to occur.
Tiger Quoll	*Dasyurus maculatus*	Wet and dry sclerophyll forest and rainforest.	Moderate. Numerous recordings in the region, however, not recorded during this survey and only a limited amount of suitable habitat.
Common Planigale	*Planigale maculatus*	Rainforest, sclerophyll forests and grasslands, marshlands and rocky areas.	Moderate due to some amount of suitable habitat, but not recorded during the survey.
Koala	*Phascolarctus cinereus*	Eucalypt forest and woodlands with feed tree species.	Moderate. Known to occur frequently throughout the region and suitable habitat, however not recorded during the survey.

Table 3.1 Likelihood of Threatened Fauna and Flora Species

COMMON NAME	SCIENTIFIC NAME	HABITAT	LIKELIHOOD OF OCCURRENCE
Parma Wallaby	*Macropus parma*	Optimum habitat is wet sclerophyll forest with a thick shrubby understorey coupled with grassy understorey forest patches.	Moderate due to sub-optimum habitat and known to occur in the region, but not recorded during the survey.
Pale-headed Snake	*Hoplocephalus bitorquatus*	Dry sclerophyll forest and woodland, preferring those with *Callitris* spp.	Moderate due to suitable habitat and known to occur in the region, but not recorded during the survey.
Stephen's Banded Snake	*Hoplocephalus stephensii*	Wide range of habitats including rainforest, wet sclerophyll forest and drier eucalypt forests; favouring rocky outcrops.	Moderate due to suitable habitat and known to occur in the region, but not recorded during the survey.
Austral Toad Flax	*Thesium australe*	Grasslands, grassy heaths and eucalypt woodlands in which Kangaroo Grass (*Themeda australis*) occurs.	Moderate due to suitable habitat, however frequency of recordings in the region is low and not recorded during the survey.

Table 3.1 Likelihood of Threatened Fauna and Flora Species

COMMON NAME	SCIENTIFIC NAME	HABITAT	LIKELIHOOD OF OCCURRENCE
Spider Flower	*Grevillea granulifera*	Ridge tops and hillsides in open forest.	Moderate due to suitable habitat, but frequency of recordings in region is low and not recorded during the survey.
Grevillea	*Grevillea obtusiflora*	Dry sclerophyll forest or woodland, mostly on acidic substrates.	Moderate due to suitable habitat, but frequency of recordings in region is low and not recorded during the survey.
Tetratheca	*Tetratheca juncea*	Sandy and swampy heath, as well as dry sclerophyll forest with a xeromorphic understorey.	Moderate due to suitable habitat, but frequency of recordings in region is low and not recorded during the survey.
Rudder's Box	*Eucalyptus rudderi*	Sclerophyll forest.	Known to occur.
Slaty Red Gum	*Eucalyptus glaucina*	Grassy woodland on deep, moderately fertile and well-watered soils.	Moderate due to some suitable habitat, but infrequently recorded in the region and not

Table 3.1 Likelihood of Threatened Fauna and Flora Species

COMMON NAME	SCIENTIFIC NAME	HABITAT	LIKELIHOOD OF OCCURRENCE
			recorded during the survey.
Hibbertia	*Hibbertia hexandra*	Heath, open forest and rainforest.	Moderate due to some suitable habitat, but recordings in region are relatively infrequent and not recorded during the survey.

RESULTS

Each of the eight matters for consideration under the eight part test is addressed below.

(a) Refer to individual species discussed below for further details.

(b) No *relevant* endangered populations have been listed on the Schedules to the TSC Act, 1995, hence they were not considered in this report.

(c) The study area contains known habitat for two threatened fauna species (the Brush-tailed Phascogale and Glossy Black Cockatoo) and one ROTAP species (Rudder's Box). A detailed description of the study region has been provided in the SIS to allow the existence of threatened fauna and flora habitat on both a broad and detailed scale to be examined. Particular emphasis has been placed on the existence of vegetation communities in the region which provide similar habitat to that found on the site.

(d) The study area provides known habitat for three significant species. The forest vegetation of the study area is relatively continuous for approximately 140 ha. It is an island of habitat, and there are no appropriately forested corridors leading to larger expanses of forest outside of the study area. The proposal is to encroach on the perimeter of an area of forest, rather than isolating another section, therefore the proposal will not result in an area of known habitat becoming isolated from currently interconnecting or proximate areas of habitat for a threatened species, population or ecological community.

(e) There is no critical habitat listed on the Schedules to the TSC Act, hence it could not be considered in this assessment.

(f) The Australian Nature Conservation Agency (ANCA) has developed a system of interim biogeographic regionalisation for Australia (IBRA). This system has been discussed in detail in Chapter 3 of the SIS.

Thackway and Cresswell (1995) have determined the reservation status within each interim biogeographic region by calculating the relative area of each region conserved in protected areas. The NSW North Coast (NNC) biogeographic region covers 60,794 square kilometres. The Queensland component accounts for 2,604 square kilometres of this area, while the NSW component amounts to 58,189 square kilometres. In the NNC region, reserved areas account for 5-10% of the total area.

Thackway and Cresswell (1995) document the dominant ecosystem condition and limiting factors and constraints to conservation management of each IBRA. In the NNC region, the dominant ecosystem condition of the Queensland component is

documented as being 'modified ecosystems with very few indigenous ecosystems remaining'. The NSW component is documented as having indigenous ecosystems present but co-existing with pastoral/timber industries. Dominant limiting factors to conservation management in the Queensland component are documented as being urbanisation and horticulture. In the NSW component, the major limiting factors to conservation management are documented as being agriculture, clearing, cropping, feral animals, wildfire, forest timber production/harvesting, grazing and pastoral use, horticulture, mining, tourism, urbanisation and weeds. Thackway and Cresswell's assessment indicates that there is an inadequate representation of reserves in the NNC region.

The SIS discusses the distribution of threatened species habitat (or similar protected areas) in the region in Chapter 3. The species profiles in the SIS document the occurrence of each species in conservation reserves. This information has been taken from the NPWS Atlas of Wildlife and other scientific studies available for perusal during early 1996, at the time this study was being formulated.

(g) There are no *recognised* threatening processes listed on the Schedules to the TSC Act, hence they could not be considered for this assessment, however habitat removal is generally recognised by the scientific community as being detrimental to the survival of threatened species and the proposal will result in the removal of approximately 4.4 hectares of known threatened species habitat over a twenty year period.

(h) Refer to individual species discussed below.

INDIVIDUAL SPECIES

Glossy Black Cockatoo

a. This species was identified on the study area during a 1986 survey. This species was not identified to be roosting or nesting on site during the field survey, and is therefore likely to be utilising the site for feeding purposes only. This is a highly mobile species and it is therefore unlikely that the amount of habitat to be removed for the proposal will disrupt this species' lifecycle to the extent that a viable population would be placed at risk of extinction.

h. This species range extends from southern Queensland to southern Victoria, hence it is not at the limit of its known distribution.

Swift Parrot

a. This species breeds in Tasmania and is a vagrant to mainland Australia. It therefore would not be using the hollows on site for nesting. Because this species is

highly mobile, it is unlikely that the proposal will disrupt this species' lifecycle to the extent that a viable population would be placed at risk of extinction.

h. This species is found from Tasmania to southern Queensland, hence it is not at the limit of its known distribution.

Turquoise Parrot

a. This species has not been observed on the study area, therefore it is unlikely that any viable population utilises the study and it is therefore unlikely that the proposed development may impact upon this species' lifecycle to the extent that a viable population would be placed at risk of extinction.

h. This species occurs in the eastern half of NSW, through to southern Queensland, hence it is not at the limit of its known distribution.

Powerful Owl

a. It is unlikely that this species relies upon the hollows on the study area for nesting and roosting, as none were recorded during the field survey. Because of the frequency of the recordings of this species in the region, and the relatively small amount of suitable habitat to be removed in comparison to this species' home range, it is unlikely that the proposed development would impact upon this species' lifecycle to the extent that a viable population would be placed at risk of extinction.

h. The Powerful Owl is found from southern Queensland to southern Victoria, hence it is not at the limit of its known distribution.

Masked Owl

a. It is unlikely that this species relies upon the hollows on the study area for nesting and roosting, as none were recorded during the field survey. Because of the frequency of the recordings of this species in the region, and the relatively small amount of habitat to be removed in comparison to this species' home range, it is unlikely that the proposed development would impact upon this species' lifecycle to the extent that a viable population would be placed at risk of extinction.

h. The Masked Owl is found from southern Queensland to southern Victoria, hence it is not at the known limit of its distribution.

Square-tailed Kite

a. No nests were observed on the study area during the field inspection, therefore if the site is utilised by this species, it is likely to be for hunting purposes only. Given the mobility of the species, it is unlikely that the proposal will disrupt

the lifecycle of this species to the extent that a viable local population may be placed at risk of extinction.

h. This species is found from Victoria through to northern Queensland, therefore it is not at the limit of its known distribution.

Regent Honeyeater

a. This species is highly mobile and does not rely upon tree hollows for nesting, relying instead upon a variety of flowering eucalypts as a food source. They are highly nomadic (Frith, 1976) and mobile. Due to the relatively small amount of this species' habitat to be disturbed for the proposal, it is unlikely that the proposed development would disrupt the life cycle of the species to the extent that a viable local population is likely to become extinct.

h. This species extends from the Tropic of Capricorn in eastern Queensland, down to southern Victoria, hence, it is not at the known limit of its distribution.

Great Pippistrelle

a. This species may rely upon the hollows on the study area for roosting and breeding, although it was not recorded during the survey. This species is known to occupy sclerophyll forests and woodland with small colonies being found on occasion within tree hollows and under loose bark. Because of the poor quality of the habitat on the study area, the likely presence of more continuous habitat in nearby Kiwarrak State Forest, and the fact that this species was not recorded during the survey, it is unlikely that any viable population utilises the study area. If this species does utilise the study area, because of its mobility, the proposal is unlikely to disrupt the life cycle of this species to the extent that a viable local population may be placed at risk of extinction.

h. This species has been recorded from Victoria to Queensland, hence it is not at the limit of its known distribution.

Little Bent-wing Bat

a. This species roosts in caves and forages over wet and dry sclerophyll forests. This species was recorded foraging in the study area. There are no caves on the study area. It is also highly mobile and it is therefore unlikely that the proposal will disrupt the life cycle of this species to the extent that a viable local population may be placed at risk of extinction.

h. This species ranges from far north Queensland to the mid north coast of NSW, hence it is at the approximate southern limit of its known range.

Eastern Little Mastiff Bat

a. This species may rely upon the hollows on the study area for roosting and breeding, although it was not recorded during the survey. This species is known to occupy sclerophyll forests and woodland with small colonies being found on occasion within tree hollows and under loose bark. Because of the poor quality of the habitat on the study area, the likely presence of more continuous habitat in nearby Kiwarrak State Forest, and the fact that this species was not recorded during the survey, it is unlikely that any viable population utilises the study area. If this species does utilise the study area, because of its mobility, the proposal is unlikely to disrupt the life cycle of this species to the extent that a viable local population may be placed at risk of extinction.

h. This species ranges from southern Queensland to the southern coast of NSW hence it is not at the limit of its known distribution.

Greater Broad-nosed Bat

a. This species roosts in tree hollows in wet sclerophyll forests. It is not proposed to directly disturb this species' roosting habitat on the study area. Because of the poor quality of the habitat on the study area, the likely presence of more continuous habitat in nearby Kiwarrak State Forest, and the fact that this species was not recorded during the survey, it is unlikely that any viable population utilises the study area. If this species does utilise the study area, because of its mobility, the proposal is unlikely to disrupt the life cycle of this species to the extent that a viable local population may be placed at risk of extinction.

h. This species is found from northern Queensland, south to Victoria, hence it is not at the known limit of its distribution.

Large Bent-wing Bat

a. This species roosts in caves and forages over wet and dry sclerophyll forests. This species was recorded foraging in the study area. There are no caves on the subject site. It is also highly mobile and it is therefore unlikely that the proposal will disrupt the life cycle of this species to the extent that a viable local population may be placed at risk of extinction.

h. This species ranges from northern Australia (*M. s. orianae*) and from northern Queensland down to southern Victoria/South Australia (*M. s. blepotis*) therefore the Large Bent-wing Bat is not at the limit of its known distribution.

Yellow-bellied Glider

a. This species was not recorded on the study area during the field survey, and it is therefore unlikely that this species utilises the study area. If it does utilise the study area, it is possible that the proposal will disrupt the life cycle of this species to the extent that a viable local population may become extinct.

h. This species occurs along eastern Australia, therefore this species is not at the limit of its known distribution.

Squirrel Glider

a. This species roosts in tree hollows in dry sclerophyll forest and woodland. This species was not identified during the survey, but is a typically shy species and it is considered likely that this species utilises the study area. If it is proposed to remove this species' roosting habitat on the study area, it is possible that the proposal will disrupt the life cycle of this species to the extent that a viable local population may become extinct.

h. This species occurs from northern Queensland through to southern Victoria, where it is most common west of the Great Dividing Range, hence it is not at the known limit of its distribution.

Brush-tailed Phascogale

a. This species roosts in tree hollows in a range of forests with sparse understorey. This species is known to occur on the study area, and it is likely that it utilises the tree hollows in the area proposed for clearing. It is therefore possible that the proposal will disrupt the life cycle of the species such that a viable local population may be placed at risk of extinction.

h. This species occurs in scattered locations along the east coast, from northern Queensland through to southern Victoria, hence it is not at the limit of its known distribution.

Tiger Quoll

a. This species has a large home range and if the study area is being used by this species, it is likely that it is a relatively small part of a larger home range. This species was not observed during the survey. It is unlikely that the proposal will disrupt the life cycle of the species such that a viable local population may be placed at risk of extinction.

h. This species is found from Victoria through to southern Queensland, hence it is not at the limit of its known distribution.

Common Planigale

a. Habitat selection by this species is based primarily upon surface cover (Andrews and Settle, 1992). This species has a small home range and is not particularly mobile. The amount of habitat to be removed for the proposal is insignificant when compared to the amount of continuous habitat in the study area for this species, therefore it is unlikely that the proposal will disrupt the life cycle of the species such that a viable local population may be placed at risk of extinction.

h. This species occurs from Cape York south to approximately Sydney, hence it is not at the limit of its known distribution.

Koala

a. The subject site does not contain core Koala habitat. It is proposed to retain movement corridors and restrict cats and dogs. Provided that these measures are implemented, it is unlikely that the proposal will disrupt the life cycle of the species such that a viable local population may be placed at risk of extinction.

h. The Koala extends from mid-north Queensland to southern Victoria therefore it is not at the limit of its known distribution.

Parma Wallaby

a. The area to be cleared for the proposal does not provide optimum habitat for this species, however it may provide part of a larger home range. An individual's home range has been documented at around 22 hectares and it is therefore unlikely that the proposal will disrupt the life cycle of the species such that a viable local population may be placed at risk of extinction.

h. In NSW, this species occurs from the Nightcap Ranges in the north, south to the Bega district, hence it is not at the limit of its known distribution.

Pale-headed Snake

a. Due to the relatively small home range of this species of approximately 1.4 hectares per individual (Austeco, 1994), and the relatively small amount of suitable habitat to be removed when compared to adjacent forest, it is unlikely that the proposal will disrupt the life cycle of the species such that a viable local population may be placed at risk of extinction.

h. This species occurs from Gosford in the south, north to around the Queensland border, hence it is not at the limit of its known distribution.

Stephen's Banded Snake

a. Stephen's Banded Snake may utilise a small portion of sub-optimum open and closed forest habitat with rocky ground cover in the area proposed to be cleared. The removal of this small amount of habitat, compared to the presence of more suitable habitat is surrounding areas, it is unlikely that the proposal will disrupt the lifecycle of the species to the extent that a viable local population may be placed at risk of extinction.

h. This species occurs on both sides of the Great Dividing Range, from Sydney in the south to the Queensland border.

Thesium australe

a. Because there is an abundance of suitable habitat surrounding the area to be cleared and this species was not identified during the field survey, it is unlikely that any viable population exists in the area to be cleared for the proposal. It is therefore unlikely that the proposed development will cause the extinction of a viable local population of this species on the study area.

h. This species is found on the north coast, central coast, northern tablelands, southern tablelands and the north western slopes, hence it is not at the limit of its known distribution.

Grevillea granulifera

a. Because there is an abundance of suitable habitat surrounding the area to be cleared and this species was not identified during the field survey, it is unlikely that any viable population exists in the area to be cleared for the proposal. It is therefore unlikely that the proposed development will cause the extinction of a viable local population of this species on the study area.

h. This species is found from near Wingham to Barrington Tops State Forest and west to Woolombi Falls, hence it may be at the southern limit of its distribution if it occurs on site.

Grevillea obtusiflora

a. Because there is an abundance of suitable habitat surrounding the area to be cleared and this species was not identified during the field survey, it is unlikely that any viable population exists in the area to be cleared for the proposal. It is therefore unlikely that the proposed development will cause the extinction of a viable local population of this species on the study area.

h. This species has a scattered distribution on the Central and Northern Tablelands and coast of New South Wales, hence it is not at the limit of its known distribution.

Tetratheca juncea

a. Because there is an abundance of suitable habitat surrounding the area to be cleared and this species was not identified during the field survey, it is unlikely that any viable population exists in the area to be cleared for the proposal. It is therefore unlikely that the proposed development will cause the extinction of a viable local population of this species on the study area.

h. This species has been recorded chiefly south of the study area, therefore this species may be close to the northern limit of its distribution.

Eucalyptus rudderi

a. A small number of individuals of this species occur on the study area. Unless there is an appropriate number of individuals in the remainder of the continuous expanse of forest on site to sustain a viable population, the proposal may disrupt the life cycle of the species such that a viable local population may be placed at risk of extinction.

h. This species is confined to the Taree/Karuah district, therefore it is at the limit of its known distribution.

Eucalyptus glaucina

a. Because there is an abundance of suitable habitat surrounding the area to be cleared and this species was not identified during the field survey, it is unlikely that any viable population exists in the area to be cleared for the proposal. It is therefore unlikely that the proposed development will cause the extinction of a viable local population of this species on the subject site.

h. The coastal population of this species occurs from Taree in the north to Broke in the south, therefore it is at the known northern limit of its distribution.

Hibbertia hexandra

a. Because there is an abundance of suitable habitat surrounding the area to be cleared and this species was not identified during the field survey, it is unlikely that any viable population exists in the area to be cleared for the proposal. It is therefore unlikely that the proposed development will cause the extinction of a viable local population of this species on the study area.

h. This species occurs on the ranges of Mt Warning and has also been collected from around Wauchope, therefore it is approaching the southern limit of its known distribution.

Appendix F

TRAFFIC AND TRANSPORT ASSESSMENT

TRAFFIC AND TRANSPORT ASSESSMENT

Existing Road Network

The roads that are affected by the present quarry operations are the Pacific Highway, Possum Brush Road and the internal access road from Possum Brush Road. Each of these roads is described below.

i. Pacific Highway

Vehicular access to the study area is from the Pacific Highway via Possum Brush Road. The Pacific Highway is the main arterial route between Taree and Bulahdelah and is maintained by the Roads and Traffic Authority (RTA). The highway in the vicinity of Possum Brush passes through flat to undulating terrain. Road conditions are dual carriageway with two lanes in each direction, 3.7 metre lane widths, 2 metre shoulders and a speed limit of 100 kilometres per hour. The intersection of the Pacific Highway and Possum Brush Road is situated on a short straight section of the highway which curves gently to the north and south of the intersection.

The intersection of Possum Brush Road and the Pacific Highway is a three-way unsignalised T-junction. Prior to the commencement of quarry operations in 1987 the applicant upgraded the intersection to an Ausroads Type C intersection (Ausroads, 1988a). More recently, with the upgrading of the Pacific Highway, the RTA has constructed a 45 metre wide median junction, typical for the intersection of a major rural road and a minor road. There are no turn bays, acceleration lanes or deceleration lanes at the intersection.

At the intersection vehicles have entering sight distances of approximately 300 metres in a northerly direction and 200 metres to the south. Approach sight distances are approximately 170 metres to the north and 150 metres to the south.

ii. Possum Brush Road

Possum Brush Road is maintained by Greater Taree City Council. The road passes through undulating terrain and has a speed limit of 100 kilometres per hour. The applicant has previously reconstructed and sealed the section of Possum Brush Road from the Pacific Highway to the quarry access road to Council standards for rural roads. The applicant has also imposed a 70 kilometre speed limit for haulage contractors on Possum Brush Road as a condition of employment.

The 1.1 kilometre sealed section has a minimum width of six metres with an average one metre unsealed shoulder although in sections the shoulder is negligible. The pavement of the east bound lane is currently damaged due to the weight of loaded quarry trucks. West of the quarry access road intersection, Possum Brush Road reverts to gravel.

iii. Internal Access Road

The access road is 2.06 kilometres long and constructed to a width of eight metres. The first 1.36 kilometres rises from the intersection with Possum Brush Road to the southern ridge running through the property before descending down to the quarry crushing plant site. The first 630 metres of the access road from Possum Brush Road has been bitumen sealed. The applicant has imposed a speed limit of 40 kilometres per hour on the access road.

The entrance of the access road onto Possum Brush Road has previously been upgraded by the applicant to provide a separate ingress and egress of 12 metres width per lane with a three metre wide median. This belling out of the intersection allows a swept path for turning trucks. At the intersection with Possum Brush Road entering sight distance to the west is in excess of 200 metres. Entering sight distance to the east is approximately 115 metres. This distance has been reduced from the design distance of 200 metres by regrowth of roadside vegetation. Approach distances are approximately 45 metres west and 60 metres east.

Existing Traffic Volumes

i. Level of Service

The operational performance of roadways is defined by the "*level of service*" (Ausroads, 1988b). Levels of service are qualitative measures of a number of factors such as travel speed, freedom to manoeuvre, road geometry and safety. The six levels of service for roadways are summarised in *Table 1.*

Table 1 Levels of Service

Level of Service	Conditions
A	A condition of free flow, with high speeds and low traffic volumes. Drivers can hold their desired speeds without experiencing delays.
B	A condition of stable flow, where drivers have reasonable freedom to select their speed. Traffic volumes at this level of service have been associated with target conditions for rural highways.
C	A condition of stable flow, where drivers are restricted in their freedom to select their own speed or to change lanes and overtake. Operating speeds are still reasonable.
D	Approaching unstable flow, with nearly all drivers being restricted. Comfort and convenience are low but may be tolerated for short periods. Fluctuations in conditions cause substantial drops in speed. This service volume corresponds to the tolerable capacity.