

EIS 1422

AA068155

Roads and Traffic Authority Taree Bypass embankment material quarry environmental impact statement - Connell Wagner Pty Ltd.

NSW DEPT PRIMARY INDUSTRIES
AA068155

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ENVIRONMENTAL IMPACT STATEMENT

PACIFIC HIGHWAY UPGRADE
EMBANKMENT MATERIAL QUARRY
TAREE BYPASS, KOORAINGHAT



Prepared by

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EIS
1422

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Roads and Traffic Authority
Taree Bypass
Embankment Material Quarry
Environmental Impact Statement

28 October 1998

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Form 2

Submission of environmental impact statement (EIS)
prepared under the *Environmental Planning and Assessment Act 1979*
Section 78A (8)

EIS prepared by

name	J Brockhoff
qualifications	Bsc(Hons), MEnv Planning, MRAPI, MEIA
address	Connell Wagner Pty Ltd 116 Military Road NEUTRAL BAY NSW 2089

in respect of

development application

applicant name	Roads and Traffic Authority
applicant address	1 Mort Street, Port Macquarie NSW 2444
land to be developed	Taree Cut Batters, Four Mile Hill
lot no, DP/MPSm, vol/fol etc proposed development	Refer Figure 1.1 and 1.2
	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 54A and 55 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 J. Brockhoff
name JOHN BROCKHOFF
date 30/10/98

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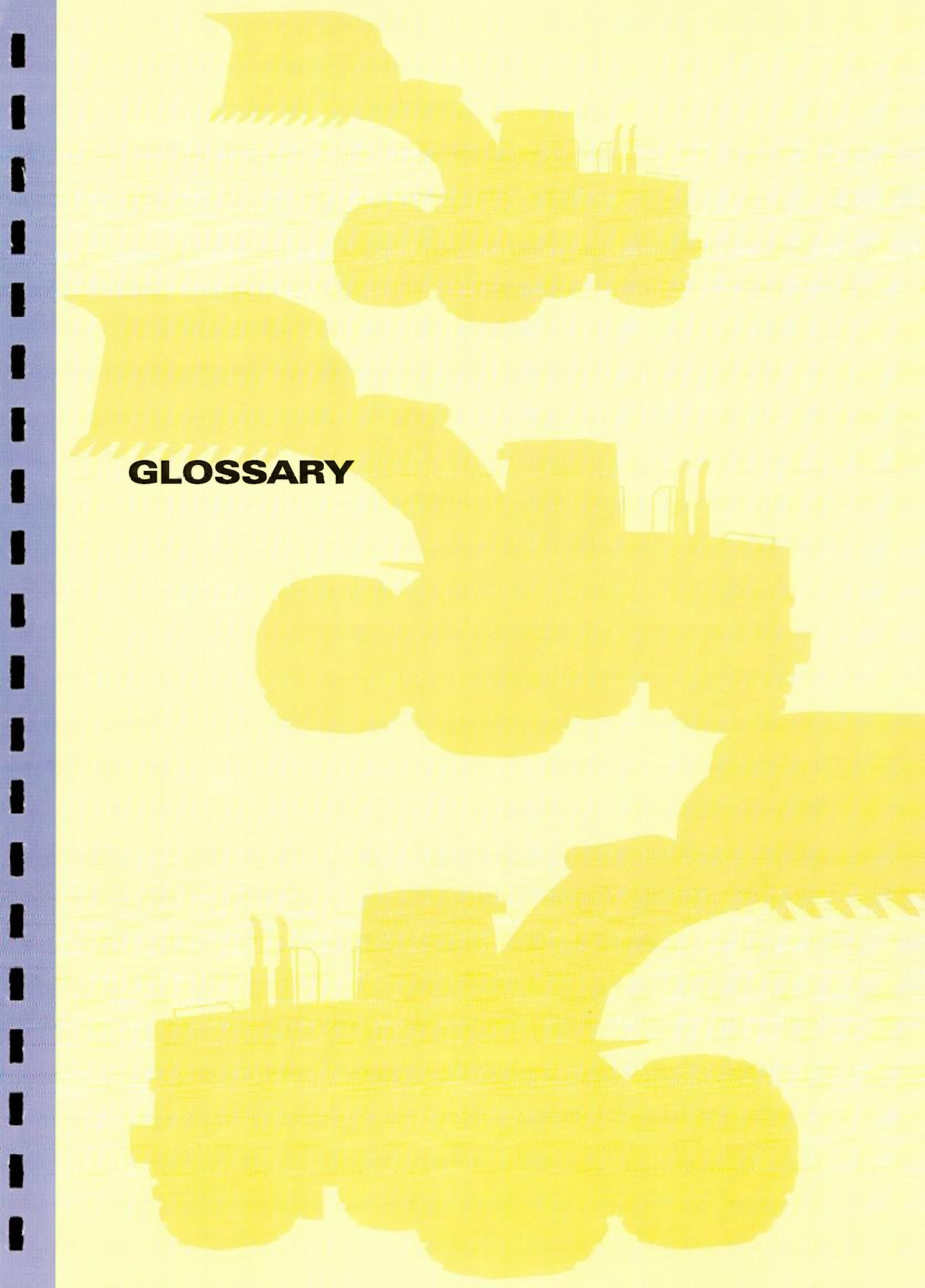
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Approved By:	Paterson	*Date:* 30-10-98



GLOSSARY

Glossary

AADT	Annual Average Daily Traffic volume representing the total traffic in both directions at each location, calculated from mechanically obtained axle counts. A recorded vehicle represents a mechanical count of two axles and adjustments are made for seasonal variations in traffic flow.
ADT	Average Daily Traffic based on survey counts and not adjusted as for AADT.
AEP	Annual Exceedence Probability refers to the probability of a flood event exceeding a nominated level in a year. A 1% AEP is the probability of an event exceeding a nominated level in 100 years.
AHD	Australian Height Datum
Acid Sulphate Soils (ASS)	Naturally acid clays, mud and other sediments usually found in swamps and estuaries. They may become extremely acidic when drained and exposed to oxygen, and may produce acidic leachate and runoff which can pollute receiving waters and liberate toxins.
Air Blast Overpressure	Peak response linear (unweighted) level in frequency range 2 Hz to 20 Hz of a pressure wave propagating through air arising from blasting (Unit: dBL).
Alluvial Soil	Juvenile soils formed by deposition from still or moving water. Little pedological development beyond some accumulation of organic matter at the surface.
Ambient Noise	The background noise at a point being a composite of sounds from near and far.
ASS	Acid Sulphate Soils.
Atmospheric	The processes by which gaseous pollutants discharged into the dispersion atmosphere are diluted. These processes include diffusion, which involves the spreading out of the pollutant from the point of discharge, and transport by wind.
Attenuation	The reduction in sound pressure level magnitude during transmission (eg. around a barrier or over a distance outdoors). (Unit: dB, dBA).
Background Noise Level	The A-weighted ambient sound pressure level in the absence of the sound under investigation exceeded for 90% of the measurement period. Normally equated to the average minimum A-weighted sound pressure level. Symbol L_{A90}. (Unit: dBA).
Batter	The side slope of walls, embankments and cuttings etc.

	or the degree of such slope, usually expressed as a ratio of horizontal distance to 1 vertical height.
Berms	A ledge formed at the top, bottom, or intermediate level of an earth slope.
Biological Diversity	The broad variety and relative abundance of plant and animal life in a nominated area; encompasses diversity at genetic, species, ecosystem and habitat level (or Biodiversity).
Carriageway	That portion of a road or bridge used by vehicles (inclusive of shoulders and auxiliary lanes).
Contour Drain	A surface drain designed to slow the rate of runoff by diverting water along a gently sloped path, from a construction site to nearby stable areas at a discharge velocity that will not cause erosion.
Culvert	One or more adjacent, enclosed channels for conveying a stream below road formation level.
Cut	The material excavated from a cutting.
Decibel	A scale unit used in the comparison of powers and levels of sound energy. The number of decibels is 10 times the logarithm to the base of 10 of the ratio of the powers. (Unit: dB).
Diversion drain	A drain leading water away from a given area.
Dual Carriageway	A highway or road with separated carriageways for traffic travelling in opposite directions.
EMP	Environmental Management Plan
Ecologically Sustainable	Development that maintains and improves the total quality of life.
Development (ESD)	Development both now and in the future in a way that maintains the ecological processes on which life depends. Key components of ESD are intergenerational equity, maintenance of biodiversity, improved economic evaluation of environmental costs and benefits and the precautionary principle.
EPA	Environment Protection Authority (NSW) (formerly State Pollution Control Commission).
Equivalent Continuous Sound Level	Of a fluctuating sound over an extended time interval: the constant sound level which, when operating over the same time interval, is equivalent to the same sound energy. (Symbol: L_{Aeq}), (Unit: dBA).
Erosion	The wearing away of the land and removal of soil by running water, rain, wind, ice or other geological agents, including such processes as detachment, entrainment, suspension, transportation and mass movement.

Fill	The material placed in an embankment.
Floodplain	Flat large area of alluvium adjacent to a watercourse, characterised by frequent active erosion and aggregation by channelled and overbank stream flow.
Ground Vibration	Representing the combined speed of ground oscillation at a point from a source of vibration such as a blast or piece of mobile plant. (Unit: mm/s, m/s).
Invert	The level at the lowest point of a drain, culvert, pipe or channel.
L_{AN}	Percentile sound level of fluctuating sound pressure (usually A-frequency-weighted and Fast time response) on the level which is exceeded for N% of the observing time. Common measures are: L_{A1}, L_{A10}, L_{A50} and L_{A90} (Unit: dBA).
L_{A1}	The A weighted sound level exceeded for 1% of the measurement period. (Unit: dBA).
L_{A90}	The A weighted sound level exceeded for 90% of the sample period and referenced as the "average minimum or background noise level". (Unit: dBA).
L_{A10} (18 hour)	Arithmetic average of L_{10} noise levels for each 18 hour sampling period from 6.00am to midnight. (Unit: dBA).
L_{Aeq} (24 hour)	Equivalent continuous noise level over any 24-hour period. (Unit: dBA).
L_{Aeq} (8hr)	Equivalent continuous noise level over the eight hour period between 10.00pm to 6.00am. (Unit: dBA).
L_{amax}	Maximum A-weighting noise level during a single event such as truck pass by or hammer impact (Unit: dBA).
Median	A strip of road not normally intended for use by traffic, which separates carriageways for traffic in opposite directions.
PM_{10}	Usually airborne particulate matter less than 10μm (microns or one millionth of a metre) in diameter, a measure of dust.
Sedimentation Basin	An area where runoff is ponded to allow sediment to be deposited. The longer the period that the runoff is held, the smaller the size of the sediment deposited. Such basins have to be cleaned regularly.
Sound Level	The level of the frequency-weighted and time-weighted sound pressure, as determined by a Sound Level Meter. Symbol: L_A, L_{AC} etc. (Unit: dBA, dBC).
Sound Level Meter	An instrument consisting of a microphone, amplifier and indicating device, having a declared performance, and designed to measure a frequency-weighted and time-weighted value of the sound pressure level.

Sound Power Level	10 times the logarithm to base 10 of the ratio of the energy emitted by a sound source per unit time to the reference sound power. Symbol: Lw or SWL. (Unit: dB).
Sound Pressure Level	20 times the logarithm to the base 10 of the ratio of the root mean square sound pressure to the reference sound pressure. Symbol: L_p. (Unit: dB).

SUMMARY

Summary

Introduction

The Roads and Traffic Authority (RTA) is proposing to quarry material from the existing cut batters of the Taree Bypass, approximately 5km south of Taree (refer Figure 1.1). The excavated material would then be used as fill for the Pacific Highway upgrade between the Taree Bypass and Moorland over the proposed construction period of these projects. This Environmental Impact Statement (EIS) addresses the effects of establishing and operating the proposed quarry.

The EIS has several main components including a review of the need for a fill material quarry (Section 3), definition of the project objectives (Section 3), consideration of alternative fill sourcing options (Section 4), description of the proposed quarry (Section 5) and assessment of the environmental, economic and social impacts and proposed safeguards for the proposal (Section 6).

The proposal will be assessed under Part 4 of the Environmental Planning and Assessment Act 1979.

The Proposal

The proposal is to quarry material from the existing cut batters along a section of the western side of the Taree Bypass on Four Mile Hill between Purfleet and Koorainghat. The site includes the area known as Cut B (1 km north from Fords Road) and the area adjacent the Fords Road intersection (refer Figure 1.1, 1.2 and 1.3).

Cut B incorporates the area between the former highway and the Taree Bypass, and is approximately 1000m long and varies in width to a maximum of 80m. The area presently consists of steep batter slopes and scattered native vegetation and weed species. Cut B would be cleared and excavated to a maximum batter slope of 2 horizontal to 1 vertical. As components of the quarry are excavated to their design level they would be rehabilitated and revegetated. Approximately 578,500m^3 of in situ material is winnable from Cut B.

The entrance to Fords Road is in some places steep and difficult to manoeuvre. By re-aligning and rationalising this section of Fords Road, 52,500m^3 of in situ fill material would be available for use.

It is expected that a majority of the material would be excavated by a large bulldozer and excavator with some by hydraulic rock hammer or with minor, localised blasting. The material is expected to be suitable for bridging and draining material and general embankment fill for the highway projects.

Access for haul vehicles would be via the existing turning bay from the south bound carriageway of Taree Bypass into Fords Road. Vehicles would then enter the site, be loaded and exit using the former highway as an access ramp onto the north bound carriageway of the Taree Bypass.

The proposal would require the acquisition of approximately 8ha of forest land from State Forests between the former Pacific Highway and the Taree Bypass.

Need for the Project

As part of the upgrade of the Pacific Highway, the RTA is proposing the construction of a dual carriage highway across the Manning and Lansdowne River floodplains. To raise the highway above 1 in 20 year flood immunity levels, a large quantity of fill material is required. Total borrow material required for the Taree Bypass to Coopernook and the Coopernook Bypass is estimated at 323,000m^3 and 355,000m^3 respectively. Little cut to fill material is available locally (approximately 35,000m^3) and therefore the majority of the material must be imported to site from other sources.

Local quarries could supply a small portion of the fill material, approximately 25,000m^3, however,

major new fill sources are required.

Whilst the provision of fill is the primary objective of the quarry, an additional benefit is the stabilisation of the batter slopes along the northbound carriageway of the Taree Bypass. The requirement for the stabilisation of these batters became apparent during the construction phase of the Taree Bypass. Temporary measures were carried out on the basis that the subject batters would become a source of fill for future road projects.

Fill material would be required for both the Taree to Coopernook Upgrade and the Coopernook Bypass proposals. Work on these projects could not commence until suitable fill material has been sourced and secured.

Option Evaluation

Various fill sources have been identified, including:

> local commercial quarries
> dredging sand from the Harrington back channel (Manning River)
> quarrying from the Taree Bypass cut batters

The various options are not exclusive and a combination of fill material sources may be used for highway construction.

Biological Environment

The proposed quarry area includes several patches of logged open forest totalling approximately 1.5ha. The low number of flora species recorded within the affected study area together with the isolation of the habitat by the former Pacific Highway and Taree Bypass reduce the conservation value of the affected native habitat. No threatened species would be significantly affected by the proposal.

Noise and Vibration

Noise impacts during the quarrying operation from plant and equipment at the closest residence in Fords Road (300m to the south west) is expected to be of the order of 50-55dB(A) when working at the top of the batter, exceeding the recommended goal of 45dB(A). Plant equipment would be operated with mufflers and appropriate noise controls and a noise control plan would be implemented. The impact from increased construction traffic along the Taree Bypass is expected to be minimal.

The levels of ground vibration from the construction site is expected to be well below a level that would be perceived at the closest residential property in Fords Road. Ground vibration and airblast levels would be monitored during any blasting activities and would be managed to within EPA comfort and building damage criteria.

Traffic and Local Access

The safe and efficient management of local and construction traffic is central to the proposal. Analysis of traffic inputs have resulted in the formulation of the following:

> No extension to the existing right turn bay at Fords Road is recommended as it would provide ample capacity to accommodate the traffic associated with the construction activities under normal as well as extreme circumstances.
> The three part contingency plan described in Section 6.8 would be adopted to prevent over flow queues onto the main southbound carriageway of the highway.
> the shoulder of the northbound carriageway would be appropriately line marked to function as a temporary acceleration lane for semi-trailers seeking entry to the new highway alignment from the old alignment.
> Temporary signposting would be provided in accordance with the Australian Standards for

work sites to provide ample warning for general traffic of the construction activities.

Visual Impact

The visual landscape of the study area would be altered by the loss of a small area of vegetation and the progressive loss of material from the cut batters. The visual quality of the quarry whilst in operation is expected to be low, but would be significantly improved by landscaping works as sections of the quarry are exhausted. The temporary retention of part of the existing cut batters would also mitigate the visual impacts of the quarry by providing an earth mound barrier between motorists and the quarry activities. This barrier would eventually be excavated to provide fill material towards the final operating stages of the quarry. The overall visual impact would be minimal as no residents are located within its immediate visual catchment and the impact would be imposed temporarily on passing motorists. Background views of the cut batters are expected from a small number of distant residents. These visual impacts would be temporary and in the long term would be mitigated by the establishment of revegetation of the final batters.

Drainage and Water Quality

The closest natural watercourses to the study area are Stitts Creek and Kooraingnat Creek, located approximately 1km west and 1.5km southeast respectively. The proposed works could have the potential to increase the level of suspended sediment in these waterways during the quarry operation if not appropriately controlled. Safeguards are proposed to be implemented according to an outline Erosion and Sediment Control Plan, a key feature of which would be the successive working and rehabilitation/revegetation of the quarry.

Air Quality

The most significant air quality impact associated with the proposal is the generation of dust during the operation of the quarry activities. The quarry contractor would comply with all legal and policy requirements to mitigate dust emissions during operation. Potential dust impacts includes nuisance to residents and poor visibility on the adjacent highway. Dust generation would be controlled by the following measures:

- screens beside the highway.
- watering of disturbed areas.
- minimising the exposed surface area by revegetating or stabilising the slopes as soon as practicable after excavation.
- cover loads of the haul vehicles if dust becomes a problem during transportation.
- reduce blow-off dust by cleaning mobile plant equipment.
- locating conveyors, if used, and loading points away from areas exposed to high winds.
- conveyors to be suitably enclosed and fitted with dust suppression spray equipment at terminals that are exposed to high winds

Aboriginal Archaeology

No Aboriginal cultural materials or registered Aboriginal sites were located within the proposed quarry area. One isolated stone artifact was recorded during a survey of the area, located approximately 45m south-west of Cut B. This area would not be affected by the proposed quarry.

The closest recorded Aboriginal site is a water hole located approximately 600m north of Cut B and would not be affected by the proposal. The EMP would contain measures to address the assessment of sites and artifacts should they emerge during construction.

Non-Indigenous Heritage

Searches of the Greater Taree LEP Heritage Register and the Register of National Estate together with a visual site inspection and discussions with local residence has confirmed that there is no evidence of items of non-indigenous heritage significance within or in close proximity of the study. Ford Road and the old highway alignment were investigated for heritage significance during the

Taree EIS and also re-assessed as part of this EIS. It has been determined that neither Fords Road or the old Highway alignment contain any features or structures, such as culverts, of any heritage value within the proposed study area.

Other Impacts

This EIS has also investigated a range of other potential environmental impacts associated with the quarry. These include hazard and risk assessment, land use, property and business impacts, energy consumption, biological diversity and other current ecological issues. In each case, the impacts were found to not be significant or effective safeguards were defined to minimise or manage adverse effects.

Submissions

Any person or organisation is invited to make a written response to this Development Application and accompanying EIS. Written submissions should be sent to Greater Taree City Council 2 Pulteney Street, Taree 2430.

1

INTRODUCTION

1. Introduction

1.1 Background to the Proposal

As part of the State and Federal Government's commitment to the upgrading of the Pacific Highway between Hexham and the Queensland border, the Roads and Traffic Authority (RTA) are proposing to construct a dual carriageway highway north from the Taree Bypass over the Manning and the Lansdowne River floodplains bypassing the village of Coopernook and creating a new crossing over the Lansdowne River. To form the dual carriageway embankments across the floodplains, a large quantity of fill material is required to be imported to the site. Cut batters elsewhere on the project would not provide sufficient fill to raise the proposed road to the 1 in 20 year flood immunity level (approximately 2.4m).

A range of potential sources of fill material are presented in the Coopernook Traffic Relief Route Environmental Impact Statement (EIS) including two small local quarries, quarries located in Coopernook State Forest, sand resources in the Harrington Main Channel and Back Channel (Manning River), and the cut batters in the Taree Bypass construction site, which in the absence of this proposal would require further stabilisation.

Of the potential sources of fill material discussed in the Coopernook Traffic Relief Route EIS, the cut batters on the Taree Bypass 3km south of Purfleet (chainages 160700 to 162500) have been identified as the most appropriate to provide the significant quantity of suitable fill material which would be required for the future extension of dual carriageways between the Taree Bypass and Coopernook. In essence, the cut batters would become a quarry for fill material for the above highway construction projects. A location of the study area is shown in Figure 1.1. Photos of the study area are included in Appendix H.

The proposed quarry is considered to be permissible with Council consent in accordance with the provisions of Greater Taree Local Environmental Plan and GTCC Development Control Plan. Owing to the volume of material to be quarried this proposal is classed as designated development under the Environmental Planning and Assessment Act 1979 and as such requires the preparation of an Environmental Impact Statement. This Environmental Impact Statement (EIS) has been prepared to accompany a Development Application to Greater Taree City Council.

1.2 Purpose and Scope of EIS

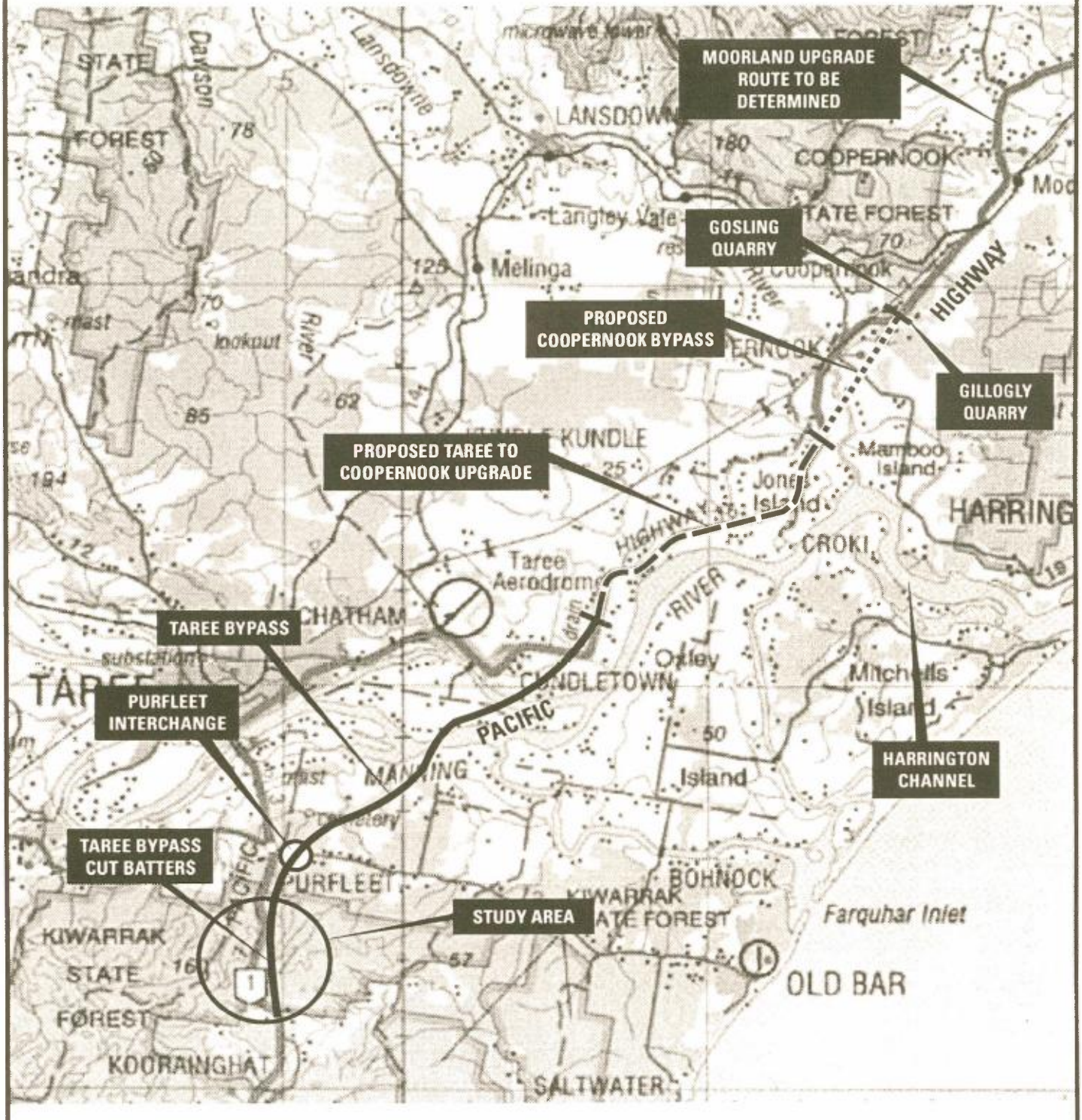
The RTA have engaged Connell Wagner to prepare an Environmental Impact Statement (EIS) to investigate the impacts of the additional works which would be required adjacent to the Taree Bypass construction site to extract fill for use in the upgrade of the Pacific Highway from Taree Bypass to the northern end of the Coopernook Bypass. The stabilization of the existing cut batters would also be a secondary benefit for the project.

The EIS is required to define and assess the project in terms of a range of environmental, social, economic and engineering criteria in accordance with the statutory requirements of Part 4 of the Environmental Planning and Assessment (EP&A) Act (1979). The EIS addresses matters for consideration listed under the EP&A Regulation, as well as the form and content requirements identified by the Director, Department of Urban Affairs and Planning (refer Appendix A).

The EIS study has several main components including:

> a review of the need for a fill material quarry
> definition of the project objectives
> consideration of possible fill source options
> description of the proposed fill material quarry
> assessment of the environmental, social and economic impacts of the proposal
> description of the safeguards and mitigating measures to be adopted

This EIS is the culmination of all of the above study components with respect to the range of design



SCALE 1 : 140,000

FILL MATERIAL QUARRY -
TAREE BYPASS
5606.01.CE

FIGURE 1.1
LOCATION MAP

and environmental parameters of significance both regionally and within the study area and local community.

This EIS specifically addresses the issues of winning material, requirements for erosion and sedimentation control, access arrangements, planning issues and rehabilitation and landscaping works proposed for the batter slopes. The EIS addresses the potential impacts of the proposal on the environment and outlines environmental management principles and procedures.

The impacts associated with the transport of material to the road construction sites are beyond the scope of this EIS and have been dealt with in the Coopernook EIS.

The EIS provides a mechanism for the community to scrutinise the proposal and provides Greater Taree City Council (GTCC) with the basis for considering the project.

1.3 Statutory Requirements and Approvals Process

The study area and Pacific Highway Road reserve remain in the 1(f) Rural Forests zone as part of Kiwarrak State Forest. The proposed extraction of fill material associated with both the stabilisation of the existing Taree Bypass batters and the winning of fill for the upgrade of the Pacific Highway is interpreted as permissible with the consent of Council. The proposed works are interpreted to be consistent with the general aims of Greater Taree Council Local Environmental Plan (GTCCLEP) 1995 to provide for future arterial road needs.

In relation to the specific objectives for the Rural Forests 1 (f) zone, the following GTCCLEP 1995 objectives are relevant:

a) the objectives specified in Clause 12 (General Rural);

b) the protection of land under forest management to ensure the environmental and economic future of the forests;

c) the provision for normal forestry management practices on land managed by Forestry Commission without the need for consent of Council to be obtained;

d) the maintenance of the rural amenity of the land including landscape and scenic quality and its value for tourism; and

e) the regulation of development so that it is compatible with the forest environment.

While the clearing and quarrying operations proposed may be superficially inconsistent with the specific zone objectives (b), (d) and (e) above, the accompanying Environmental Impact Statement serves to demonstrate that the development is not inconsistent with the aims of the LEP and in particular meets the information requirements of Clause 10.1 of the GTCC Development Control Plan (DCP) 1995. This clause provides that where an environmental impact report (prepared accordingly to the Clause 10.1) accompanies a DA for potentially inconsistent development, that development may be interpreted as not prohibited but permissible with consent of Council based on merit and with regard to zone objectives, LEP provisions and specific site and locality considerations.

According to Clause 35(2) of GCCTLEP 1995 Council shall not consent to the development of land zoned 1(f) for extractive industry if the development will have direct access to an arterial road or a road connecting to an arterial road and the access to that development is within 90m of the arterial road.

The quarry is proposed to be entered via a connection with Fords Road within 90m of an arterial (Taree Bypass Pacific Highway). The quarry exit would be directly onto the Taree Bypass. Reconfiguration of the quarry concept design to create a situation where access to and from the quarry via Fords Road is more than 90m from the highway would have a greater environmental impact. This reconfiguration would force both entering and existing trucks to congest this intersection and bring truck noise and activity closer to the nearest residents for a longer period of time.

Further traffic management measures are proposed over the short life of the operation of this quarry to remedy the potential for traffic safety problems to arise due to the proposed layout of the quarry.

As a result the proponents propose to submit an objection under State Environmental Planning Policy No. 1 to the operation of this development standard according to the traffic safety and flow, environmental impact and quarry operations prerogatives described in Sections 5 and 6.

A development application and accompanying SEPP 1 objection is thus submitted to Council for the assessment of this proposal according to Part 4 of the Environmental Planning and Assessment Regulation 1994. The proposal is Designated Development under Schedule 3 of the Environmental Planning and Assessment Regulation 1980, being interpreted as "extractive industry" due to the volume of material and area of the cut batter quarry being greater than 30,000m^3 and 2ha respectively. An Environmental Impact Statement prepared according to the EP&A Regulation therefore accompanies the Development Application to Council.

The proposed quarry covers an area of land owned by the State Forests of NSW and is known as Kiwarrak State Forest. The RTA are currently proposing to acquire the land from the State Forests. To enable the acquisition to proceed the State Forest land must be transferred to the RTA prior to the commencement of any quarrying operations. Negotiations on the cost estimating and extent of land acquisition are proceeding between the RTA and State Forests.

The Environment Protection Authority has a statutory responsibility in relation to Pollution Control Approval (PCA) under Section 17K of the Pollution Control Act for erosion and sedimentation controls to be implemented during the development of the fill material quarry. Should discharge be anticipated from any pollution control structure a licence to discharge under the act would also be required.

As the quarry would be greater than 2ha in area it would a scheduled premise under Section 18 of the Noise Control Act. A licence from the EPA under this Act would be required for the operation of the quarry.

1.4 Study Area

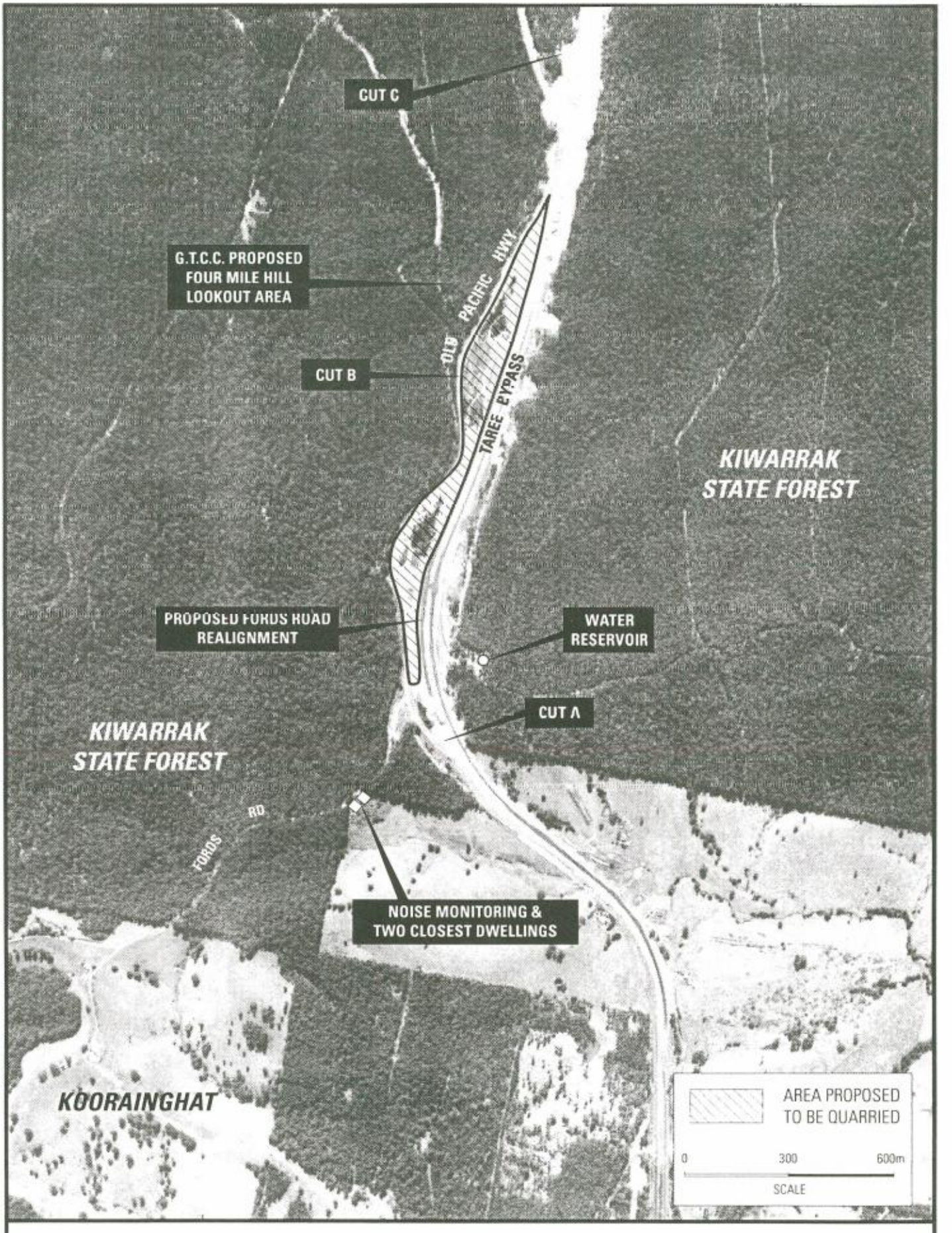
The study area is located within the Kiwarrak State Forest, along the Taree Bypass section of the Pacific Highway. The area is located between the small townships of Koorainghat and Purfleet on what is known as "Four Mile Hill", approximately 5km south of Taree (refer Figure 1.1).

The site is contained between the Taree Bypass and the bypassed section of the former highway. It is located along the western side of the northbound carriageway of the bypass. The limits of the work extends from approximately 2.5km to 3.5km south of the Purfleet Interchange. The study area lies wholly within the local government area of Greater Taree City Council.

The settlement of Koorainghat consists of scattered dwellings on rural allotments. The two closest residents to the proposed site are located approximately 300 metres from the southern extent of the works, along Fords Road. The next closest residents are greater than 500 metres away from the proposed works. The works would not be visible from residences due to the crest of Four Mile Hill.

The quarry site covers an area of approximately 8ha of the ridge between the former highway and the Taree Bypass, and was mostly cleared during the construction of the new highway, but includes several areas of remnant native vegetation, totalling an area of approximately 1.5 ha. The area is part of the Kiwarrak State Forest and is proposed to be transferred to the RTA as part of the Bypass road reserve (refer Figures 1.2 and 1.3).

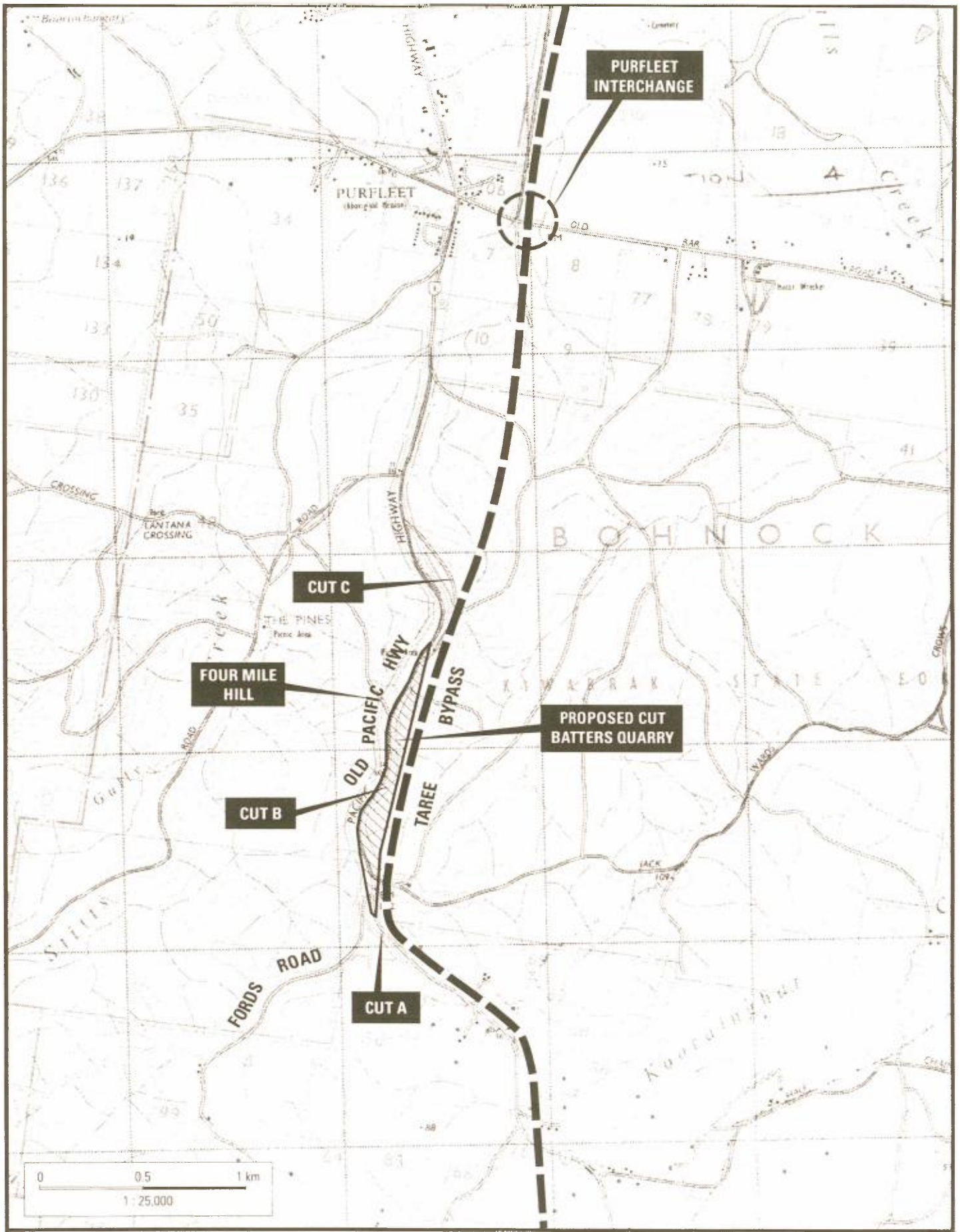
The construction of the Taree Bypass involved re-configuration of the entrance to Fords Road as well as the formation of steeply sloping cuttings along the highway illustrated in the photographs in Appendix H.



FILL MATERIAL QUARRY -
TAREE BYPASS
5606.01.CE

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FIGURE 1.2
STUDY AREA



FILL MATERIAL QUARRY -
TAREE BYPASS
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FIGURE 1.3
TAREE CUT BATTERS
STUDY AREA TOPOGRAPHY

1.5 Hunter Regional Environmental Plan 1989

The Hunter Regional Environment Plan (HREP) 1989 was developed to provide a framework for integrated action between various state government authorities and councils in respect of the region which extends from Greater Taree in the north throughout the remainder of the Hunter River Catchment to the south and west.

The REP sets requirements and provides guidance to:

> councils preparing Local Environmental Plans
> public authorities on the likely future needs of the region
> determining authorities as to consent and how proposals ought to be determined
> the community and business on the way regional growth and development are to be managed

Of specific relevance to the proposal are the overall objectives of the plan and the principles and policies for control of development relating to transport, economic development and environmental protection. Relevant project related policies which have been addressed throughout the EIS include:

> to ensure that traffic management techniques optimize the existing road systems
> to ensure that new or upgraded roads are constructed to meet identified road user demands (including bicycles) and that their impact is minimized
> to control direct access onto main roads
> to maintain an appropriate acoustic environment
> to control development to minimize air, water and noise pollution and minimize the exposure of development to environmental hazards such as soil erosion and flooding
> to protect natural areas of interest and strictly control any reduction in the extent of important natural areas, especially wetlands

The Hunter REP Background Report, 1989 also acknowledged that in general the provision of dual carriageways, improved alignment, town bypasses and increased overtaking lanes are warranted on the Pacific Highway throughout the region.

1.6 DUAP Directors Requirements

Table 1 summarises DUAP Directors Requirements for the EIS (included in Appendix A) and identifies where the requirement has been addressed in the EIS document. Correspondence from other authorities is summarised in Section 2.2.

Table 1.1: Summary and Location of DUAP Directors Requirements in the EIS

	Requirement	EIS Reference
1.	A summary of the environmental impact statement	Executive Summary
2.	A statement of the objectives of the development or activity	Chapter 3
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	Section 4.5 Chapter 3

Requirement	EIS Reference
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. In that area 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 (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 on the development or activity on the environment.	Section 4.4, Chapter 5 Chapter 6 Chapter 6 Chapter 6, Chapter 7
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.	Chapter 8
6. Compilation (in a single section of the environmental impact statement) of the measures referred to in 4(d).	Section 6.16
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.	Section 1.3
8. For the purposes of Schedule 2, the principles of ecologically sustainable development are as follows: (a) the precautionary principle (b) intergenerational equity (c) conservation of biological diversity (d) improved valuation of resources	Section 6.14

Requirement			EIS Reference
9.	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	Section 6.1
	(b)	the impact of the development or activity of flora and fauna	Section 6.5
	(c)	the likelihood of air, noise or water pollution arising from the development or activity	Section 6.2, 6.3 and 6.4
	(d)	the impact of the development or activity on the health of people in the neighbourhood of the development or activity	Section 6.8 and 6.12
	(e)	any hazards arising from the development or activity	Section 6.12
	(f)	the impact of the development or activity on the traffic in the local neighbourhood of the development or activity	Section 6.7
	(g)	the effect of the development or activity on local climate	Section 6.2
	(h)	the social and economic impact of the development or activity	Section 6.8
	(i)	the visual impact of the development or activity on the scenic quality of land in the neighbourhood of the development or activity	Section 6.6
	(j)	the effect of the development or activity on soil erosion and the silting up of rivers or lakes	Section 6.3
	(k)	the effect of the development or activity on the cultural and heritage significance of the land.	Section 6.10 and 6.11
	a)	Consideration of the proposal with respect to the Hunter Regional Environmental Plan (1989)	Section 1.3
	b)	Impacts on the Kiwarrak State Forest	Chapter 6

1.7 Assessing the Principles of Ecologically Sustainable Development

The NSW Government is currently a signatory to the *Intergovernmental Agreement on the Environment (1992)*. As a public authority in NSW, the RTA is subject to this agreement and as such this EIS has given consideration to issues raised in this agreement. The principles of ESD and their relevance to the project is demonstrated at the conclusion of relevant chapters of the EIS.

The Australian National Strategy for Ecologically Sustainable Development (1992) states that:

> *"Ecologically Sustainable Development is using, conserving and enhancing the communities resource so that the ecological processes on which life depends are maintained, and the total quality of life now and in the future, can be increased".*

The core objectives and guiding principles of the National Strategy for Ecologically Sustainable Development have been set out as four principles for environmental impact assessment in NSW. These principles are presented below and have been adopted as the basis for consideration of ecologically sustainable development in this EIS:

- the precautionary principle: 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
- intergenerational equity: 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
> improved valuation and pricing of environmental resources

A summary of ESD issues is summarised at the end of relevant chapters. The summaries assess particular impacts of the project against a set of criteria which consider three of the core ESD principles. The summaries do not cover the fourth criteria, improved valuation and pricing of environmental resources, which is covered broadly in Chapters 2 and 5.

Table 1.1 sets out the criteria for determining how the impacts of the project may be considered in relation to the principles of ESD.

Table 1.1: Assessment Criteria for Ecologically Sustainable Development

Precautionary Principle	Intergenerational Equity	Conservation of Biological Diversity
Threats of serious or irreversible damage	The health, diversity and productivity of the environment is enhanced for the benefit of future generations, no depreciation or degradation in the use of renewable and non-renewable resources is predicted.	No loss of genetic, species or ecosystem diversity is expected which could result in diminished ecological integrity or viability.
Some threats of serious or irreversible damage may exist, future consequences are predictable and means of mitigating damage are clearly available	There are threats to the health, diversity and productivity of the environment which could result in a degraded resource for future generations, but mitigation measures are available. The depletion of non-renewable resources can be prevented by the use of renewable substitutes.	Loss of genetic, species or ecosystem diversity is such that resulting ecological integrity or viability is sustained and reversible provided alternatives and/or means of mitigation are available.
Uncertainty over threats of serious or irreversible damage exist, future consequences are not predictable and mitigation measures are not viable	There is serious and permanent degradation to the health, diversity and productivity of the environment. The rate of depreciation or degradation of renewable resources is not sustainable.	Loss of genetic, species or ecosystem diversity is such that resulting ecological integrity or viability is unsustainable.

2

CONSULTATION

2. Consultation

2.1 Consultation with Property Owners and Other Stakeholders

During the preparation of the EIS interviews were undertaken with the two residents (Mr and Mrs Henderson and Mr and Mrs Thrift) closest to the site located on Fords Road on 15 June 1998 (the next closest residents are some 300m further away from the proposal). During these interviews the main issues raised included:

> concern that water supply would be interrupted (water supply would be maintained)
> concern that dust may become a nuisance (refer Section 6.2)
> concern that any further vehicle traffic on Fords Road would cause excessive noise (6.4)
> concern that adequate temporary access to their dwellings would not be provided during construction (access would be maintained)
> concern that the traffic turning bay into Fords Road from the southbound carriageway is not sufficient to support local traffic as well as construction traffic (refer Section 6.7)
> concern as to the damage that any blasting may cause to their houses (refer Section 6.4)
> request for Fords Road to be sealed to the houses (it is currently only sealed to the location of the old Pacific Highway) (not proposed)
> comment that there is no turning bay into Fords Road for northbound traffic along the Taree Bypass, and that this may be unsafe for local traffic (not directly related to project, comment referred to RTA for investigation).

All property owners along Fords Road and all other property owners within a two kilometre radius of the site were sent letters describing the project and requesting comments. Of 18 letters issued, no responses were received in writing or by personal communication as at August 1998.

2.2 Consultation with Authorities

Relevant State and Commonwealth authorities were contacted during the preparation of the EIS who either have land, facilities and infrastructure within the study area, or where they have a funding or advisory responsibility during the determination, construction or operational phases of the project.

Initially, the many of the authorities were requested to provide requirements applicable to a Review of Environmental Factors (REF) for this project. They were approached again for any further requirements when it was determined that an EIS study would be undertaken under Part 4 of the EP&A Act. Their correspondence for both of these occasions is included in Appendix B.

2.2.1 Department of Urban Affairs and Planning (DUAP)

The requirements of the Director of the Department of Urban Affairs and Planning for the preparation of the EIS is included in Appendix A.

2.2.2 State Forests

State Forests responded by indicating that they were concerned about the proposal further impacting upon Kiwarrak State Forest. State Forests welcomed the opportunity to comment on the proposal and were prepared to consider the sale of any fill material to the RTA if the quarry site included any areas of State Forest, provided that the assessment did not identify the areas of conservation significance.

A meeting was held with State Forests on 15 June 1998 and included an inspection of the site. During this meeting, State Forests indicated that they were willing to consider the proposal, subject to agreement being reach with the RTA on a range of financial and future management issues. The main issues raised were:

> the acquisition of the State Forests land located within the boundary of the proposed site and compensation for the quarry material resource and lost forestry resource.

- once the site has been quarried and rehabilitated, a viable forest suitable for State Forest's needs is unlikely to be established on the new batter slopes, and therefore State Forests are unlikely to consider accepting the land to be transferred back to State Forests ownership and management.
- the value of existing remnant vegetation on the site is marginal to State Forests due to its small area and low quality of timber, although any practical salvage of timber would be recommended to be undertaken prior to work.
- the fire access track network may require minor upgrading should the proposal affect access onto existing fire trails.

State Forests noted that the adjacent State Forest compartment has a conservation moratorium for harvesting until an agreement can be achieved in consultation with NPWS. This matter does not affect the proposal and is the subject of ongoing assessment in relation to the approval of this compartment for logging by State Forests.

2.2.3 Environment Protection Authority (EPA)

The EPA responded by requesting the following actions be commissioned prior to commencement of the project:

- Preparation of an Environmental Management Plan incorporating:
  - Water Quality Monitoring Program
  - Pollution Incident Management Plan
  - Site Rehabilitation Plan
  - Sediment and Erosion Control Plan
  - Noise Management Plan

- Attainment of a Pollution Control Approval for the following activities:
  - Scheduled activity under Section 27(licence) of the Noise Control Act, 1975, proposal will require a licence under Section 18.
  - Runoff Control Works under Section 17 of the Clean Waters Act 1970

The EPA also listed in their correspondence the assessment criteria adopted by the EPA for specific activities related to the project (refer Appendix B).

The EPA advised that they have no further requirements for an EIS to those outlined in their original response in relation to the previous draft REF.

2.2.4 Department of Land and Water Conservation (DLWC)

During the initial consultation, the DLWC requested the following issues be addressed:

Erosion Control: Preparation of an Erosion and Sediment Control Plan (ESCP).

Groundwater: All works which intercept groundwater must be licensed with DLWC prior to their construction. Address all potential impacts to quality and quantity of groundwater if interception occurs.

Flooding Impacts: Address impact of the proposal on flooding of adjacent lands.

A meeting was held with DLWC Taree on 15 June 1998. The following issues were raised during this meeting:

- the preparation of a suitable erosion and sedimentation control plan
- compliance with DLWC guidelines for quarry management
- adequately sized sedimentation basins should be provided (to contain 1 in 5 year flow) and licensed through the EPA
- if greater than 2 hectares of land is to be cleared of native vegetation, approval of the DLWC must be sought (less than 2 hectares of native vegetation would be cleared)

> A formal response from DLWC regarding the EIS study stated that they have reconsidered the proposal and concluded that their previous reply adequately covered the issues of concern to their department.

2.2.5 National Parks & Wildlife Service

During the initial consultation, the NPWS responded with concerns of the impacts of the proposal on native flora and fauna. Specifically, they requested the following information be included in the REF:

> A description of the vegetation and extent of vegetation to be cleared.
> An assessment of the impact on existing vegetation in terms of increased edge effects and disturbance.
> Particular emphasis to be given to the potential occurrence of Koalas in the study area.

During further consultation, the NPWS recommended that the following factors be considered in the EIS:

> Proximity of the development to existing fauna underpasses associated with the Taree Bypass.
> Protection of the Koala movement corridor.
> Investigate the potential to provide Koala-proof fencing along the old highway.
> Incorporate appropriate native plant species into the revegetation program.
> Consider the threatened fauna listed in their correspondence.

2.2.6 Greater Taree City Council

During the initial consultation with Council, Council advised that up to 450,000m³ of sand material may become available at the time at which the Harrington Back Channel is dredged to improve navigation. Further communication would be necessary to coordinate the use of this material by the RTA for upgrade of the Pacific Highway across the Manning floodplain as this material is not likely to be available within the time frame of the Pacific Highway upgrade between the Taree Bypass and Coopernook.

In their response to the draft REF study, Council highlighted the need to assess the impact of further clearing on threatened species and the visual impact of the proposal.

A meeting was held with Council on 15 June 1998, during which the following issues were raised:

> Council advised that the local Lions Club were proposing to utilise the former highway for access to a new lookout proposed adjacent the quarry site. Council stressed the importance of maintaining access to any proposed lookout.
> Council requested that a cost estimate of the project be provided in the EIS that includes the cost of winning and loading of material, and acquisition and rehabilitation costs.
> Council offered information on the approach for addressing permissibility issues with respect to the development.

In the formal response provided by Council in regard to the EIS study, they reaffirmed their previous letter regarding the draft REF and the requirement to provide a lookout area on Forestry land adjacent the old highway. A letter from the Taree Lions Club to Council regarding the observation site was attached to Council's response.

2.2.7 Environment Australia

A formal response from Environment Australia (Biodiversity group) regarding the EIS study identified Crowdy Bay National Park as the closest wetland of national significance, as listed in "A Directory of Important Wetlands in Australia, Second Edition", some 30km northeast. No further comments were received.

2.2.8 Telstra

Telstra raised no objections to the proposal and provided plans to aid in locating its fibre optic cable that extends adjacent to the western boundary of the former highway. Telstra also provided its Code of Practice for works in vicinity to its network and stressed that quarrying must not affect the operation of this major communications cable as significant costs for taking such a cable off line would be incurred.

2.2.9 Optus

Optus raised no objections to the proposal and advised that there were no Optus assets within the quarry area.

2.2.10 Mid Coast Water

Plans of the Mid Coast Water assets in the study area have been provided to the study team. The only area of concern is the existing watermain crossing beneath the Taree Bypass and the former highway between chainage 161800 and 161950. Water supply would be maintained to Fords Road throughout the project.

Summary of ESD Principles

Precautionary Principle	Intergenerational Equity	Conservation of Biological Diversity
A program of consultation was established at the outset of the project to allow the community and relevant government authorities to raise their concerns at the earliest possible time. By receiving and reviewing their comments and feeding them into the concept design early on in the project timeline, the project could be refined so as to minimise the threat of serious or irreversible damage to the environment.	Requesting comments from the local community of the study area meant that issues could be raised which they believe are relevant to future generations. The main issues raised were primarily concerned with access arrangements and dust generation impacts. To ensure that adequate provisions were incorporated into the concept design.	The NSW National Parks and Wildlife Service was consulted for their input on the impact of the proposal on native flora and fauna. Comments from NPWS have been incorporated into the concept design and presently NPWS have no outstanding issues with the project in terms of biological diversity.

3

NEED FOR THE PROJECT

3. Need for the Project

3.1 Objectives of the Development

The primary objectives of the project would be to:

> establish a quarry that will provide suitable fill material that would enable the Pacific Highway upgrade between the Taree Bypass and Moorland to proceed.

> provide a cost effective means of supplying fill material for the Pacific Highway upgrade project.

> minimise all environmental impacts associated with the construction and operation of the quarry.

> to install equipment and implement operating practises which ensure the safety of staff and the community.

> avoid the depletion of local fill material resources.

> to incorporate the principles of ecologically sustainable development if the formulation and assessment of the quarry proposal.

3.2 Demand for Embankment Material

As part of the upgrade of the Pacific Highway, the RTA are proposing the construct a dual carriageway highway across the Manning and Lansdowne River floodplains including; the Taree Bypass to Coopernook Upgrade and the Coopernook Bypass. To form the dual carriageway embankments across the floodplain, a large quantity of fill material is required to be imported to the site. Cuttings proposed elsewhere on the project would not provide sufficient fill to raise the proposed road to the 1 in 20 year flood immunity level.

The Coopernook Traffic Relief Route EIS and Taree to Coopernook REF identified both the availability of fill material and impact of its extraction as significant issues for the upgrade of the Pacific Highway across the floodplain. Based on the earthworks quantities needed for two potentially concurrent projects (refer Table 3.1) there will be a significant cumulative demand on the local and regional fill resources.

Table 3.1: Approximate Earthworks Quantities for Various Highway Upgrade Proposals (m^3)

Highway Upgrade	Cut to Fill	Import Required General Fill	Import Required Select Material	Bridging Layer (0.5m thick)	Total Borrow
Taree Bypass to Coopernook	nil	250,000	33,000	40,000	323,000
Coopernook Bypass	35,000	285,000	30,000	40,000	355,000
Total	35,000	535000	63000	80000	678000

The above table is based on the following assumptions:

> the figures are bank values and have not taken into account bulking factors.
> unsuitable material has not been factored into the above calculations.
> the volumes above take account of settlement assumptions.

It has been identified that less than ten percent of the fill required for the Coopernook Bypass (approximately 25,000m^3) could be won from the existing approved quarries within 10km of the project (Connell Wagner, 1997) and that major new fill sources would need to be developed to construct the Coopernook Bypass as well as the adjacent projects. Considering the possibility of simultaneous construction of the Taree to Coopernook and Coopernook Bypass projects; a total of around 678,000m^3 of fill would be required to be imported.

3.3 Fill Sources

The Taree Bypass cut batters in Kiwarrak State Forest (7km south of Taree) are considered the most accessible large source of fill. It is anticipated that sufficient general and select fill may be available to meet the needs of the Taree to Coopernook Upgrade and the Coopernook Bypass. Section 4.4 describes the material and quantities available from the Taree Bypass cut batters and discusses alternatives to this proposal.

3.4 Batter Stabilisation

The cut batters slopes along eastern side of the Taree Bypass in the vicinity of the proposed quarry site have undergone extensive batter slope treatment involving shotcrete application and rock bolting to stabilise the steep slopes. However, along the western side of the bypass and within the proposed quarry site, the batter slopes require extensive stabilisation treatment. Some of these batters have been treated with shotcrete only, but require further stabilisation to be considered to be permanent slopes, and should be regarded as temporary slopes until these works are completed. To date, stabilisation of these slopes has been delayed in anticipation of the proposed fill material quarry.

The geotechnical consultant, Robert Carr and Associates (refer Appendix D), observed that the existing slopes on site are presently subject to active batter erosion, and identified that an increasing level of maintenance would be required unless batter improvement works are undertaken. It was also noted that the risk of rock falls occurring will increase with time as the surface material undergoes progressive erosion and deterioration.

These batters may be stabilised by a number of methods including further shotcrete application and rock bolting. Alternatively, the slope of the cut batter could be reduced to a level suitable to provide long term stability, this would also have the added benefit of introducing a positive visual impact as opposed to the unsightly stabilization of the existing batters using shotcrete and rockbolts. It is proposed that the final profile of the fill material quarry on these cut batters would have a maximum slope of 1 vertical to 2 horizontal. Advice from Robert Carr and Associates suggests that at this grade, long term stability would be achieved without addition support. Should steeper batters be required to maximise fill quantities the final design of quarry would incorporate further measures to support the slope where necessary to ensure stability for safety purposes and to control the potential for erosion. Slope stability would also be assisted by the rehabilitation and revegetation work proposed for the new batters on completion of the quarry operations.

Whilst the primary objective of the quarry is to provide fill for the construction of Pacific Highway upgrades, additional benefits would include the stabilisation of the existing batter slopes together with positive visual impacts, in comparison to the shotcrete and rockbolt stabilization alternative, along the western side of the Taree Bypass through the Kiwarrak State Forest.

3.5 Consequences of No Action or Deferral

The consequences of no action or deferral of the fill material quarry project would be a potential deficiency in the supply of quality fill material for the progressive upgrade of the Pacific Highway. Such as deficiency would have both cost and programme implications as well as significantly altering the feasibility of the project. Without the fill material quarry on the Taree Bypass, alternative more distant sources of fill would be pursued. These sources, either alone or in conjunction, must have sufficient quantities of fill material of suitable quality to sustain the highway projects.

The various alternative fill sources described in Section 4 in total, they are unlikely to be able to provide enough fill for the highway upgrade from Taree to Coopernook, the Coopernook Bypass and

the Moorland highway upgrade. Local quarries are currently licensed to supply only a small amount of material refer Section 4.2. The only other identified significant source of fill would be the dredged material from the Manning River, Harrington Back Channel, and even then this source may not supply enough fill for of the highway projects previously mentioned.

To reduce the demand on fill material the highway design could be radically altered with significant environmental and social impacts. There are three main ways how the highway design could be altered to reduce the demand on fill:

> the width of the highway could be reduced by eliminating the depressed median and replacing it with a barrier (eg. wire rope). This approach would have implications on the safety and maintenance including headlight glare, obstruction of flood debris and maintenance of the barrier. This alternative would depart from the uniformity offered to travellers along the carriageway and would also reduce the opportunity for landscaping.

> the height of the embankments could be reduced below the proposed 1 in 20 year flood immunity level. This would result in more frequent closure of the highway due to flooding and an inconsistency of flood immunity of the highway over the Manning River floodplain. Flood closure of the highway has been identified as a major problem for the existing highway across the floodplain, and an important benefit of the proposal.

> the alignment of the proposed highway corridor could be altered to follow a route located at a greater elevation to reduce the embankment height required for flood immunity. Alternative alignments of the highway have been thoroughly investigated in various EIS documents, which have revealed that there are significant planning, environmental and economic constraints in locating the highway on such alignments.

Should the Taree Bypass cut batters not be used for embankment material further stabilisation work would be required to stabilize the existing cut batters. This work would attract the costs approximated in Table 3.2.

Table 3.2 Batter Stabilization Costs

Description	Approximate Cost
Batter Preparation	$0.5M
Shotcrete Batters	$1.2M
Rock Bolting	$0.7M
Total	$2.4M

The costs involved represent a discount to the costs of options involving the excavation on the existing embankment.

4

OPTION EVALUATION

4. Option Evaluation

4.1 Fill Sourcing Options

The following options have been identified for the supply of fill to the proposed Highway upgrade projects between Taree and Moorland:

> the local commercial quarries
> dredging sand material from the Harrington Back channel.
> quarrying from the Taree Bypass cut batters

These fill sources are in no way mutually exclusive, and it is anticipated that combinations of options, may be eventually utilised during the highway upgrade projects. The "Do Nothing" option has also been investigated in the previous section.

4.2 Local Quarries

Robert Carr and Associates identified various local quarries as potential sources of fill in their geotechnical investigation for the proposed Coopernook Bypass. It was noted during this investigation that only two small quarries, the Goslings and Gillogly's quarries, held current extraction licences and that under the terms of the licence the quarries are limited to their existing extent. Interim licences were held by a number of the other quarries, however, these expired in September 1995 (Robert Carr and Associates). Several of these quarries are located on forestry land and are unlicensed. A list of the quarries nominated appears below in Table 4.1:

Table 4.1 Local Quarries

Pit	Location	Material	Comment
Gillogly's	Spring Hill Road	weak siltstone and silty sandstone with pebbly sandstone capping	Existing rights usage 1,500tn/annum
Gosling	North of Coopernook, RTA depot.	weak siltstone and silty sandstone with pebbly sandstone capping	Existing rights usage
Melinga Quarry	Lansdowne Road South of Melinga	sandstone, shale and siltstone	Existing rights usage 20,000tn/annum
Coral Ville	Corral Ville Road	quartz river gravel	Existing rights usage to be confirmed
Roses Quarry	Langley Vale	shale / argillite	Unlicensed
Sowters Road Unicombs	Between Langley Vale and Coopernook State Forest	conglomerate, siltstone "hard rock"	Unlicensed Identified by GTCC as a potential hard rock source.
Stations Road Forestry	North of Coopernook	conglomerate and claystone	Unlicensed
Hoggs	Spring Hill Road	conglomerate and sandstone	Existing rights usage to be confirmed
Long Point	Long Point Road	quartz river gravel	Unlicensed

Under the current license for the Gosling's and Gillogly's Quarries, only approximately 25,000 m^3

would be available, which constitutes less than 10% of the local fill requirements for the Coopernook Bypass project alone. Clearly, the current licensed quarries in the area alone do not have the capacity to satisfy the fill material demand for the Highway project.

Nevertheless, it is possible that the material available at these quarries would be largely suitable for the general fill material required for the highway embankments, except for possibly bridging material due to the clay content. It is feasible that the material from these quarries could be used as an intermediate source of fill whilst the Taree Bypass cut batters are undergoing initial development in preparation for quarrying.

Communication with the Quarry Manager of Boral Blue Metal Quarry at Stewarts River (17km north of Coopernook) indicated that up to 50,000m^3 of overburden from the Blue Metal quarry may represent a usable resource for highway construction. Further investigation by a geotechnical engineer has been commissioned to assess the suitability of this resource. This resource however, can only be considered complimentary to other major materials sources due to the quantities available.

The use of the remaining licensed local quarries for the highway upgrade projects would be likely to severely deplete or even exhaust the resources of the quarries. This may impact on the quarry as an operating business or impact on the present users of locally quarried material that would be forced to find alternative and potentially more distant source. Positive impacts may include a short term major increase in business for the quarries.

4.3 Dredging from Harrington Back Channel

Discussions have been held with the DLWC regarding the availability and suitability of sand resources that are proposed to be dredged form the Harrington Channel and Back Channel of the Manning River Estuary for navigation purposes. It is understood that approximately 350,000 to 450,000 m^3 of mostly marine sand would need to be dredged to assist navigation along the river. In order to dredge material from the river, the appropriate approvals and licences would be required and agreement on royalty payments would need to be negotiated with DLWC. The timing and availability of the dredged material would be affected by the need for the preparation of a separate EIS and background study, as well as the rate of output and haulage distance from Harrington.

Dredging of the Manning River has the potential to cause significant environmental impacts. These may include the suspension of fines that could affect water quality. Aquatic flora and fauna would be impacted upon due to disturbance of the benthic environment, loss of benthic habitat, smothering due to settling of sediments and potentially from altered hydrological regimes. Disturbance of the sand may also promote release of any accumulated basins and other contaminates that may have been immobilised in river sediments.

The dredged sand material would have the potential to cause acid sulphate conditions at the construction site across the flood plain. It is possible that the material would require treatment prior to placement to reduce water content and the potentially high levels of salt.

Haulage of the material would be over distances similar to that for the Taree Bypass cut batters, however, the haulage trucks would be required to travel along narrow rural roads that may not be suitable to carry the additional traffic without significant maintenance costs.

The high cost of extraction of sand and the lack of timing flexibility for the construction of the highway would weigh against this option. However, were a stream of material available from this source during the time frame of the project, it would form a useful complementary source, especially as a drainage layer.

4.4 Quarry from Taree Cut Batters

The existing cut batters along the Taree Bypass between Purfleet and Koorainghat, south of Taree, have been identified as potential sources of suitable quality fill. Essentially, the proposal is

to excavate the material between the former highway and the new Taree Bypass in order to layback the batters western side of the bypass. These batters would otherwise require further stabilisation, including rock bolting. The excavation site would become a quarry for the duration of the project, and would be rehabilitated and revegetated on completion. Excavation of embankment material for the realignment of Fords Road is also included in the proposal.

There are three main cuts along the western side of the Taree Bypass that have been considered, which have been named Cut A (ch160800 - ch161050), Cut B (ch161400 - ch162400) and Cut C (ch162800 - ch163000) for ease of reference. The realignment of Fords Road (ch161100 - ch161400) has also been considered refer Figure 5.1. Cuts B and the Fords Road realignment are the preferred sites for quarrying.

4.4.1 Cut A

Cut A consist of the area between chainage 160,800 and 161,050 approximately and is approximately 40 m wide. It was originally estimated that this cut may be able to supply approximately 40,000 m^3 of material. It appears that the cut has been worked in more recent times and this quantity of fill is unlikely to be presently available. Robert Carr and Associates indicated in their geotechnical investigation (refer Appendix D) that there appears to be a layer of fill overburden in the area of the old highway that may be up to 4 m deep. The geotechnical consultant was unable to ascertain the nature of the fill, however, they expect that the fill comprises unsuitable or topsoil material form the Taree Bypass construction.

The relatively small volume of available material together with the overburden layer makes the augmentation of this cut less feasible then than the following sources and is therefore not necessary to be worked at this stage.

4.4.2 Cut B

Cut B consists of a large area between the old highway and the Taree Bypass, north of the intersection with Fords Road, extending between 161,400 and 162,400 approximately. The bank volume of material available from this cut has been estimated to be approximately 603,500 m^3 (less 25,000m^3 previously extracted). The material is accessible with no major overburden or topsoil stockpiles.

The configuration of the old Pacific Highway and Fords Road intersection provides the opportunity to safely circulate construction vehicles through the site. Construction vehicles would be able to leave the site at the location where the old highway meets the north bound carriageway of the Taree Bypass.

Cut B presently consists mostly of grasses and weed species with small areas of remnant vegetation.

4.4.3 Cut C

Cut C consists of a small area of land where the old highway diverges from the Taree Bypass, around chainage 163,000 approximately. Cut C would only yield a small amount of material in the order of 20,000 m^3. The cut is partly wooded is partly covered with a 3-4m deep layer of overburden unsuitable for filling. Cut C is located immediately adjacent a koala fence and south of a fauna underpass beneath the Taree Bypass.

It is considered that the small volume of material available in Cut C together with the overburden, native vegetation, vegetation and habitat concerns makes the development of the cut far less desirable and economical than Cut B.

4.4.4 Realignment of Fords Road

The current alignment of Fords Road from the Taree Bypass is involves a steep tight curve connection with the former Pacific Highway. By realigning Fords Road to reduce the radius of

bends and create an even gradient would win approximately 50,000 m² of material. Realigning Fords Road is desirable not only to provide fill material but to rationalise its current alignment and stabilise existing batter slopes.

4.5 'Do Nothing' Option

The consequences of the 'do nothing' option are discussed in Section 3.3. In essence, sufficient quantities of fill would not be available for the conservation of the Pacific Highway upgrade projects and either these projects would be radically altered or no upgrade would proceed. Not proceeding with the highway upgrade is likely to generate those issued raised in the corresponding Section 3 of the Coopernook Bypass EIS (Connell Wagner 1997), including worsening road and traffic conditions, increase fatality and casualty rates and decrease in travel time with increased traffic loads.

A further consequence of the "do nothing" option is the requirement for batter stabilisation involving rock bolting nad shotcreteing which would attract additional costs and result in negative visual impacts.

4.6 The Preferred Option

The cut batters along the Taree Bypass is the most feasible source of fill material due to the following:

- the high level of certainty that the highway can be feasibility constructed within the program, as the quarry would be under RTA control
- flexibility
- large quantity of fill material available at one location
- general suitability of the material for filling.
- direct access can be made from the quarry site to the construction site via a high quality road that is distant to residents
- stabilisation of the batters would be achieved without extensive treatments
- the quarry would be limited to an area within the existing road corridor and would have minimal impact on native vegetation
- previous experience with Taree Bypass has identified the suitability of the fill material

It must be noted that all of the fill material sources are not mutually exclusive and should be used in conjunction to complement each other. It is possible that various sources may be eventually required to supply enough fill material for the highway upgrade.

Of the various cuts on the Taree Bypass, Cut B provides the largest quantity of suitable material with ease of access. It is therefore proposed that Cut B be developed as a fill material quarry. Realignment of Fords Road would also be of benefit, and is also proposed to complement the excavation of Cut B.

The quarrying of Cuts A and C remain within the scope of the project should these additional resources be required.

Summary of ESD Principles

Precautionary Principle	Intergenerational Equity	Conservation of Biological Diversity
The precautionary principle has been applied to the project through the adoption of the site as the preferred option. The impacts of this site are acceptable and would not result in serious or irreversible damage to the environment as demonstrated through the experience of the construction of the existing highway adjacent to the site.	A broad range of social, environmental and design factors were used to assess the suitability of different source material quarries. A constraints analysis exercise was undertaken with particular attention given to ensuring the sustainability of local quarry industry. In particular the likelihood of depleting the local quarries resources was considered. The excavation of the proposed quarry would directly benefit the local community with improvement to Fords Road, a local access road, and improved revegetation of the cut batters.	The impacts on remnant vegetation and wildlife in the study area was also considered. The adoption of the existing cut batters option would ensure no further fragmentation of remnant vegetation. The proposal is therefore unlikely to result in the loss of genetic, species or ecosystem diversity.

5

PROJECT DESCRIPTION

5. Project Description

The preferred option for the development of a fill material quarry is the extraction of material from Cut B, including the re-alignment of the Fords Road intersection. Of the various quarry options considered, this option was most suitable due to the large volume and quality of fill material available, and the relative low cost and expected ease of material extraction. As a result, this option was adopted as the proposal, and is described in more detail in this section.

5.1 Site Description and Quarry Design

The proposed quarry site is located adjacent to the Taree Bypass, a recently constructed section of the Pacific Highway, and is situated on Four Mile Hill between Purfleet and Koorainghat, approximately six kilometres south of Taree. The cuttings proposed for excavation would commence along the western side of the northbound carriageway of the new highway and extend as far as the western edge of the former Pacific Highway alignment. The site includes the area known as Cut B and the area adjacent the Fords Road intersection. A concept design of the development area is shown on Figure 5.1 and a typical cross section of the proposed final batter slopes is shown on Figure 5.1. Further design information is included in Appendix G.

5.1.1 Cut B

Proposed Excavation of Cut B

The proposed excavation of Cut B incorporates the area between the former highway and the new Taree Bypass, between chainages 161400 to 162400. The area of Cut B is limited to the west by an existing underground fibre optic cable operated by Telstra and the western boundary of the old highway. Consultation with Telstra in the final design would be necessary to maximise the extent of quarrying while avoiding disturbance to these utilities. A water main would also be affected near Ch 161400.

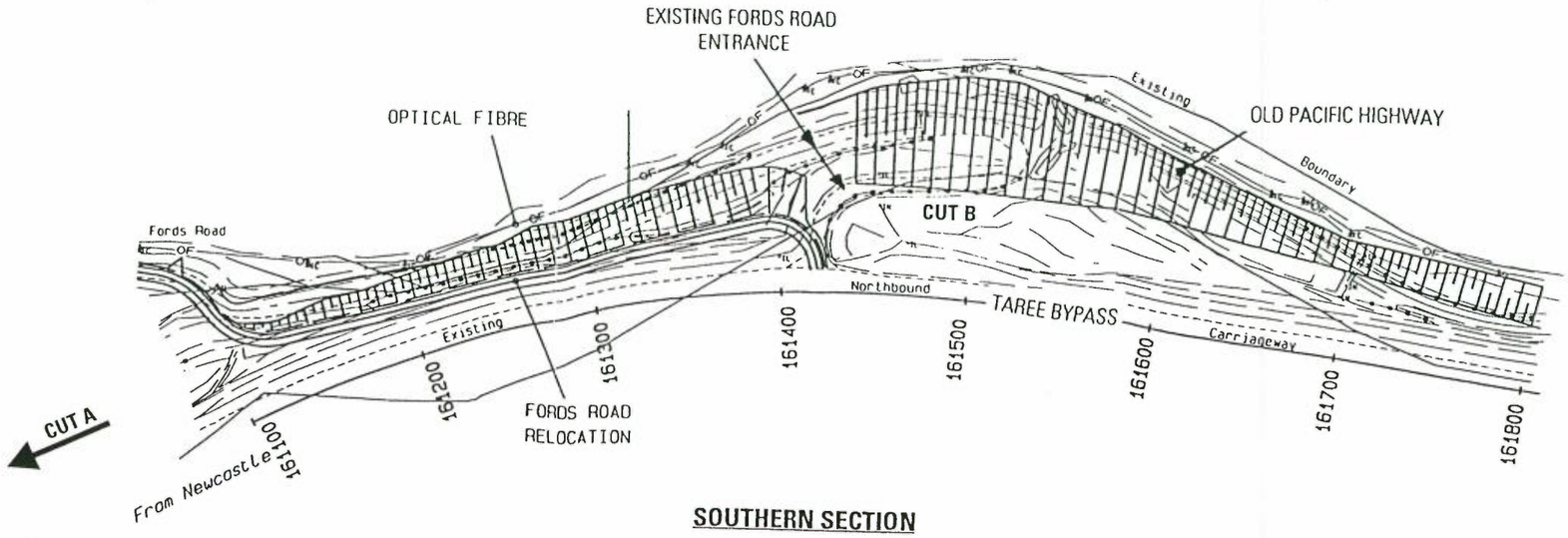
The eastern edge of the site is limited by the Taree Bypass. Cut B is approximately 1000 metres long and varies in width to a maximum of approximately 80 metres at chainage 162100. It is proposed that the pavement of the former highway be consumed during excavation. The proposed depth of Cut B varies with a maximum depth of approximately 25 metres from chainage 162000 to 162100 approximately.

The final design of the batters post quarrying would incorporate an access road along the slope to make passenger vehicle and trailer access possible to a potential lookout site nominated by GTCC on the crest of Four Mile Hill. This access road would use the Fords Road intersection.

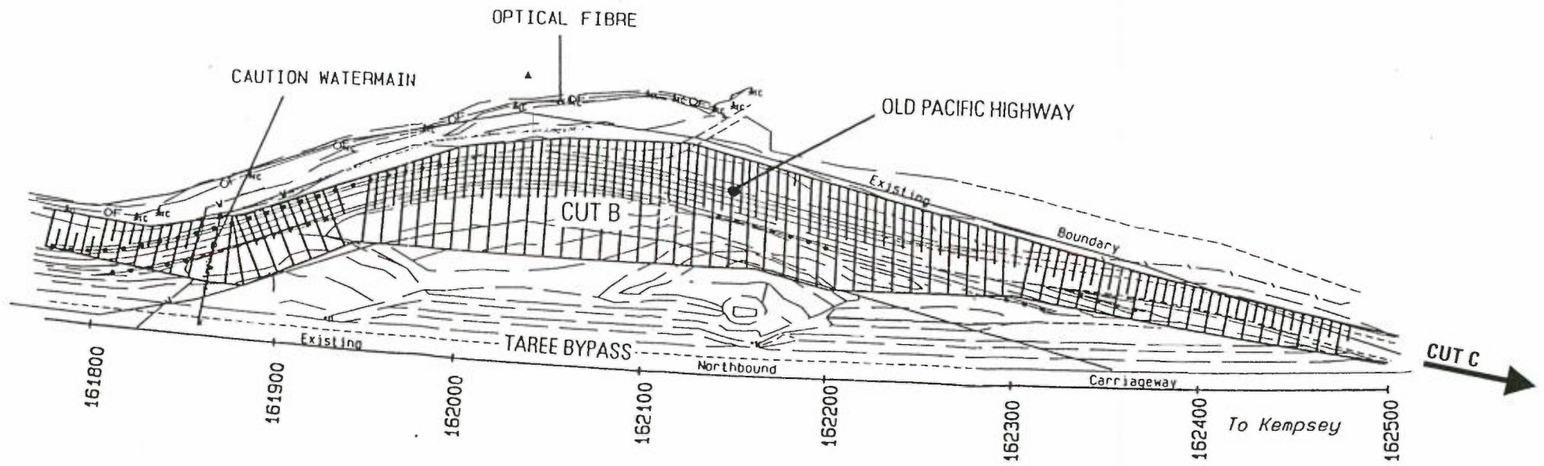
Existing Cuttings Along Taree Bypass

The site known as Cut B consists of three cuttings excavated during the construction of the Taree Bypass. Each of these cuttings are battered to approximately 3 horizontal to 4 vertical (Robert Carr and Associates, 1998), and are benched. These benches are up to approximately 4 metres wide where the height of the cut exceeds approximately 6 metres. The largest cutting is approximately 17 metres high at chainage 162000, and includes two benches. The batter slopes of these cuttings have not been fully stabilised, with only limited sections of the batters treated with shotcrete. The present treatments are not sufficient, for long term stability, to prevent rock fall hazard given the proximity to the highway. Further shotcrete treatment and rock bolting or batter slope reduction would be required to provide a suitable permanent slope.

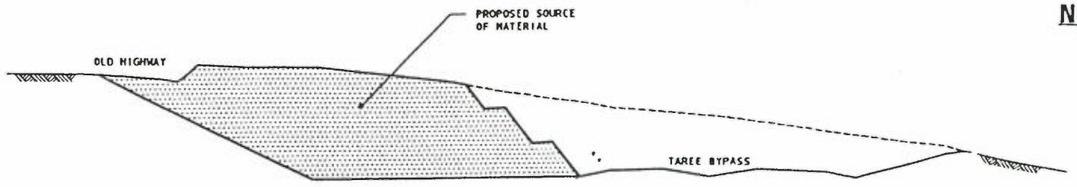
The cut located at the northern end of the site at chainage 162200 to 162400, is presently being excavated to provide material for the continuing construction of the Taree Bypass and is being laid back to a gradient of approximately 2 horizontal to 1 vertical (Robert Carr and Associates, 1998). Approximately 25,00m^3 of material has already been extracted from this site as part of the actual Taree Bypass construction. This work is beyond the scope of this EIS. The remaining fill resource is approximately 603,500m^3.



SOUTHERN SECTION



NORTHERN SECTION



TYPICAL CROSS SECTION

FILL MATERIAL QUARRY -
TAREE BYPASS
5606.01.CE

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FIGURE 5.1
CONCEPT DESIGN AND TYPICAL CROSS SECTION

Design Criteria - Batter Slope Stability

Table 5.1 summarises the proposed batter slopes required to provide long term stability for various types of in-situ material.

Table 5.1: Type of in-situ material and the recommended maximum batter slope to provide long term stability (after Robert Carr and Associates, 1998).

Material Type	Maximum Batter Slope
Residual clay soil and extremely weathered rock	1V:2H (26.5^{o})
hard weathered rock	2V:3H (33^{o})
very hard rock	1V:1H (45^{o})

A cut batter slope of 2 horizontal to 1 vertical (26.5^{o}) has been adopted in the concept design. Cross sections of the proposed quarry profile are provided at various chainages in Appendix G. It is within the scope of the project to adopt alternative cut batter slopes based on site conditions, so far as batter stability is maintained in the long term.

5.1.2 Re-alignment of Fords Road

Existing Fords Road Alignment

Presently, Fords Road enters from the northbound carriageway on the western side of the Pacific Highway (Taree Bypass), located at chainage 161400 approximately. At this location, a cross-over point and turning bay (approximately 75 metres long) is located in the median for southbound traffic to enter Fords Road. Fords Road ramps from the highway, initially bending north and then tightly south. Approximately 300 metres of the first section of Fords Road is sealed, the remainder of the road is unsealed. The entrance to Fords Road is steep and has a tight radius curve. It has been identified that by re-aligning the entrance to Fords Road a significant quantity of winnable fill material would be available.

Proposed Re-alignment

It is proposed that Fords Road be re-aligned so that it initially bends south with a steady climb along a new batter to connect with the existing road at chainage 161100 approximately, as shown on Figure 5.1. The cut associated with the re-alignment of Fords Road would extend from the intersection at the highway to the connection with the existing road, and the cut would have a maximum width of approximately 30 metres.

The new section of Fords Road would be approximately 6 metres wide and have a nominal cross fall of 3% for adequate drainage. The road would be sealed with a asphaltic and gravel surface from the Taree Bypass to where it connects with the existing road. No additional portions of Fords Road are proposed to be sealed.

5.2 Fill Material

5.2.1 Available Quantities of Fill Material

Based on the quarry design parameters described above, the volume of material available from Cut B prior to completion of the Taree Bypass, was estimated to be approximately 603,500m^3 in-situ. At the time of the EIS, the Taree Bypass was still under construction and material was being excavated from this cut for use as fill. The amount of material that is being removed for this purpose is approximately 25,000m^3. Thus, the estimated bank volume of material to be excavated from Cut B equates to approximately 578,500m^3.

Based on the design of the proposed re-alignment of Fords Road, the estimated bank volume of material to be excavated from these works is approximately 52,500m^3. The total bank volume of available fill from the cut batters and Fords Road re-alignment would be approximately 631,000m^3.

Material that has been excavated, transported to the construction site and has been placed and compacted as fill, would be looser and less dense than the original in-situ material. Therefore, the total volume of placed fill would be greater than the in-situ material and a "bulking factor" is applied. Assuming an 8 percent bulking factor Table 5.2, below, summarises the total volumes of available fill.

Table 5.2: Total Volumes of Available Fill

Site	Bank Volume (m^3)	Bulk Factor (%)	Available Fill Volume (m^3)
Cut A	Unsuitable	N/A	Nil
Cut B	578,500	8	624,780
Cut C	20,000	8	21,600
Fords Road re-alignment	52,500	8	56,700
Total			**703,080**

This amount of material (703,080m^3) is in excess of the estimated combined demand for the Coopernook Bypass (355,000m^3) and Taree Bypass to Coopernook Upgrade (323,000m^3) totalling 678,000m^3. Further material could be won by laying all batters back to 2(h):1(v).

5.2.2 Material Excavation

A preliminary assessment of the excavatability and suitability of the material has been undertaken by Robert Carr and Associates based on information from seismic refraction studies carried out by RTA along the route of the Taree Bypass in 1992/1993. The assessment investigated the extent of potentially rippable rock strata and the areas where the rock strata would require blasting during quarrying operations. The methodology of this investigation and a detail discussion of the results is provided in Appendix D.

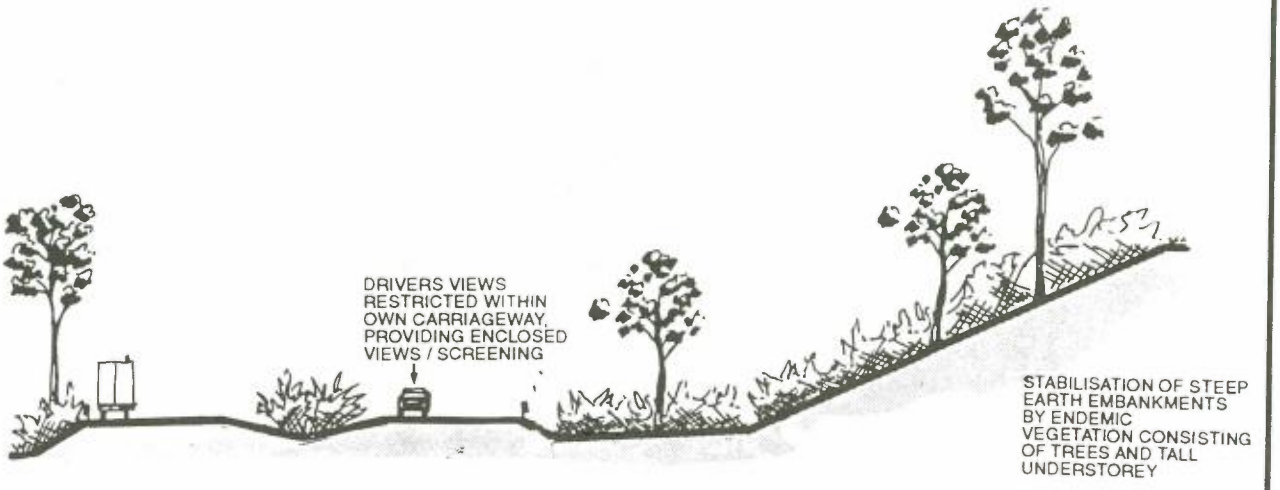
In general, the rock strata that could be excavated by a bulldozer appeared to extend to a depth of 1 to 3m, and by a large bulldozer, potentially with some minor blasting, tended to range between depths of 6 to 12m. Localised blasting would be confined to isolated zones of blue greywacke and the base of deep cuts (greater than 15m), however, these zones are neither uniformly distributed or layered. Zones of this rock was noted during earthworks for the Taree Bypass in the vicinity of Cut B. Smaller isolated zones of hard rock could be excavated with a hydraulic rock hammer, however, this may not be the preferred method where extensive hard rock areas are found to occur.

5.2.3 Suitability of Material for Road Construction

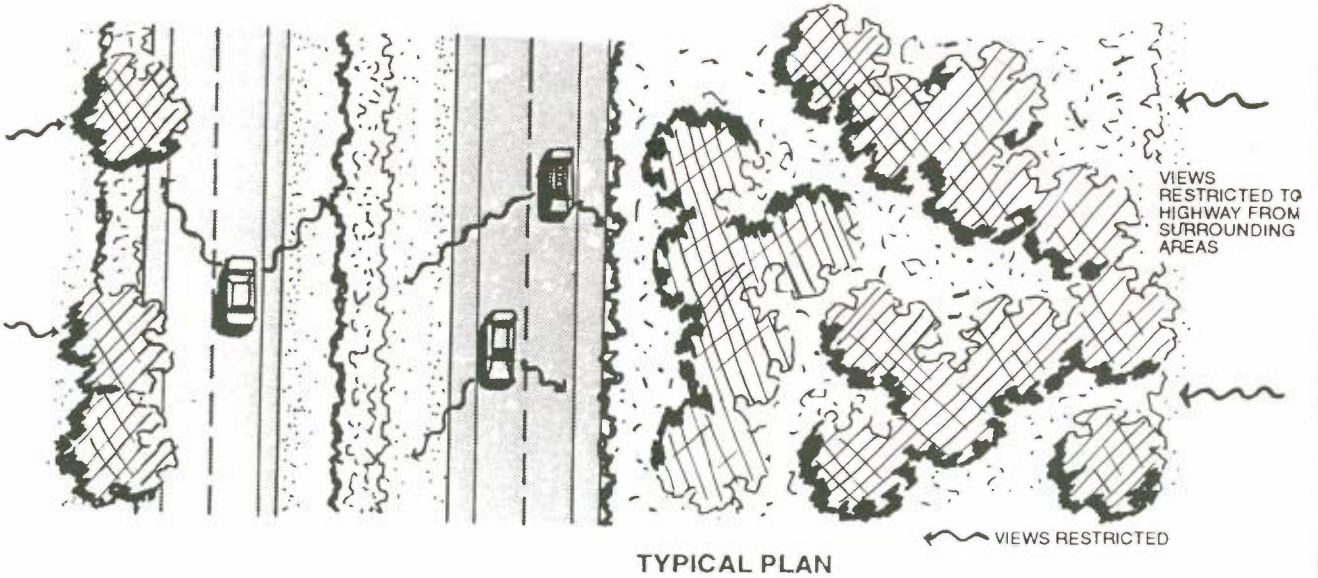
The Pacific Highway upgrade projects require different types of material during construction, namely:

> bridging and drainage material
> general embankment fill
> select material
> pavement material

The rock extracted from the quarry site is expected to be a clean rock fill material with variable



TYPICAL SECTION



TYPICAL PLAN

FILL MATERIAL QUARRY -
TAREE BYPASS
5606.01.CE

FIGURE 5.2
LANDSCAPE TREATMENT
TYPICAL LANDSCAPE SECTION

clay and sand fines content.

The following summarises the expected suitability of the material excavated from the proposed quarry derived from preliminary investigations be Robert Carr and Associates (Appendix D).

Bridging and Drainage Material

A bridging layer is required on road construction projects to provide a firm base of the subsequent embankment layers in low lying areas with low sub-grade strength or shallow groundwater. The bridging layer generally consists of material that is largely independent of moisture content such as granular sands or rock. The type of material expected to be derived from the quarry contains a variable amount of clay and sand fines that may affect its suitability as bridging material, potentially requiring screening to remove fines.

During the construction of the Taree Bypass, rock material derived from the cuttings along the road corridor has been utilised as a drainage layer, with the percentages of over-size material and fines controlled with screening. Therefore, it is expected that material excavated from the proposed quarry site would also be suitable for drainage material if similarly treated.

General Embankment Fill

General embankment fill is required to form the embankments of the proposed upgrade projects across the flood plains, and constitutes a large proportion of the material required for these projects. The rock excavated from the proposed quarry is expected to be suitable for placement and compaction as general fill embankments, with the more weathered material with a higher clay content likely to be suitable especially for the edges of fill batters provided that the material meets moisture control requirements and is well mixed.

5.3 General Construction Method

The detailed construction method would be developed by the successful contractor in response to the RTA's specification and with regard to ongoing RTA project management. The specification would include site specific requirements incorporating environmental safeguards highlighted in this EIS.

There would be three main stages in the development of the quarry, consisting of the following:

> Quarry Establishment: including site preparation, establishment of site compound and access tracks, removal of top-soil and existing vegetation, erosion and sediment control and implementation of traffic management measures.

> Quarry Operation: including extraction, possible stockpiling and transportation of material.

> Rehabilitation: rehabilitation of the quarry site including landscaping and revegetation and formation of access road to Four Mile Hill Summit.

These stages are not necessarily discrete activities. At times, all stages may be occurring simultaneously at different locations on site. Continuing throughout these stages of development would be the on-going implementation of an erosion and sediment control plan and other environmental site controls, monitoring and maintenance.

It is proposed that the quarry be incrementally worked and rehabilitated in portions to reduce the overall exposure of the site to erosion and to sequentially allow rehabilitation and revegetation. In particular minimal disruption to Fords Road users would result from minimising the duration of time worked in this area. The actual quarrying sequence would be proposed by the quarry contractor.

5.4 Quarry Establishment

The quarry establishment stage of the construction includes those preliminary activities required to enable the quarrying operation to proceed.

5.4.1 Site Facilities

Initially it is expected that a site compound and site office would be established. The site office would consist of a small portable building with the appropriate self contained worker amenity facilities, and would be likely to be located on part of the old highway on RTA land adjacent Fords Road at chainage 161050 approximately. The office would be situated so that it would not inhibit construction vehicle access. A small car parking area would be established adjacent the site office for the private cars of the employees. Construction vehicles would be located within a fenced off pen area on RTA land after hours to reduce the risk of vandalism.

5.4.2 Site Access

Site access would be via Fords Road intersection and thence existing bypassed section of the old highway. It is not expected that any additional access tracks would be required at this stage of the works. As the quarrying operation progresses additional access along batter tracks may be required to gain access to parts of the site, and prior to the re-alignment of the Fords Road entrance, alternative temporary access arrangements would be implemented for Fords Road residents to bypass successive stages of the work. Access arrangements are discussed in more detail below.
Construction and warning signs would be installed, and emergency evacuation procedures would be developed and implemented according to the quarry construction contract.

5.4.3 Erosion and Sediment Control

Prior to any cleaning or quarrying activities commencing, erosion and sedimentation controls according to an ESCP would be implemented as part of a contractual requirement. This would involve the establishment of a full "treatment Train" including the construction of sedimentation basins and catch drains and the installation of sediment fences, haybales and rocklined channels. An outline erosion and sediment control plan is provided in Figure 6.1 and outlined in Section 6.3.1. This would be further refined by the quarry contractors as a key element of the Environmental Management Plan (EMP).

5.4.4 Fencing and Barriers

Fencing and barriers would be installed to delineate the site compound and prevent rubble falling on to the road way. These would be erected adjacent to the road shoulder of the highway. The benefits of erecting the fencing/barriers are as follows:

> prevention of material falling from the quarry onto the roadway
> reduce driver distraction
> delineate the work site
> improve work employee safety

The final design will incorporate an extension of the Koala fence from Cut C south Fords Road.

The fence/barrier could be a combination of barrier kerb and chainwire fence covered with "shade cloth" type material.

It is proposed that during the excavation of Cut B part of the original embankment would remain throughout the excavation operations. This portion of the original embankment would serve the purpose of a mound barrier during the quarrying activity and would shield the carriageway. The barrier wall would be retained until the final stages of the quarrying activity where it would be excavated to form part of the required fill material. This system of working the quarry is beneficial for the following reasons:

- the operation is kept away from the existing traffic until the end of the quarry's operation
- noise and dust suppression is improved by using the remaining material as a barrier
- reduced driver distraction as quarry operations are not easily sighted from the roadway
- truck haul routes are separated from the highway
- site drainage may be controlled by the berm

5.4.5 Site Clearing and Stripping

The quarry site would be cleared and topsoil would be stripped and stockpiled in accordance with the following topsoil management controls:

- Identification and marking out weed contaminated areas of topsoil prior to clearing.
- Segregating weed contaminated topsoil from reusable topsoil during excavation.
- Protecting and storing reusable topsoil.
- Tracing any imported topsoil to ensure that it is weed free.

A large proportion of the site has been cleared during the construction of the Taree Bypass. The cleared areas consist predominantly of grasses that would not hinder site clearing operations. The removal of the remnant vegetation, would be by a bulldozer. The vegetation would be mulched and stockpiled for use in site rehabilitation.

Previous excavation works of the Taree Bypass have deposited topsoil and some unsuitable materials as overburden. The remaining top-soil would be stripped and stockpiled and vegetated with a sterile grass species to inhibit erosion. Overburden and fill that is not suitable as road fill would be stockpiled separately from the top-soil. Advice from the contractor for the Taree Bypass is that during the development of the original highway, overburden not suitable for road fill was deposited into several fills including sites immediately north of Cut B. It is expected that there may be small areas of Cut B that are covered by material not suitable for fill. This material would be stockpiled and suitably re-used on site during the completion stages of the quarry development.

The topsoil, mulch and appropriate material not suitable for fill would used during site rehabilitation.

5.4.6 Utilities Adjustment

The twin Mid Coast Water Mains (600MS and 375MS) would not be affected by the proposed quarrying activities. There would be no disturbance of other utilities.

5.5 Quarry Operation

A detailed quarry operation management plan would be the responsibility of the successful contractor who would be contractually bound to comply with any findings of this EIS, authority requirements and any approval conditions. The proposed quarry would be managed such that the poorer quality materials, that material closest to the surface, would be used for general filling. This would leave the better quality material for layers in the embankment closer to the pavement. The sequence of quarry operations throughout the site would also be included in this plan. Elements of which would be based on the following principles:

- minimisation of disruption to Fords Road traffic
- safe and efficient truck circulation through the site
- minimisation of exposed working faces at any one time
- successive regeneration of quarried areas
- planned approach to avoidance and adjustment of utilities

5.5.1 Access Arrangements

While detailed internal access arrangements would be developed as part of the contractors quarry plan, it is proposed that southbound trucks would access the site from the south end at the Fords Road intersection and be directed through the site in a northerly direction. Vehicles would then rejoin the northbound carriageway using the disused former highway pavement as an access ramp to the Taree Bypass, at the northern end of Cut B. Section 6.7 includes traffic control measures including acceleration lane line marking on the shoulder of the Taree Bypass. By circulating haul vehicle traffic through the site in the one direction, smooth and efficient traffic flow would be maintained. The proposed construction vehicle traffic flow is indicated on Figure 5.1.

Haul routes for the trucks would be established and traffic management plans implemented, including signposting. Contractual arrangement would be established to ensure that trucks would use the Taree Bypass, as the route followed by trucks could have substantial implications, to access the construction areas some 15 to 27 km to the north. Total semi-trailer tipper movements to completely work the quarry would be approximately 33,000 and 3,000 for Cut B and the Fords Road re-alignment respectively. Approximately 11,000 truck movements of the total would be required for the fill needs of the Coopernook Bypass alone.

Traffic management arrangements would be adjusted as the quarrying operation proceeds and the site changes form. The sealed section of the former highway would be used where appropriate but will eventually be consumed by excavation. Temporary unsealed access roads capable of handling the heavy vehicles would be constructed through the site. Temporary access roads would be a minimum of four metres wide and have a cross fall sufficient to prevent the ponding of water. Dust suppression by water carts would be regularly carried out over the unsealed sections of the road.

The proposed work would involve the progressive removal of the material at a rate to suit the earthworks construction for the projects requiring fill. It is assumed that material would be removed from the site over a 18 month period.

Access to the site office would be via Fords Road. Temporary access to the site office would be maintained during the works.

Suitable temporary access to the properties on Fords Road must be maintained throughout the works. Temporary access arrangements would be staged into the works to cause minimal disruption. The surface of the access track should be smooth and adequately graded for ease of access. The equivalent length of the realigned Fords Road would be sealed.

5.5.2 Method of Quarry Operation

The majority of quarrying activities would be done by ripping using bulldozers, excavators, loaders and trucks. Drilling and pre-splitting will be required for any hard rock. Blasting may be required for the very hard rock. If so, the Pacific Highway would need to be closed for short periods. It may be possible to avoid areas of hard rock to eliminate the need for blasting if outcrops are localised and alternative methods are feasible.

Cut B

There are numerous ways by which Cut B could be operated as a quarry, and is the responsibility of the successful contractor for the project. What is considered to be the most likely method of operation is via a system of benches. This type of operation is typical for commercial, open-cut quarrying where material is excavated from one bench and loaded into a haulage truck on a lower bench.

The likely method of operation is to commence quarrying from top of the existing batter slopes and progressively work west. A single workface or two smaller workfaces would be managed to enable the correct quantities of better or poorer quality material to be maintained. As indicated in

Section 5.4.4 an earth barrier would be mauntained between the quarry operations and the Taree Bypass for safety and environmental benefits.

Some work may be required on the shorter batters adjacent to the road to increase their stability. The batters would be flattened to 1 (vertical):2 (horizontal) to improve their stability while the adjacent quarry activities were ongoing.

Fords Road Realignment

The realignment of Fords Road would be undertaken in a short period of time in order to minimise the impacts on local traffic and maintain access to the proposed site office. It is proposed that the realignment of Fords Road be undertaken as the last stage of the works so that the new road surface is not damaged by heavy vehicles during quarry operation.

5.6 Landscaping and Rehabilitation

5.6.1 Landscape Concept and Treatment

The goal of the landscaping proposal is to reestablish native open forest on the excavated but more gentle batter slopes. The forest would grow to both screen and soften the appearence of the quarry face within fifteen years. The forest planting is designed to be continuous with the existing vegetation, with an open canopy of eucalypts and a sclerophyllous shrub and native grass understorey. The forest would provide fauna habitat and protection of the batter from erosion.Figure 5.2 shows the landscape treatment for a typical profile of the final quarry.

Full re-establishment of native vegetation would occur on all sections of the new embankments in accordance with landscape input to the final design. Species used would reflect the composition of the state forest and surrounding indigenous vegetation communities, and comprise trees, shrubs and groundcovers. The plan would be consistent with that being carried out elsewhere along the Taree Bypass site, and would be implemented through the framework of the Environmental Management Plan.

5.6.2 Plant Establishment

The technique used would be a combination of hydroseeding and strawmulching to ensure the best landscape outcome possible. In preparation for the application of seed, the site would be lightly cultivated and topsoiled. Where batter slopes exceed 2:1 direct seeding would be applied onto the slopes without the application of topsoil to avoid soil erosion. A hydroseed mix (containing seed, water, insecticide and organic fertiliser) would then be applied, followed by an application of strawmulching (cereal mulch plus a bitumen emulsion seal).

Where slopes are greater than 3:1, as would occur over most of the site (up to 2:1 proposed), treatment by hydroseeding and strawmulching would be carried out immediately upon completion of the stage of work to provide maximum erosion control protection. The bitumen seal in the strawmulch mix would also act as a light erosion protection prior to seed germination.

5.6.3 Plant Seed

Plant seed would be derived from collecting local indigenous seed from the surrounding vegetation to ensure local species are germinated with an emphasis on locally occurring commercial timber species. This collection would have an adequate enough lead time so as to maximise the seed varieties collected. The seed mix would also include sterile grass seed such as Ryecorn or Japanese Millet (depending on the season), to provide a rapid initial cover crop of grasses (which would not re-seed) to protect against erosion until other plants become established. Half of any Wattle *(Acacia spp.)* seed in the mix would be heat-treated to encourage faster germination and a progressive vegetation cover to be established. It should be

emphasised that no exotic grasses, other than those sterile grasses described above, should be used adjacent to bushland.

The vegetation types which naturally occur around the site are Open Dry Sclerophyll Forest, with *Eucalyptus pilularis*, *Eucalyptus paniculata* and *Eucalyptus punctata* being dominant and suitable for planting as seed and tube stock. In addition to these trees the following native shrubs, grasses and groundcovers are proposed: *Acacia falcata, A sauveolens, Themeda australis, Imperata cylindrica, Lomandra longifolia* and *Hardenbergia violacea*. Further suitable plant species occurring in this vegetation are included in Section 6.5.

5.6.4 Maintenance

A 12 month full maintenance programme would be undertaken for all landscape works, and would include watering, weeding, pruning, and replacement of any failed plants.

5.6.5 Existing Vegetation Protection

Any vegetation to be retained would be protected during construction. This would include installing temporary fencing beyond tree canopies (where possible), minimising vehicle movements and preventing stockpiling within this zone. It is suggested that all contractors involved with construction should be thoroughly briefed on the importance and techniques of tree protection prior to any works. Barriers to forest access west of the former highway are also proposed to protect the optic fibre cable and forest vegetation.

Contractors should also be aware that where any excavation is proposed within tree canopy lines, or local drainage patterns are altered in proximity to trees, existing trees are likely to die. Vegetation protection considerations, both during the design phase and construction, would be set down in the EMP.

5.6.6 Soil Management

Any existing topsoil stripped from the site during construction would be stored so as to retain maximum soil quality with respect to survival of soil microorganisms, soil loss and leaching. This would include mounds with a maximum height of 2m, the establishment of temporary sterile grasses for stabilisation during storage, and protection from traffic.

Soil used for planting, including both site soil and any imported topsoil (if required), would be tested prior to use. Any fertiliser required to ensure soil is optimal for plant growth would be specified and added.

5.6.7 Road Safety Considerations

During the detailed design phase it would be a requirement that any tree planting concur with guidelines for road safety as set out by the RTA (1996). This would include safe sight distances and sufficient clear zones beside the carriageways (ie 9m without barriers).

5.7 Cost Estimate

5.7.1 Assumptions

A cost estimate for the Proposed Quarry has been prepared in standard RTA Concept Estimate format, taking into account the following factors and assumptions:

> does not include placement and compaction of fill at construction site
> does not include haulage costs (refer Coopernook Bypass EIS)
> does not include contingencies and overheads up to EIS determination
> earthworks cut quantities have been estimated from the quarry concept design

> property acquisition costs are calculated on a rural per hectare rate
> no provision has been made for royalties / compensation to be paid in relation to the fill material resource or any lost forest production

5.7.2 Summary of Cost Estimate

A summary of the Concept Design Estimate for the Proposal is provided below. A more detailed breakdown of this estimate is provided in Appendix.

Item 1. Investigation / Design (2% of Item 4)	66,390
Item 2. Property Acquisition	70,000
Item 3. Utilities	20,000
Item 4. Construction Works	
a) Preliminaries	10,000
b) Site Preparation	22,000
c) Drainage	30,000
d) Earthworks	3,000,000
e) Pavement	67,500
f) Miscellaneous Works	100,000
TOTAL DIRECT COSTS	3,385,890
Item 5. Engineering Services 7%	237,012
Item 6. Allowances 18%	609,460
TOTAL CONCEPT ESTIMATE	$4,232,363

6

EXISTING ENVIRONMENT, IMPACTS AND SAFEGUARDS

6. Existing Environment, Impacts and Safeguards

6.1 Landform, Geology and Soils

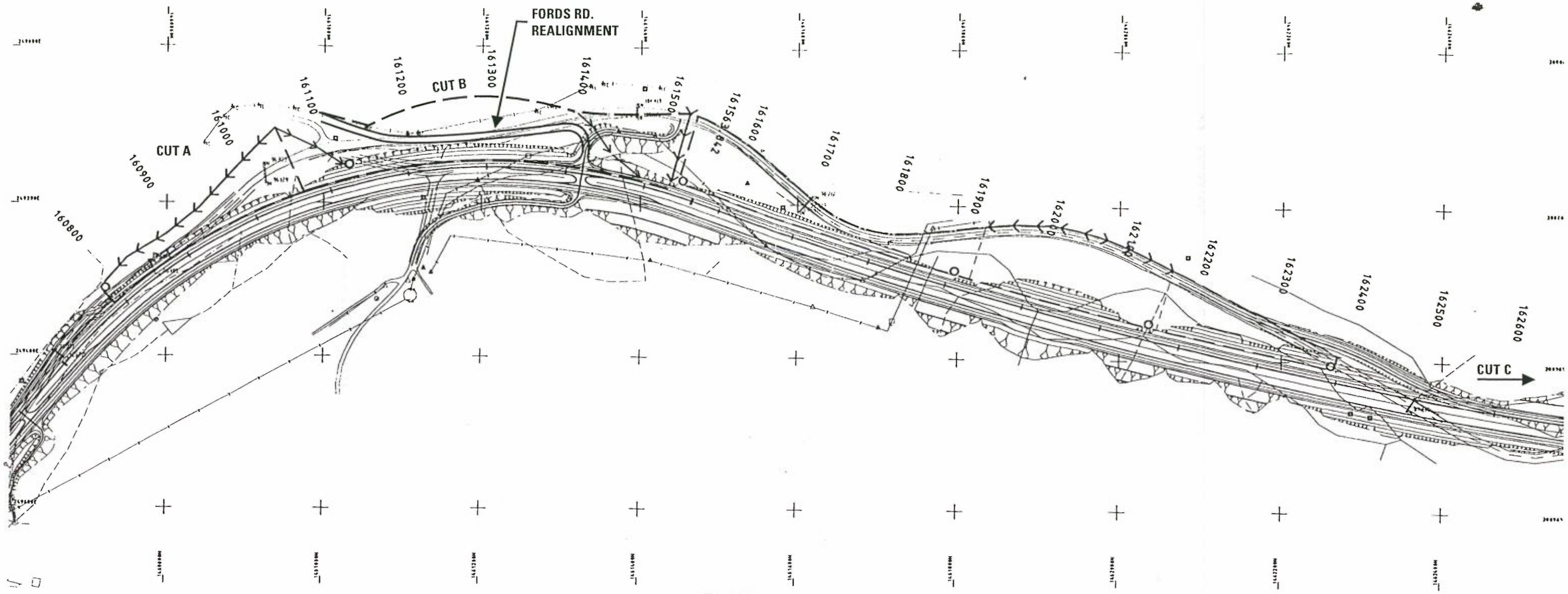
The landform at the study area consists of moderate to steep ridges and undulating hills with an elevation of around 100m, located within the Kiwirrak State Forest between the Manning River floodplain to the north and the smaller Koorainghat Creek catchment to the south. The study area is located near the crest of a ridge on a slope with a easterly aspect. Large Cuttings have been formed for the Taree Bypass through the crest of Four Mill Hill to the east of the former highway.

The geology of the study area includes sedimentary strata laid down in the Devonian period with some interbedded volcanic rock (Robert Carr and Assoc.1987). The sediments include mudstone, claystone, conglomerate, laminate, greywacke, tuff and chert. Weathering of rock is usually deep and generally with close fractures. The rock is deformed and generally dips to the west or north west, however some beds dip to the east, and contains some clear zones and igneous dykes. Excavation of the Taree Bypass cutting has not indicated any significant groundwater flows primarily due to the location of the cuttings through and immediately below the crest of the ridge.

The soils in the study area consist of Tinonee Lateritic Podzolic soils which occur on the ridges and have developed through the decomposition of the underlying rock. This is a strongly textured soil interspersed with yellow and brown podzols and overlying with lithosol rubble. The soils are low in nutrients and permit rapid infiltration, but sheet and rill erosion occur resulting in a high erosion hazard (Soil Conservation Service, 1985, GHD, 1990). Safeguards to reduce the erosion of the soil includes minimising the area exposed or disturbed at any one time and revegetating or otherwise stabilising slopes as soon as practicable. The implementation of a Sedimentation and Erosion Control Plan would involve the implementation of suitable controls such as sedimentation basins, cut drains, silt fences and diversion banks (refer Figure 6.1). The proposed final batter slopes of the quarry would be less than the existing cut batter slopes which would further aid in the mitigation of potential erosion.

Summary of ESD Principles

Precautionary Principle	Intergenerational Equity	Conservation of Biological Diversity
Detailed geotechnical investigations have been undertaken in advance of final design and operation. Therefore the consequences are predictable and the means of mitigating any impacts clearly available. Additionally the option does not disturb any pristine areas as the site is significantly disturbed by the existing cut batters.	Future beneficial uses of the local environment would not be comprised by the proposal. Erosion and sedimentation control management measures would be implemented during both the construction and operational phases of the project which would minimise the amount of sediment released into nearby waterways and the local environment. The avoidance of depleting existing stock at local quarries will ensure the continued operation of quarries for local projects.	The erosion and sedimentation control measures would prevent indirect impacts resulting in loss of genetic, species or ecosystem diversity.



PLAN
1:5000
DIMENSIONS IN METRES

LEGEND

SEDIMENT BASIN

SEDIMENT FENCE

DIVERSION BANK

DRAFT EROSION AND SEDIMENT CONTROL PLAN

FILL MATERIAL QUARRY -
TAREE BYPASS
5606.01.CE

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FIGURE 6.1
CONCEPT EROSION AND SEDIMENT CONTROL PLAN

6.2 Climate and Air Quality

6.2.1 Climate

The study area lies below the southern limit of the subtropical zone and the climate remains relatively mild at all times of the year. In the lower Manning a valley, mean summer temperatures range from 18° to 29°C with cool northeast breezes often tempering the effect of midsummer maxima. Light frosts may be experienced on the riverine lowlands, however winter temperatures seldom fall below 6°C. January is the hottest month with average maximum temperatures of 28.9°. July is the coldest month, with an average minimum temperature of 5.3°C.

Mean annual rainfall averages 1550mm annually with a summer peak, though variability through the year may be extreme. Excessively high summer rainfalls, sometimes greater than 500mm result from southward extensions of tropical cyclones. Periods of high rainfall also frequently occur during June and July when intense low pressure systems form on the NSW central coast. On such occasions flood conditions may develop along the Manning River and its tributaries and in the Coopernook district, the Lansdowne floodplain may be inundated to a depth of around 1m every five years. As a result of rainfall variability and the duration of quarrying project no season constraint on timing of work is recommended to be imposed.

Prevailing winds are generally from the southwest and west throughout the year, however the spring and early summer months are often characterised by strong and hot winds from the northwest as temperatures rise. In the afternoon, winds can tend to shift to blow from the eastern quadrant especially in summer when stronger northeasterly sea breezes are common.

6.2.2 Air Quality Impacts

The hazard of dust on high wind days would be greatest for motorists as forest occurs between the nearest houses and the southern extent of the work. Air quality goals for the quarry operations are provided at Appendix J.

Estimates of dust emissions from construction operations can be made using emission factors developed by SPCC (1983) and the USEPA (1981). These emission factors relate to the amount of dust generated by different types of equipment and operations associated with the construction work. The most likely equipment to be used in the project includes excavators, rippers, explosives and haul trucks. The major sources of dust would be the excavators, rippers and wind erosion during operation.

The appropriate air quality goal for determining dust impacts from construction work is the EPA 24-hour goal for PM_{10} of 150mg/m^3. This is approximately equivalent to the former EPA 24-hour goal of 260mg/m^3 for total suspended particulate matter (TSP). It is still useful to refer to this goal as many historical measurements are for TSP. There is no direct relationship between PM_{10} measurement and total dust generation. However, the EPA goal represents the threshold of nuisance conditions.

Dust generation arising from the quarry operations and vehicle movements would be controlled by watering of the disturbed areas and cloth screening of the quarry site from the road edge. In addition, measures implemented to conserve soil and protect water quality will assist in reducing dust potential. These measures include minimising the area exposed or disturbed at any one time, revegetating or otherwise stabilising the slopes as soon as practicable and confining vehicle movements to designated areas. It may be necessary to cover loads of the haulage trucks if windborne dust becomes a problem during transportation of material.

Monitoring of visible dust and its potential to affect traffic safety and local residents will be required by site officers throughout the project, wherever a potential hazard occurs. The Environmental Management Plan will specify the required frequency and location of dust monitoring, however, it is recommended that it be undertake around the site particularly near the

highway and the local residents.

The potential for dust to enter the water supply by settling on the water reservoir east of the Taree Bypass at chainage 161200 approximately is unlikely, as the reservoir is covered and not open to ambient air. Dust is unlikely to significantly impact on agricultural activities in the area due to the location of forest around the quarry area and the implementation of control measures.

All emissions from construction machinery, vehicles and trucks would remain within the other relevant non particulate air quality goals nominated in Appendix D. Compliance with these EPA guidelines would be achieved by maintenance of plant and vehicles as specified in the Environmental Management Plan.

Summary of ESD Principles

Precautionary Principle	Intergenerational Equity	Conservation of Biological Diversity
Consideration of air quality impacts associated with the project has been undertaken. Dust generation has been identified as the major contributor to potential impacts on air quality.	Dust generation would not result in the loss of air quality for future generations. In addition, monitoring of emissions together with dust suppression controls would ensure levels do not exceed EPA goals in the future.	Air quality issues associated with the quarry would not result in the loss of genetic, species or ecosystem diversity.

6.3 Drainage and Water Quality

The closest natural watercourses to the study area are Stitts Creek and Koorainghat Creek. Stitts Creek is located approximately 1km west of the study area and drains to the Manning River, however very little of the quarry area drains to the west beyond the crest of the ridge. Koorainghat Creek is located approximately 1.5km south east of the study area draining to the Koorainghat Creek Lagoon at Saltwater Beach. The proposed works could have the potential to increase the level of suspended sediment in these waterways during the quarry operation phase if not appropriately controlled. This could potentially lead to short-term adverse impacts on aquatic life in their tributaries and on dependent species, and reduce the visual quality and amenity value of the waterways.

The quarry site presently drains into roadside swales along the western side of the Taree Bypass and then into the highway drainage system which discharges into local tributaries of Koorainghat Creek. Lined, diversion banks exist above the existing cutting on the site and were installed during the construction of the Taree Bypass. Two existing sedimentation basins, also installed for the Taree Bypass, are located on site at chainage 161450 approximately (adjacent to Fords Road at the southern end of Cut B) and 162150 approximately. These basin are relatively small and may need to be enlarged to be able to serve the quarry site. Sedimentation basins would be sized during the design phase of the project. All basins will require EPA licensing to enable overflow discharge to the stormwater system (refer Outline Erosion and Sediment Control Plan below).

Because the proposed quarry site extends from the Taree Bypass to the top of the ridge and location of the old highway, there is virtually no up-slope catchment. Therefore, minimal diversion banks would be required to divert up-slope runoff from around the site. Almost the entire site will drain towards the Taree Bypass to the east in the Koorainghat Creek catchment.

To ensure that sediment laden runoff does not enter local watercourses a range of erosion and sedimentation control measures would be implemented according to an outline Erosion and Sediment Control Plan which would be further developed by the contractor in the EMP during the

preparation of the Quarry Management Plan. Soil and vegetation disturbance would be confined to the minimum necessary area to carry out the extraction of the material in order to reduce the extent of exposed material with potential to transport to the watercourses. Stockpiles would be protected by the diversion of runoff away from the stockpile and other disturbed land towards sedimentation basin(s) Longer term stock piles would be revegetated with sterile grass species to stabilise the material and reduce erosion potential. These measures would be implemented and monitored as outlined in the Environmental Management Plan to be prepared. An Outline Erosion and Sedimentation Control Plan is attached as Figure 6.1 and provides a basis for contractors to prepare an ESCP specific to their proposed work method.

6.3.1 Safeguards Prior to Quarry Works

Before construction commences a number of erosion and sediment control measures would need to be implemented as follows:

- buffer strips would be maintained for as long as practicable adjacent to drainage lines with existing vegetation retained and sediment fenced installed adjacent to improve the quality of runoff from the quarry site prior to entering local streams.
- sediment fences would be erected adjacent to the buffer strips and downslopes of the quarry site.
- diversion banks and channels would be constructed along contours and above cuts to reduce runoff peaks and erosion rates (peak runoff is reduced by the increased overall travel time afforded by the longer flow distance; erosion is reduced due to slower velocities along the contour compared with directly downslope velocities)
- sediment basins would be constructed at the receiving end of the diversion banks to intercept and retain sediment from runoff
- sediment basins would be designed to take account of peak flows, including rates, volumes and sediment yield from the contributing catchment
- sediment basins would be fitted with outflow baffles to prevent the discharge of any oil and grease products
- excess water would be treated, if necessary, prior to release to ensure that water quality is acceptable
- a preliminary assessment of the erosion potential (soil erodibility) of the area likely to be disturbed by clearing and earthworks would be undertaken to quantify the anticipated surface runoff flows and associated sediment loads for the site
- design of site specific erosion and sedimentation control measures would be based on accurate on-site drainage flows and soil properties
- work activities would be staged to minimise the extent of disturbed land at any given time to ensure that disturbed areas are manageable and adequately protected by effective soil erosion and sediment control measures at all times

6.3.2 Safeguards for the Quarry Operation Stage

The most significant potential impact during construction would be soil erosion from exposed areas and subsequent downstream pollution with sediment, dissolved salts, organic matter and other associated material. The soils of the study area do have a moderate clay content.

Environmental effects of sediment pollution are mainly due to the smaller clay sized particles known as colloids. Colloids have a very high surface area available for pollutants to absorb to, are easily suspended in runoff and are difficult to remove by physical sedimentation processes. Their presence results in increased turbidity. This reduces light penetration and impedes aquatic plant growth and reduces the visual quality and amenity value of water ways. Sediments containing high concentrations of phosphorus and nitrogen can cause excessive growth of algae and other water plants leading to the eutrophication and degradation of the aquatic habitat. Heavy metals and pesticides previously absorbed to sediments can be released, with increasing toxicity through bioaccumulation.

The following specific practices would be included in developing a range of site specific water quality controls as well as influencing the formulation of the Erosion and Sediment Control Plan:

> timely installation of control measures and regular monitoring to ensure their adequacy and performance
> where practical maintain natural or grassed buffer zones between the disturbed land boundary and environmentally sensitive areas such as the Kiwarrak state forest
> periodic desilting of sedimentation basins to ensure adequate runoff holding capacities at all times
> stabilise batters and disturbed areas to reduce exposed land as works progress from one section into the next
> minimise the amount of runoff which is sediment laden
> keep sediment laden water separate from clean runoff
> re-use sediment laden water on-site
> treat excess contaminated water on site to an acceptable standard for release
> the smallest possible area of land would be exposed for the shortest possible time
> where topsoil is excavated it would be stripped, stockpiled and stored for reuse in revegetation works
> stockpiles would be stored outside hazard areas and protected with temporary control measures such as being revegetated with sterile crop species
> erosion and sediment control measures would be maintained by regular inspection
> temporary revegetation on regraded, cleared or disturbed land would be undertaken to provide soil stabilisation during construction. Seeding would be carried out by hydro seeding and/or hydro mulching
> in areas of dispersive soils, water in sedimentation ponds may require flocculation be to aid in the settling of the colloidal particle fractions prior to release
> sedimentation basins would be emptied as required to retain capacity to contain design storm events

Principles and practices relating to construction methods, access arrangements and site management for the Proposal would include the following:

> construction activities would be confined within the proposed quarry site
> all temporary access tracks would be constructed using clean aggregate, have site specific erosion and sediment controls and be rehabilitated following construction
> reuse of water on site, from sedimentation ponds, would be maximised for purposes such as washing of construction equipment, dust suppression and watering of revegetated areas
> areas for storage of oils and other hazardous liquids used during construction would be bunded and any spillage would be collected and disposed of off-site at an approved facility
> stockpile areas would be located away from flood plains and drainage lines and would have site specific erosion and sediment controls including silt fences downslope and diversion banks or drains on the up-slope side
> ongoing monitoring of water quality in receiving waters of the construction site

6.3.3 Rehabilitation Stage Safeguards

Measures would be implemented to mitigate the potential adverse long term effect of erosion, sedimentation and pollution on water quality in the study area. Water quality in the study area could be affected following rehabilitation of the site as a result of further erosion from inadequate implementation of surface stabilisation treatments and revegetation programs.

The RTA Water Policy is to incorporate controls into design to ensure that the existing natural overland flows and groundwater regimes in and around construction sites are either retained or will have only minimum alterations. Appropriate technologies to contain and treat runoff to avoid or minimise impacts on sensitive aquatic environments are to be incorporated into the quarry design.

To meet this policy the RTA has already implemented a system of road shoulder swales and water pollution control ponds to protect the sensitive aquatic environments of the immediate catchment from the effects of direct discharge of stormwater and the escape of spillage from the Taree Bypass.

Other measures to be undertaken to mitigate long-term effects of the quarry would include:

> removal of temporary control measures put in place during construction including removing sediments, nutrients and pollutants in stormwater from the rehabilitated quarry.
> batters and exposed areas would be revegetated through hydro seeding, hydro mulching and subsequent mulching and watering
> undertake a long term maintenance of permanent control measures
> establish a water quality monitoring programme that would extend into the post-construction phase of the quarry to ensure that water quality goals were being met

Summary of ESD Principles

Precautionary Principle	Intergenerational Equity	Conservation of Biological Diversity
Consideration of water quality impacts during both the operation and revegetation phases of the quarry have been included in this assessment. Erosion and sedimentation control measures would be implemented throughout the entire project.	No loss of water quality would result from this project. Drainage and water quality would be ensured through the erosion and sedimentation control plan. The final proposed batters would be far less susceptible to erosion and hence degradation of water quality as they would be less in grade and revegetated.	Water quality issues associated with the project would not result in the loss of genetic, species or ecosystem diversity.

6.4 Noise and Vibration

Existing noise and vibration levels and the expected impacts associated with the proposed fill material quarry have been assessed by Atkins Acoustics. The noise assessment report can be found in Appendix F, and its findings are outlined below.

Noise impacts of material excavation would be confined to the day time only and would be associated with the use of equipment such as dozers and excavators. Haulage and loading of embankment material by truck may take place over 24 hours. The overall duration of the quarry operation period would be between 8 and 18 months, while blasting and the use of explosives, if required, would be of short duration in relation to specific geotechnical conditions encountered.

During the quarry operation period, pre-splitting and overburden blasting may be required at both cuts to excavate any hard rock and associated fill material. Such blasting would generate ground-borne vibration and air blast wave over-pressure. Both phenomena, if not controlled, can cause damage to structures. Local residents that are likely to be affected by the by blasting activities would be notified prior to the blast. The homes of the closest residents would be inspected before and after the blast to determine whether any structural damage has been sustained.

6.4.1 Existing Noise Levels

Field survey results from Atkins Acoustics (1998), undertaken for the proposed quarry site in order to ascertain the "usual" background levels at the closest resident (Thrifty/Henderson),

located on Fords Road. The noise measurement results indicated that the daytime background level (L_{A90}) noise levels ranged between 33-45 dB(A), with an average minimum level of 40 dB(A). During the daytime hours the average maximum (L_{A10}) noise levels were generally 8 to 10 dB(A) higher than the background levels (ie 41-55 dB(A)).

6.4.2 Noise and Vibration Assessment Criteria

Plant and Equipment Noise Criteria

For the evaluation of the noise levels during the operation of the quarry, the EPA normally recommend that the source (L_{A10}) noise level from the proposal should not exceed the existing background (L_{A90}) by more than 5dB(A) when assessed at or on the nearest noise sensitive property, and that the level derived by this method should comply with the recommended outdoor background noise levels (EPA, Environmental Noise Control Manual (ENCM) in the Atkins Acoustics report, 1998).

According to the ENCM, the recommended daytime background noise level for assessment purposes is 45-50dB(A) for "rural" areas similar to the developed areas in proximity to the proposed quarry site. Atkins Acoustics' report recommends that based on the measured background levels and the EPA noise level criteria that "noise from the site activities when assessed as an L_{A10} shall not result in a noise contribution exceeding 45dB(A) when assessed at any residential property".

Atkin Acoustic's report states that it is generally acknowledged that an appreciable change to road traffic noise is represented by an increase of 3dB(A) or greater.

Vibration Criteria

Weighted curves are provided in the EPA"s ENCM for the assessment of vibration levels. Other applicable assessment criteria includes the British Standard B56472, which nominates vibration levels for assessing human comfort in buildings, and the German Standard DIN 4150, which prescribes guidelines for evaluating the affects of vibration on structures. These are summarised in the Atkins Acoustics report in Appendix F.

Blasting Criteria

EPA's ENCM also provides criteria for the assessment of ground vibration and airblast impacts from blasting based on human comfort. Structural damage criteria from ground vibration can be found in the Australian Standard Explosives Code AS 2187.2-1993. Again, these criteria are summarised in the Atkins Acoustics Report, (Appendix F).

6.4.3 Assessment of Expected Noise and Vibration Impacts

Plant and Equipment Noise Impacts

Predicted noise levels for the proposed fill material quarry has been determined for the closest residential property on Fords Road by Atkin Acoustics and are included in Table 7 of Appendix F. It is noted that the maximum noise level is likely to occur when quarrying works are operating at the top of the batter slopes, especially at the southern end of the Fords Road Realignment work. These levels have been estimated to be in the order of 50-55dB(A), but may be as high as 60dB(A), exceeding the recommended assessment goal of 45dB(A). It is noted by Atkin Acoustics that, other than plant selection, there is little opportunity to reduce noise levels, and recommends that the plant and equipment be operated with mufflers and appropriate noise controls and work practices be adopted to minimise potential noise.

Although the maximum hourly throughput of trucks is likely to be 25/hour at the quarry, the predicted increase in traffic noise generated by construction traffic would be in the order of $L_{A10, 1hr}$

0.96dB(A). Based on the premise that an appreciable noise increase is greater than 3dB(A) (Atkin Acoustics), the additional noise impact caused be construction traffic along the Taree Bypass during the operation of the quarry would be minimal.

Vibration Impacts

Ground vibration from the double this amount (50 trucks/hour)site is likely to be mainly associated with rock breakers and a typical vibration level .40m from the site will generally be below 0.2mm/sec (Atkin Acoustics, 1998), well below a level that would be perceived at the residential properties 256-300m from the closest portion of the site.

Blasting Impacts

The energy of a blasting activities can quickly dissipate through the ground depending on geology. Considering the predicted ground vibration and peak airblast at varying distances from airblast location, developed by Atkin Acoustics, EPA comfort criteria and building damage criteria would be met. The ground vibration and airblast levels would be monitored during any blasting activities. Blasting would be managed according to RTA Guidelines to avoid damage to adjacent pavement and highway structures.

6.4.4 Safeguards for Noise and Vibration Impacts

The management of noise and vibration would form part of an Environmental Management Plan to ensure impacts are mitigated. The following measures were identified by Atkins Acoustics for inclusion in the Construction Noise Management Plan component of the EMP:

> the selection and operation of plant and equipment to be based on acoustical performance where practicable

> the use of appropriate plant and equipment to minimise potential noise impacts

> the implementation of a noise monitoring program to ensure that `best practice' is being implemented

> the initiation of a program to inform residents of any changes to the envisaged site works or time when impacts may be experienced. If blasting is required, pre and post inspections of the closest buildings would be undertaken

Summary of ESD Principles

Precautionary Principle	Intergenerational Equity	Improved Valuation
Noise monitoring and modelling of impacts associated with the project have been undertaken. Construction and operation activities would not result in noise levels above the EPA goals at the closest residence. These impacts are predicable and mitigation measures are available.	Available mitigation measures for those properties affected by noise would ensure that noise impacts would not result in a depreciation to the environment for future generations.	The appraisal of noise control measures would be based on an economic valuation taking into account the environmental and social constraints of the setting.

6.5 Biological Environment

A detailed flora and fauna study of the highway corridor including the quarry area was undertaken as a component of the Taree Traffic Relief Route EIS (Gutteridge, Haskins and

Davey, 1990). A supplementary Fauna Impact Statement (FIS) of the preferred bypass route was undertaken by SWC Wetlands & Ecological Management Consultancy (1993). An ecological survey of the specific quarry study area was undertaken by Connell Wagner in August 1997 and again in April 1998 with a search for threatened species in the pockets of native vegetation which are proposed to be cleared as a result of the quarry proposal.

6.5.1 Flora

Flora Survey Methods

Two flora surveys of the study area were undertaken by Connell Wagner. The first was a reconnaissance survey undertaken in August 1997 involving walked transects of the three isolated patches of forest. A two hour random search for threatened flora species was also undertaken at this time to determine whether any threatened or otherwise significant species were present in the area to be removed. This survey provided a vegetation map for the study area (refer Figure 6.2).

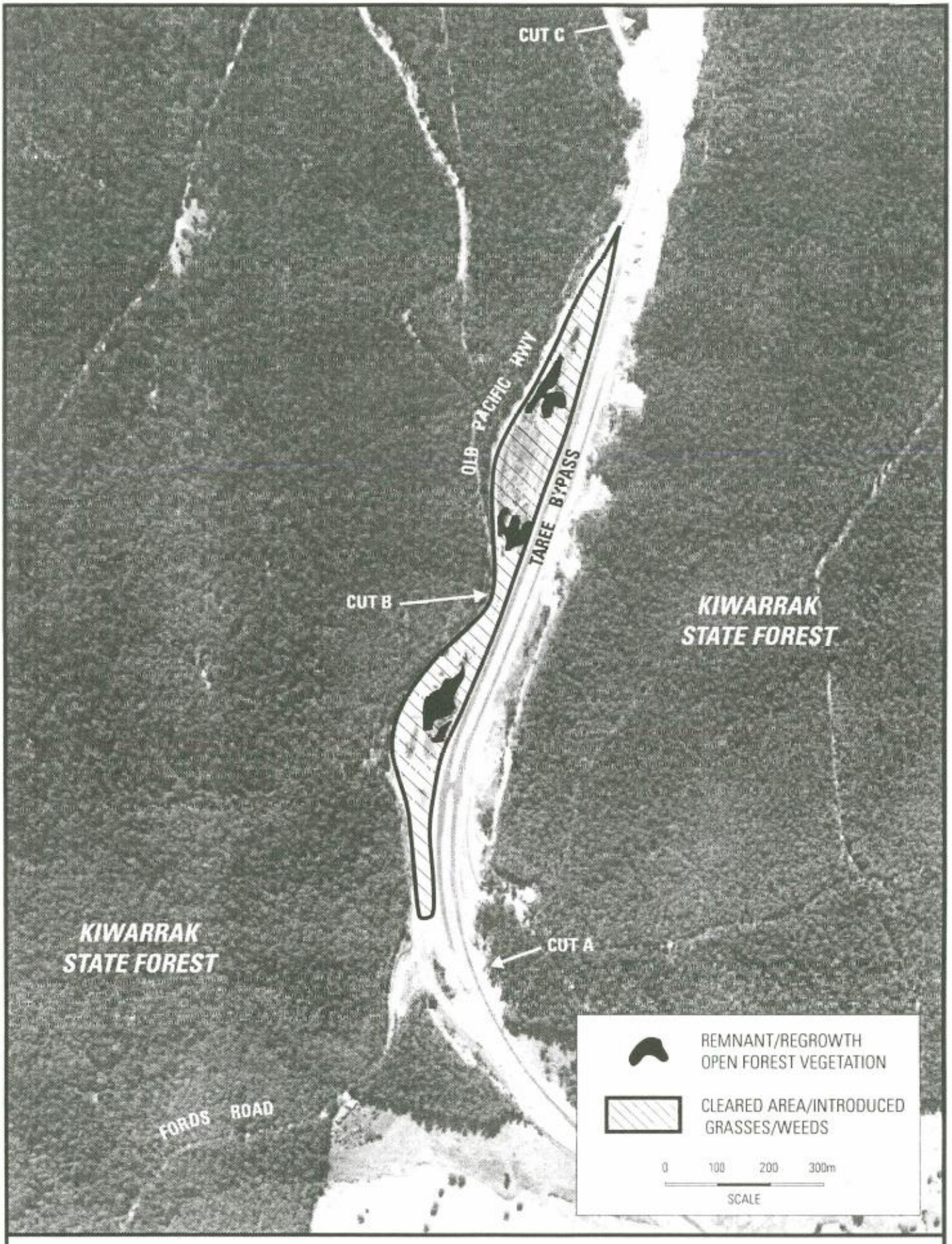
A more detailed survey of the study area was then undertaken between 29th and 2nd May 1998. This survey also involved walking random patterns throughout the study area in addition to sampling at least two 10m x 10m plots in each isolated patch of forest (depending on its relative size). The endemic vegetation community identified in the study area during the fieldwork was characterised according to its structure floristics and habitat. This survey also included a random 2 hour search for any threatened flora species within the forest remnants.

Flora Communities

The flora of the study area between the former highway and the Taree Bypass is predominantly introduced grasses and roadside weeds, growing on overburden and fill. Three small patches of logged native forest, approximately 1.5ha in total, occur on natural ground surface (refer Figure 6.2).

The study area is surrounded by Kiwarrak State Forest in which the dominant vegetation communities are Open Dry Sclerophyll Forest (Grey Gum/Grey Ironbark Dominant), and Open Dry Sclerophyll Forest (Blackbutt Dominant). Few trees with a breadth height diameter greater than 30-40cm are evident indicating relatively recent harvesting.

The remnant patches of native vegetation on the cut batters are dominated by the former community where Grey Gum (*Eucalyptus punctata*) and Grey Ironbark (*Eucalyptus paniculata*) are co-dominant with overstorey components including Forest Oak (*Allocasuarina torulosa*), Spotted Gum (*Eucalyptus maculata*) and White Mahogany (*Eucalyptus acmenoides*). The understorey of this community is sparse and open, dominated by Kangaroo Grass (*Themeda australis*), Blady Grass (*Imperata cylindrica*), Paspalum (*Paspalum dilatatum*) and Bracken (*Pteridium esculentum*). Less prevalent understorey shrub species include *Leucopogon juniperinum*, *Dillwynia retorta*, *Acacia myrtifolia* and the introduced *Lantana camara*, *Chloris gayana*, *Rubus sp* and *Verbena bonariensis*. The floristics of the community are shown below in Table 6.1.



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FIGURE 6.2
VEGETATION PLAN

Table 6.1: Plant Community Description

Community	Structure			Dominant Species	
	Strata	Height	% Cover	Overstorey	Understorey
Dry Sclerophyll Open Forest (*E. punctata, E. paniculata)*	Trees: Sm Trees: Shrubs: G. Layer:	15m 5-8m 1-5m <2m	20-30% 10-30% 5-30% 10-50%	*E. punctata* *E. paniculata* *E. maculata* *A. torulosa*	*Themeda australis* *Imperata cylindrica* *Paspalum dilatatum* *Pteridium esculentum* *Chloris gayana*

Threatened or Significant Plant Species

Gutteridge, Haskins and Davey (1990) indicated that no threatened or significant plant species were located within the area surrounding the cut batters on the Taree Traffic Relief Route. Nor were any threatened or significant plant species located during plot surveys and two random 2 hour searches undertaken by Connell Wagner in August 1997 and April 1998. Additionally, correspondence from NPWS regarding the proposal and a search of the Wildlife Atlas does not indicate that any threatened flora species have been found in the vicinity of the study area. There is not expected to be a significant effect on any threatened flora species as a result of the proposal.

Flora Impacts and Proposed Safeguards

Several small, isolated parcels of native vegetation between the old and new highways (combined total of approximately 1.5 hectares), owned by State Forests NSW, on the cut batters would be required to be removed. The stands comprise Open Dry Sclerophyll Forest as detailed above, however, they have all been considerably altered from their natural state and the understorey has been invaded by introduced species such as *Paspalum dilatatum*, *Lantana camara*, *Chloris gayana* and *Verbena bonariensis*. The remnants have been logged in the last 20 years and no old trees with hallows are apparent. The majority of trees have diameters of 15-45 cm dbh (mostly 30cmdbh).

The stands of vegetation on the cut batters are isolated between the existing Pacific Highway and the new Highway and do not form any part of a continuous vegetation or fauna corridor not already affected by these transport corridors. Subsequently, the removal of these small stands of vegetation does not represent a significant impact on local vegetation given their isolation and altered state and the large expanse of this vegetation community occurring in the surrounding Kiwarrak State Forest. Temporary fencing would be proposed to prevent any straying or unnecessary clearing of native vegetation by machinery during the quarrying activities.

A landscape plan would be implemented on the final batters by way of a contractual agreement with the operator(s). Locally collected seed and tube stock, if required, would be planted to restore the native vegetation and provide plant cover for erosion control purposes

6.5.2 Fauna

A fauna survey of the Taree Traffic Relief Route was undertaken by Kendall and Kendall Environmental & Ecological Consultants (1990) along the southern forested section of the route corridor, incorporating sites near the study area of the current proposal. A supplementary Fauna Impact Statement was undertaken by SWC Wetlands & Ecological Management Consultants (1993). Connell Wagner additionally undertook small mammal trapping and spotlighting traverses within the study area. This survey was undertaken between 29th of April and 1st of May and involved 2 days and 2 nights of fieldwork (refer below).

Fauna Habitat

Logged, Open Dry Sclerophyll Forest (Grey Gum/Grey Ironbark dominant), formed the habitat within the immediate surrounds of the cut batters. This habitat appears to have been extensively logged in the past, as the majority of trees are of uniform age (dbh 30cm). The trees lack hollows, which could provide den sites for fauna such as arboreal mammals and it is considered that the lack of hollows would be a limiting resource for the utilisation of this habitat by hollow dependent fauna, including arboreal mammals, birds and reptiles. Leaf litter is very shallow in this habitat, to an approximate depth of 1-2cm. Ground litter, such as fallen logs is generally sparse (SWC, 1993).

Fauna Survey Methods

A detailed fauna survey was undertaken within the study area by Connell Wagner between 29th April and 1st of May involving 2 days and 2 nights of fieldwork. Fieldwork involved investigations of terrestrial and arboreal mammals, birds, reptiles and frogs at each of the three isolated patches of open forest (totally 1.5ha). The survey procedures involved habitat searches, avifaunal transects and spotlighting for 4 hours (using a 50 watt torch) over a two-night period. Weather conditions during this period were fine and warm with an average temperature of 20-25^{o}C. Daytime avifaunal transects and habitat searches were made of the entire length of each of the patches of forest (1.5 hours duration each) noting any incidental species.

Small mammal trapping was also employed at each of the three sites including the use of Elliot A and B traps, hair tubes and cage traps. The traps were left for a period of two nights and were checked and re-baited (if necessary) early each morning. Species captured in the traps were noted and then released. In total, 10 Elliot A traps, 5 Elliot B traps, 4 hair tubes (2 x 6cm diameter and 2 x 10cm diameter) and 2 cage traps were employed over each of the three areas for two nights having a combined total of 126 trap nights for an area of habitat totalling around 1.5ha.

Observed and Predicted Fauna

A total of 4 mammal species (1 introduced), 16 bird species and 3 reptile species were observed within the study area. A further 2 mammal species (Grey-headed Flying Fox and Sugar Glider) were heard calling from within bushland in the State Forest to the west of the study area. The Eastern Whipbird was also heard calling from west of the study area. A full list of observed and predicted fauna species is attached as Appendix I.

The mammal trapping captured the following species: Brown Antechinus (*Antechinus stuartii*), Bush Rat (*Rattus fuscipes*) and House Mouse (*Mus musculus*). Additionally, a feral cat (*Felis cattus*) was caught in one of the cage traps. No hairs were obtained from any of the hair tubes. No significant herpatafauna were observed or heard call. No evidence of Koala were located on site.

Spotlighting of the study area did not locate any arboreal mammals in any of the three small patches of open forest. The only fauna species observed during the nocturnal survey of the study area was a Tawny Frogmouth. However, several Sugar Gliders and Grey-headed Flying Foxes were heard calling from within bushland to the west of the study area. The proximity to the highway, back of mature trees with hollows and also the isolation of the patches of open forest from the remainder of the State Forest is likely to be the reason for the generally low numbers of fauna species observed in the study area.

Threatened or Significant Fauna Species

SWC (1993) report that five threatened fauna species were located along the length of the Taree Traffic Relief Route - Koala (*Phascolarctos cinereus*), Powerful Owl (*Ninox strenua*), Common Planigale (*Planigale maculata*), Eastern Little Mastiff Bat (*Mormopteris norfolkensis*) and Little Bent-wing Bat (*Miniopterus australis*). Correspondence from NPWS regarding the proposal note

that the following additional threatened fauna species have been previously recorded within Kiwarrak State Forest: Glossy Black Cockatoo (*Calyptorhynchus lathami*), Square-tailed Kite (*Lophoictina isura*), Sooty Owl (*Tyto tenebricosa*), Brush-tailed Phascogale (*Phascogale tapoatafa*), Squirrel Glider (*Petaurus norfolcencis*), Tiger Quoll (*Dasyurus maculata*), Yellow-bellied Glider (*Petaurus australis*) and Fishing Bat (*Myotis adversus*). An analysis of the local distribution and habitat preferances of the listed species (refer below) indicated that only the koala has the potential to occor and utilise habitats that would be disturbed within the study area. The koala is therefore the subject of our Eight Part Test according to Section 5A of the EP&A Act (Refer below " Eight Part Test - Koala"). Therefore of these species, it is considered that only the Koala has the potential to be impacted upon by this proposal for the reasons outlined below.

The Powerful Owl and Square-tailed Kite have specific tree hollow and canopy requirements for nesting and foraging and are usually associated with forests containing mature trees that are rich in passerines (SWC, 1993). The habitat adjacent to the cut batters of the study area do not provide for the requirements of the Powerful Owl or the Square-tailed Kite and it is therefore considered that this proposal would not have a significant impact on these species with respect to the removal of nesting habitat. As the disturbance, isolation and lack of shelter trees for arboreal fauna reduce the value of the study area for the prey to the Powerful Owl and Square-tailed Kite, there would not be a significant loss in foraging habitat.

The Sooty Owl is found in tall, wet old growth forest on fertile soils with a dense understorey in south- eastern Australia. The habitat of the study area is logged dry sclerophyll forest and does not correspond with the favoured habitat of this bird. It is therefore considered unlikely that this species would be found to use the resources found within the study area and therefore unlikely that the proposal will effect this species.

The Glossy Black Cockatoo is a specialised Casuarina nut feeder, generally inhabiting eucalypt woodland which contains a plentiful supply of *Casuarina* and *Allocasuarina* species. The study area contains few mature *Allocasuarina* (<10 trees) which would attract this species to the isolated patches of woodland. This species was not detected during the Fauna Impact Statement of the Taree Traffic Route (SWC, 1993) and it is therefore considered that the NPWS record of this species is from further within Kiwarrak State Forest.

The Little Bent-wing Bat and Eastern Little Mastiff Bat both rely upon caves and structures such as buildings or tree hollows as diurnal roosts. Major maternal nurseries are also generally found in caves. It is predicted that neither of these species would breed within the study area due to the absence of suitable nursery and roost sites (SWC, 1993). It is therefore considered unlikely that this proposal would have a significant impact on the breeding or roosting habitat of these species. The loss and eventual replacement of a small area of potential foraging habitat is not considered significant in the context of the large area of surrounding more suitable habitat of these species.

The Fishing Bat (or Large Footed Myotis) is also found in caves, mines or tunnels, under bridges or in buildings. Colonies of this species are never located far from waterbodies where they swoop over the water and rake the surface for insects which constitute most of their diet. The closest major watercourse to the study area is Stitts Creek, located approximately 500-600m west of the area. It is therefore considered unlikely that this species would inhabit the study area given the lack of suitable roosting structures and distance from a suitable water body.

The Squirrel Glider and Yellow-bellied Glider are both inhabitants of tall eucalypt forest and woodland in eastern Australia. Both species roost during the day in leaf-lined nests in tree holes. Incisions or grooves in the trunks of trees are common indicators that these species have been feeding in the area, drawing the gummy exudates from the eucalypts or acacias. An inspection of the trees of the study area for these characteristic grooves did not locate any. Again, given the lack of tree hollows, isolation from the remainder of the State Forest and proximity to the highway it is considered unlikely that either of these species would utilise the small patches of vegetation within the study area.

The Common Planigale inhabits a variety of habitats including rainforest, sclerophyll forests, grasslands to marshlands, and rocky areas. This species, however, generally requires structures such as fallen logs or rocks for diurnal roosts. The absence of any fallen logs, rock outcrops or other suitable structures within the study area limits the potential for this species to occur. It is considered more likely that this species would have been detected further within Kiwarrak State Forest where the groundcover is denser and there is a plentiful supply of prey.

The Tiger Quoll inhabits a range of vegetation types from rainforest to heath, while the Brush-tailed Phascogale lives in dry sclerophyll open forest. Both species sleep by day usually in tree hollows, fallen logs or rock crevices. Again, given the lack of tree hollows, isolation from the remainder of the State Forest and proximity to the highway it is considered unlikely that either of these species would utilise the small patches of vegetation within the study area. Additionally, being carnivorous animals the Tiger Quoll and Brush-tailed Phascogale are more likely to inhabit the less disturbed areas of Kiwarrak State Forest where prey species are plentiful.

The survey of the study area revealed that no resident Koala populations were located in the study area nor was there any evidence of koalas (droppings, scratch marks) found around any of the Tallowwoods or Grey Gums occurring in the study area. Four Koala road kills have been reported within the Kiwarrak State Forest component of the Taree Traffic Relief Route in the past 12-18, months indicating the presence of Koala population within the district. Further study of the road kill site by SWC (1993) indicates that an area located 100m north of Cut C, forms part of a Koala movement corridor between forested areas to the north-east of the existing Pacific Highway, and forested habitat to the west (towards Tinonee). It is not known, however, if the four documented road mortalities were dispersing individuals, and what significance these road kills are to the local population of Koala.

It is noted that the existing cut batters are very steep and may be avoided by Koalas, most likely crossing at points which occur at road level or at the cut/fill interface. A koala/wildlife underpass and barrier fencing has been built approximately 300m north of the proposed works. The barrier fencing does not extend into the quarry area.

Fauna Impacts and Proposed Safeguards

A direct impact of the proposal on fauna habitat will be the removal of around 1.5ha of disturbed open forest on the crest of the cut batters between the existing Pacific Highway and the new Highway, thereby resulting in the loss of habitat mostly as a foraging resource for fauna species mostly residing in the adjacent State Forest. The clearing of this area of vegetation is not considered to constitute a significant impact upon the habitat of more mobile species such as avifauna and bats, and it is considered unlikely that sedentary species would rely on the habitat of these parcels of vegetation given their isolation from the remainder of Kiwarrak State Forest between the Old Pacific Highway and the Taree Bypass.

It is unlikely that the Koala would reside or forage in the trees contained within the 1.5ha area of open forest which is proposed to be removed, given the relative lack of preferred food trees and also its isolation from the larger stands of vegetation contained within Kiwarrak State Forest. However, the increased traffic movement along the new highway during the haulage stage of the proposal may represent a marginal increase in the risk of road kill to the Koala as they move between different areas of the State Forest.

Several ameliorative measures have been proposed (SWC, 1993) to reduce the potential impact of the Taree Traffic Relief Route on the Koala. These measures include exclusion fencing, fauna underpasses, increased signage and awareness to motorists and monitoring. As final cut batters would be less steep, Koala movement towards the Taree Bypass may be made easier. It is therefore proposed to extend the existing exclusion fencing southwards above Cut B as far as Fords Road. It would be appropriate to erect this fence on the eastern side of any access road to Four Mill Hill Lookout. Other fauna safeguards include the proposed landscape planting on the final batters with native species and measures to protect aquatic habitats through erosion and

sedimentation controls described in Section 7.

Eight Part Test - Koala

Section 5A of the Environmental Planning and Assessment 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 communities, and whether or not a Species Impact Statement is required prior to a development being approved. As there is the potential for there to be some impact upon the Koala as a result of the proposal, an eight-part test has been applied to this species.

(a) *"in the case of threatened species, whether the life cycle of the species is likely to be disrupted such that a viable population of the species is likely to be placed at risk of extinction"*

Along the Taree Bypass alignment, SWC (1993) found the populations of Koalas to be closely linked to tree species occurring on high nutrient soils, such as those of river valleys. Such prime foraging habitat is found north of Old Bar Road adjacent to Halls Creek (approximately 2.5km north of the study area). There will be no direct impact on this habitat area as a result of the proposal as the quarry would involve only the removal less preferred ridge crest vegetation on shallow soils.

Koalas are found to utilise a small number of species of eucalypts for foraging and habitat. Koalas have been most frequently recorded foraging in the following eucalypt species: *Eucalyptus salignus, E. tereticornis, E. punctata, E. pilularis, E. microcorys* and *E. grandis* on the mid north coast. The small area of vegetation to be removed from the cut batters does not contain an expanse of any of the above listed eucalypt species and it is therefore considered unlikely that a Koala population would reside in this small patch of vegetation (only several small *E.punctata* and E.microcorys were observed). Also, given the separation of this area of vegetation from the remainder of Kiwarrak State Forest by roads it is further unlikely that a population of Koala's would regularly use this small area of vegetation.

Haulage trucks transporting the material north to Coopernook would use the Taree Traffic Relief Route, of which a small area north of the study area has been identified by SWC (1993) as a potential Koala crossing. Ameliorative measures have been recommended in the Fauna Impact Statement (1993) including exclusion fencing, fauna underpasses and increased awareness to motorists, in order to reduce the potential for road kill of the Koala. As the batters on in the quarry would be made less steep and more accessible for koalas it is proposed to extend the existing koala exclusion fence south to Fords Road to prevent any further roadkill as a result of the project.

Given the above factors, it is considered unlikely that the life cycle of the Koala would be disrupted by this proposal as it would not result in any new impact over the existing situation.

(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"*

No endangered populations in Part 2 of Schedule 1 of the TSC Act, 1995 are listed for the region. Similarly, the population of the Koala would not be disrupted to the extent that the viability of the population would be significantly compromised for the reasons given above in (a). The quarry activities would not have an additional effect on roadkill over the impact of the newly opened Taree Bypass.

(c) *"in relation to regional distribution of the habitat of a threatened species, population or ecological community, whether a significant area of known habitats are to be modified or removed"*

The area of sub-optimal logged dry sclerophyll forest habitat proposed to be removed constitutes a very small proportion of the area of the surrounding Kiwarrak State Forest. Furthermore, the habitat contained within the area to be removed does not represent potential Koala habitat nor does it form a continuous area of fauna habitat.

(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"*

The existing Pacific Highway and the Taree Traffic Relief Route have both isolated areas of potential Koala habitat within Kiwarrak State Forest. The current proposal will not further isolate populations as the proposed works are to occur in an already isolated portion of forest between the parallel old and new highway alignments. A fauna underpass has been constructed beneath the Taree Bypass 300 m north of Cut B. The proposed extension of the fence would enhance this measure.

(e) *"whether critical habitat will be affected"*

Relevant critical habitats to the study area are not listed in schedules to the TSC Act, 1995. However, given the lack of preferred food trees in the small area of vegetation to be remove and its isolation from the remainder of the State Forest, it is considered unlikely that this area would constitute critical habitat.

(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"*

Locally, the forested lands within Kiwarrak State Forest provide adequate foraging potential for Koala populations likely to occur within the region. Regionally, potential foraging habitat for the Koala is located in Yarratt, Lansdowne, Coopernook and Lorne State Forests as well as Crowdy Bay National Park. The adjacent State Forest has been recognised as having a conservation investigation classification by State Forests and NPWS.

(g) *"whether the development or activity proposed is of a class of development or activity that is recognised as a threatening process"*

Relevant threatening processes such as predation by the European Fox would not be influenced by this proposal.

(h) *"whether any threatened species, population or ecological community is at the limit of their distribution"*

A 1986-87 survey (Reed et al 1991) on the distribution of Koalas in eastern Australia found that populations of the Koala are concentrated mainly on the north coast of NSW as far north as Townsville in Qld, although they also have an extensive but highly fragmented distribution west of the Great Divide and in the southern half of the State and into Victoria. Therefore, the Koala is not at its limit of distribution within the study area.

Summary of ESD Principles

Precautionary Principle	Intergenerational Equity	Conservation of Biological Diversity
The quarry selection process incorporated consideration of flora issues. Consultation was undertaken with NPWS and followed by detailed surveys of the route. The project will impact on a small area of vegetation which is already isolated between the two road alignments. Landscaping with native vegetation would ensure that no serious or irreversible damage is caused to the local environment.	No significant flora species would be lost as a result of the project and each of the vegetation communities are well represented within the adjoining State Forest. No species or community would be further endangered by the proposal.	The study area is predominantly disturbed and isolated between two road alignments. Vegetation cover is minimal and isolated from the adjoining bushland. The existing cut batters are bare and unable to support vegetation. Notwithstanding this, mitigation measures such as landscaping have been included in the project in order to minimise the impacts on the local environment, including loss of a small isolated area of native trees.

6.6 Visual Environment

6.6.1 Visual Assessment Methodology

A visual appraisal of the site has been undertaken by a Stacey Brodbeck Landscape Architect with Connell Wagner.

Commonly adopted visual assessment methods have been used to minimise the subjective nature of the assessment of visual quality and sensitivity to change, such as those employed by the United States Forest Service (1974), Department of Planning (1988), the Forestry Commission of Tasmania (1983) and the State Pollution Control Commission (1981).

Visual Quality

Visual quality is a measure of the degree to which the visual aesthetics of a landscape is valued. Relevant studies have concluded that landscapes that are relatively natural and vegetated, and those with water features, dramatic topography and contrasting features are favoured by the viewer. Landscapes generally least preferred are those with high amounts of human disturbance and industrial landscapes, landscapes with few trees and those with flat, unvaried topography (Wright, 1973; State Pollution Control Commission, 1981; and Colleran and Gearing, 1980). In terms of the mostly forested environment of the land surrounding the subject site, most people are likely to prefer natural bushland, undulating topography and distant views to more urbanised or mostly cleared artificial landscapes.

Visual Sensitivity

Visual sensitivity is a measure of the degree to which any visual change in the landscape is likely to affect the viewer. Locations normally most sensitive to change are those with high, fixed viewing populations and visually prominent and elevated sites. Also, the closer the viewer is to the site of change the higher the potential for impact. Usually, foreground views (less than 0.5km) are more sensitive than midground views (0.5 to 6.5km), and background or distant views (over

6.5km) are the least sensitive (United States Forest Service, 1994; Department of Conservation, Forests and Lands, undated). The proximity of the quarry site to the Taree Bypass increases its visual sensitivity.

Landscape and Visual Impact

In addition to visual quality and sensitivity considerations, the type and severity of landscape change and the extent which a landscape is represented in the district are also relevant. Aspects of this can include changes in landscape topography, the effect of introducing new elements into the landscape, visual separation or view prevention and landscape segregation. The proposal would actually recreate the existing cut batter landscape some 20-40m further back from the road which would decrease the existing visual impact of the current batters. The proposed batter grades of 2 horizontal to 1 vertical (2:1) are substantially less than the existing batters and would not only improve stability but also enable revegetation of the slopes. Subject to final design the opportunity to bench the final cut batters may be incorporated to facilitate improved regeneration.

To further mitigate the visual impacts during the construction and operation phase of the quarry part of the existing cut batter would be preserved. This earth mound would function as a visual and safety barrier between the existing Pacific Highway and the quarry activities. The barrier would eventually form part of the required fill material and would be excavated as part of the final quarry operations and rehabilitation.

6.6.2 Site Context

The study area is located within Landscape Zone 1A (Upland Forest Terrain) as identified by Land Systems EBC Pty Ltd (in GHD 1990) in their role on the Taree Traffic Relief Route EIS. The visual character of the study area is characterised by rugged and forested terrain mostly included in Kiwarrak State Forest. The forest itself is regarded as having high scenic value, however, the isolated remnants of forest contained between the roads coupled with the high visual intrusion of both the old and the new Highway, including large batter faces, detracts from the local scenic significance of this zone and results in the study area having a lower scenic value. Photographs of the cut batters and surrounds are included in Appendix H.

6.6.3 Visual Catchment

Figure 6.3 shows the effect of the visual catchment of the cutting. It is likely that the visual catchment would actually be reduced due to the quarry of the upper section of the existing cutting which is located on the ridge west.

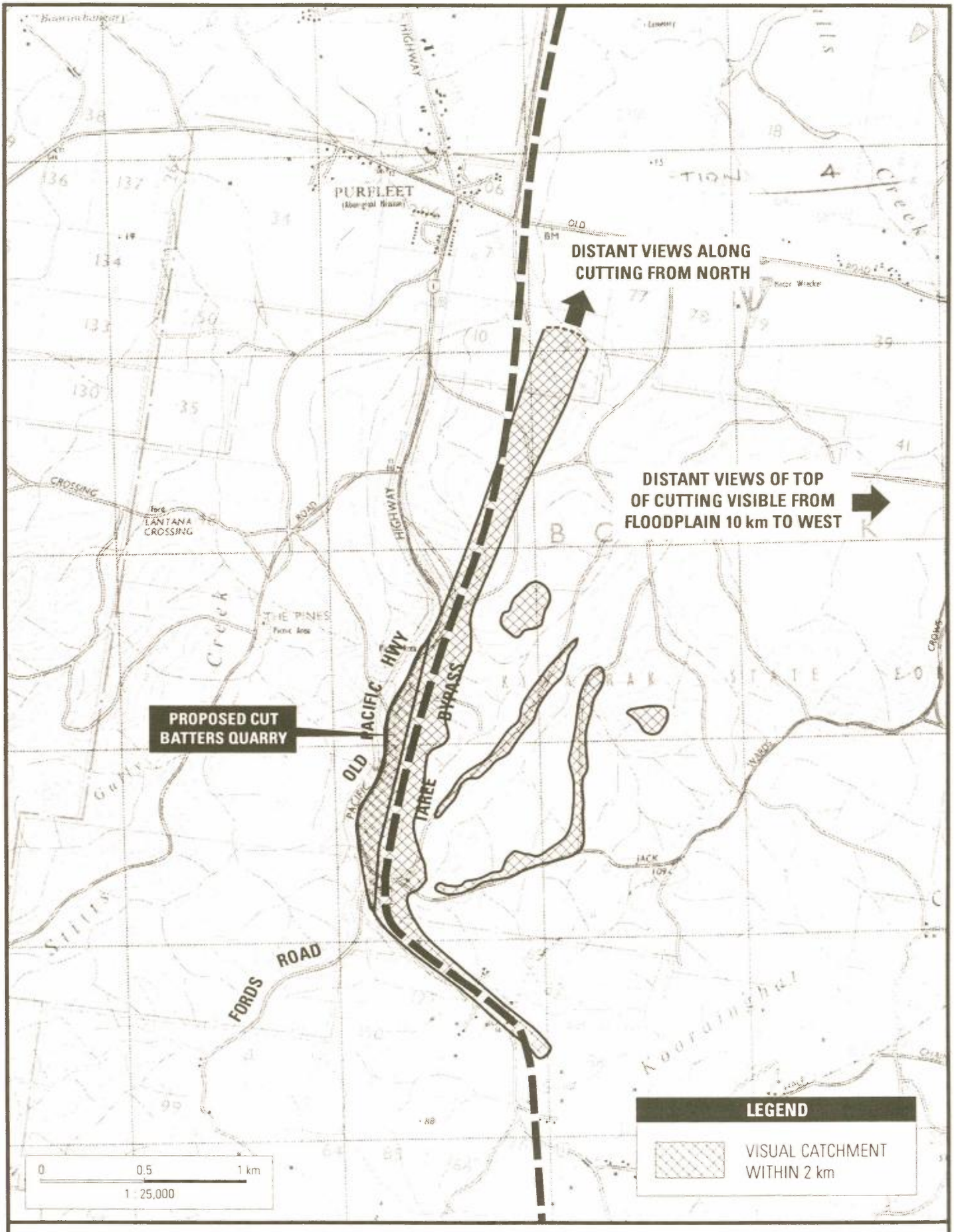
Notwithstanding the ridgetop location of the cutting it has a limited visual catchment beyond the inmideate highway.

The site is not visible from dwelings in Koorainghat but is visible along the straight section of highway north and south of the site. Intermediate distance views of the site are possible from the state forest but not from any popular viewpoints.

The top of the cutting would be less visible from distant view from the east than it is now following excavation.

6.6.4 Proposed Visual Changes and Impact Assessment

The visual landscape of the study area would be altered by the loss of a small patches of native vegetation located on the crest of the cut batters and the progressive loss of material from the cut batters. The visual quality of the quarry whilst in operation is expected to be low as exposed areas of bare rock would be visible and general construction traffic present on site. Once quarrying operations have ceased and landscaping works complete, the appearance of the batter



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FIGURE 6.3
VISUAL CATCHMENT OF PROPOSED TAREE BYPASS CUT BATTERS QUARRY

slopes would be improved and would increase in visual quality as vegetation matures. The new profile of the site would be more gentle without the existing intrusive cut batter faces and with greater opportunity for vegetation regrowth.

The overall visual impact of the removal of the fill material from the cut batters would be minimal as no residences are located within the direct visual catchment of the study area. The main visual intrusion of the quarry operations would be that imposed temporarily on passing motorists.

At the highest point of the site on the top of the ridge, the view extends to the north-east towards Old Bar, and north along the Taree Bypass towards the Manning River floodplain (refer photograph). In these directions, rural properties are visible in the distance. The quarry site would be a background view from these properties, and would consist of the quarry operation at the top of the ridge only. Whilst the quarrying operation would be a new element in the landscape, the visible scale of the works would be limited to the duration of quarry operation whilst the small visible area on top of the ridge is being excavated. As quarrying operations and rehabilitation proceeds, the top of the ridge would be reduced in elevation and would eventually change colour from the light exposed rock to mulched areas and vegetation. It is expected that the final profile of the quarry site with vegetation may not be distinguishable from these properties.

The removal of earth adjacent the Taree Bypass may in fact improve views of the forest and valley area by opening new visual corridors for northbound motorists approaching Taree.

Public sensitivity to management of the scenic forest environment would be relatively high as the cut batters are located on the new Pacific Highway which forms part of the main road corridor through the region. It is proposed that landscaping measures be implemented within the study area following removal of the fill material from the batters. Landscape planting using native forest timber species consistent with the Taree Cut Batters Landscape Plan will increase the attractiveness of the study area as well as acting to stabilise the batters (refer Section 5).

Summary of ESD Principles

Precautionary Principle	Intergenerational Equity	Conservation of Biological Diversity
A detailed visual assessment of the study area has been undertaken. The quarry would have limited but permanent impacts on the existing environment, however, these impacts are considered positive in comparison to stabilising the existing cut batters. The proposed batters would be located further from motorists and would be suitably revegetated with native vegetation.	The visual character of the study area would not be permanently changed and there would be no loss of visual amenity.	Revegetation of the final batter slopes with native species would maintain, and in some areas improve, the species diversity of native plants in the currently on the site.

6.7 Traffic Assessment

The traffic analysis for the construction of the Taree Bypass focussed on three aspects:

> the adequacy of the existing right turn bay at Fords Road, Moorland North
> design aspects of the northbound slip lane that is used by construction traffic to access the highway
> signposting and linemarking issues associated with construction traffic

As the scope of the Coopernook Bypass EIS included the impacts of haul truck traffic from the potential Taree Cut Batters Quarry, this aspect of the traffic assessment is beyond the scope of this study.

6.7.1 Right turn bay at Fords Road

To assess the adequacy of the existing southbound right turn lane at Fords Road, Moorland North a number of assumptions were made in relation to the current and future traffic conditions at the intersection and along the highway.

- A maximum of 25 semi-trailers per hour would turn right into Fords Road from the north. A total of some 25 vehicles would be expected to be used which are expected to require a 1 hr round trip to complete the loading at the quarry site, unloading at the construction site and travel of some 20-30km each way between the two sites.
- 10 residents vehicles make a right turn out of Fords Road during the peak analysis period (ie approximately 1 vehicle per dwelling).
- Through traffic along the highway is 10110 veh/day (this is the Annual Average Daily Traffic volume or AADT for 1997 as provided by RTA), which equates to 506 veh/hr (50-50 directional split, 10% of traffic during the peak analysis period).
- The right turn bay is 75m long and would be capable of storing 3 semi-trailers at a maximum legal length of 19.0m plus a 6.0m spacing. If B-doubles or other large trucks would be used, only two vehicles could be stored at one time.
- The flow of the semi-trailers arriving at the site is evenly spaced so that they do not all come at once.

The analysis was carried out using the INTANAL intersection analysis model, which is commonly used by RTA for the subject purposes and a copy of the analysis is attached in Appendix C. It is evident that the average queue length for semi trailers in the right turn bay is 1 vehicle with an average delay of 8 sec/veh. The queue length is well below the storage capacity of the bay and provides ample spare capacity to cater for additional vehicles in case for example some bunching of vehicles occurs during the travel or unloading process at the construction site.

Accordingly there are no concerns about traffic queueing onto the main carriageway during normal operations and normal traffic conditions.

However, given the potential safety concerns about queues extending onto the main carriageway, a sensitivity analysis was carried out using the INTANAL program. For these purposes, it was assumed that the daily traffic volumes would be at the peak holiday traffic flow recorded in 1997 (ie 16940 veh/day), with a peak hour factor of 18% and a 50-50 directional split. In addition an allowance of 6% growth has been made to accommodate increases in traffic during the construction period and since the measurements were taken. These assumptions would represent a total flow of 1616 veh/hr in each direction, which is 3 times greater than the base traffic flow assumption of some 506 veh/hr.

The results of the sensitivity analysis show that the number of semi-trailers in the queue would remain at 1 vehicle, but that the average delay per vehicle would increase from 8 sec/veh to 30 sec/veh. It should be noted, that delays for residential traffic exiting Fords Road at a rate of 10 veh/hr would become unacceptable under the assumed extreme circumstances, but these assumptions are not realistic and are only suitable to test the sensitivity to traffic flow increases for right turn bay overflows.

Accordingly, the access way to the site would continue to operate satisfactorily, even under extreme traffic conditions.

Although the right turn bay is expected to operate satisfactorily under both normal and extreme traffic conditions, there may be unforeseen situations under which the queues could extend onto the main carriageway. It would be appropriate to provide a contingency plan to prevent such

situations.

The contingency plan centres around three elements, which are discussed in detail below:

> the use of a traffic controller at the construction site
> utilisation of two-way radios on the trucking fleet to advice of unusual traffic and delay conditions
> instruction of drivers to use a detour in case of overflows at the right turn bay.

The traffic controller at the construction site must ensure that no more than three trucks leave the construction site within a five minute time span. The distribution of vehicles is potentially the largest risk factor and strict control on this factor is important. 3 trucks every 5 minutes represents an hourly flow of 36 vehicles, which exceeds the operational requirements of the construction process and can be readily accommodated at the right turn bay. The three trucks would take an average of 3x8=24 sec to clear under normal conditions and 3x30=90 sec under extreme traffic conditions. More vehicles within a short time span could lead to the fourth vehicle arriving at the right turn bay before the others have cleared and cause the queue to over flow on to the main carriageway.

It is common industry practice that truck drivers communicate with each other using their two-way radio's or CB radio network. This practice should be utilised for drivers to warn each other when three vehicles are queued in the right turn bay. The newly constructed Taree Bypass provides breakdown bays every 1.5 km between the two sites, which would present safe short term waiting areas for trucks that could cause queue over flows.

All truck drivers associated with the project must be instructed to proceed to the next intersection along the route should the bay be full. While it is acknowledged that this may require a detour of up to 15km, it is not expected to be required, except under very extreme situations and when the other two contingency measures have not been effective.

6.7.2 North Bound Slip Lane

It is understood that after loading with fill, the semi-trailers returning to the construction site will gain access to the highway at the location where the old highway alignment joins the new bypass. As the old alignment no longer functions as a public road, no formal access exists at this point. The old highway alignment is on a slight down grade and a horizontal curve, which impedes visibility onto the new bypass alignment to general traffic.

Staff currently operating at the quarry site have been observed to use traffic cones (ie "witches hats") to mark out the kerbside northbound traffic lane and provide a safe entry point for construction traffic onto the new bypass alignment.
While such practice is appropriate for short term construction activities, the subject works program is expected to continue for approximately 12 months and it is not appropriate to continue this situation.

Instead, it is proposed to provide a temporary acceleration lane along the shoulder of the new bypass, which can readily accommodate the requirements of construction vehicles. The acceleration lane needs to be marked using standard line marking and signposting practices as identified in the RTA road design manuals, which would need to be removed on completion of the works program.

6.7.3 Traffic Management / Temporary Signposting

In accordance with the Australian Standards for work sites, temporary signposting should be provided to ensure ample warning for general traffic of the construction activities along both carriageways of the new bypass. Such signposting would include warning signs for trucks turning to and from the right turn bay, trucks entering from the old highway and general works

advisory signs. The signposting and traffic management would be the responsibility of the contractor in the context of the Traffic Management Plan. The Traffic Management Plan would be subject to RTA approval prior to its implementation.

It has been assumed that appropriate signposting will also be in place at the actual construction site to warn traffic at this location. Signposting requirements at the two sites may not necessarily be the same and each site should be treated on its individual merits.

As mentioned in section 5.5.2 the quarry extraction may require some blasting for hard rock materials. Any blasting would prompt the temporary closure of the Pacific Highway for short periods of time. Any activities requiring the temporary closure of the Pacific Highway would be restricted to times of low traffic flows and would be signposted in advance to warn commuters of closure schedules.

6.7.4 Conclusions and Recommendations

- The right turn bay at Fords Road provides ample capacity to accommodate the traffic associated with the construction activities under normal as well as extreme circumstances.
- The three part contingency plan would be adopted to prevent over flow queues onto the main southbound carriageway of the highway.
- The shoulder of the northbound carriageway would be appropriately line marked to function as a temporary acceleration lane for semi-trailers seeking entry to the new highway alignment from the old alignment.
- Temporary signposting would be provided in accordance with the Australian Standards for work sites to provide ample warning for general traffic of the construction activities.
- Temporary closures of the Pacific Highway necessitated by blasting activities would be limited to times of low traffic to reduce the impacts on traffic flows.

6.8 Social and Business Effects

6.8.1 Forestry Production

Kiwirrak State Forest contains mostly dry and moist hardwood and some plantation timber. The 1.5ha of vegetation potentially affected by the quarrying is dry hardwood dominated by Grey Gum, Grey Ironbark and Blackbutt. The trees are generally around 30cm dbh or less but are sparse at a density of around 100/ha. The loss of this productive timber would in part be compensated by regenerating forest on the quarry site using a similar species mix. Salvage logging would be permitted prior to clearing for the quarry.

6.9 Planning and Land Use

The works would be located within the road reserves of the existing Pacific Highway and the Taree Traffic Relief Route, owned by the RTA. However, the boundary of the road reserve with Kiwarrak State Forest has not yet been fixed with State Forests (NSW) and would be negotiated once the final boundary line has been determined according to the western boundary of the quarry.

Kiwarrak State Forest is managed and operated by State Forests according to the management plan prepared for the Taree Management Area. This land is and would remain zoned 1(f) - Rural Forests under GTLEP, 1995. It is expected that there would be no further effect on Kiwarrak State Forest beyond the immediate quarry a result of the proposal. Approximately 1.5 ha of dry hardwood forest would be removed by the quarrying operations (between the old and new highway alignments), however the stable batters would be able to be replanted with forest timber species as proposed in the landscape strategy. No houses or private land would need to be acquired by the RTA.

The proposal is considered permissible with consent of Council under the objectives of GTLEP 1995 and those for the 1(f) Rural Forest Zone.

6.10 Hunter Regional Environmental Plan 1989 (Heritage)

The aims and objectives of the Hunter Regional Environmental Plan (Heritage) are as follows:

> to conserve the environmental heritage (including the historic, scientific, cultural, social, archaeological, architectural, natural and aesthetic heritage) of the Hunter Region.
> to promote the appreciation and understanding of the Hunter Region's distinctive variety of cultural heritage items and areas including significant buildings, structures, works, relics, towns, precincts and landscapes.
> to encourage the conservation of the Region's historic townscapes which contain one or more buildings or places of heritage significance or which have a character and appearance that is desirable to conserve.

The REP contains schedules of items of State, regional and local heritage significance and contains provisions for the conservation of these items. The study area is contained within the boundaries of the REP, however, there are no items in the study area listed on the schedules. Thus the REP does not apply to the proposal other than in relation to its overall objectives.

6.11 Aboriginal Archaeology

6.11.1 Methodology

An Aboriginal archaeological survey of the proposes route was undertaken by Jacqueline Collins Consultant Archaeologist. The purpose of the study was to :

> Identify and record all Aboriginal sites and relics within the study area.
> Assess the significance of the sites and/or relics.
> Assess the likely impact of the proposed works on any identified sites.
> Provide appropriate management recommendations for the heritage resource within the area.
> Consult with the Purfleet/Taree Local Aboriginal Land Council in order to ascertain Aboriginal views relevant to the project and the study area.

The findings of this report are summarised below, the full report is contained in Appendix E.

6.11.2 Archaeological Context

No Aboriginal sites have been previously registered or reported with the study area, except for one (isolated stone artifact) which occurred 30m east of the old highway near the former Kiwarrak Rest Area. This area was developed as part of the Taree Bypass. Another 12 sites have been recorded within 5km of the study area and all are located in more gently undulating country north and north-east of the study area.

An Aboriginal archaeological survey of the Taree Traffic Relief Route was undertaken by Helen Brayshaw Consulting to identify and record Aboriginal sites along the alignment within a 200m wide zone along the proposed highway which incorporates the study area of the proposed quarry. Of the ten Aboriginal sites identified, the closest site to the current proposal is located approximately 600m north of the proposed quarry at chainage 163000 and would not be affected by the proposal. The site is a water hole known as the Blue Hole. The water hole was assessed by Brayshaw Consulting as having moderate social significance to the Purfleet Local Aboriginal Group.

The Taree Traffic Relief Route has since been positioned west of the water hole within the 200m wide corridor to avoid the site. The current proposal, therefore, would not affect this site as it is

not positioned within the immediate vicinity of either cut batter, not is it positioned on or near the haulage route.

6.11.3 Field Investigation and Archaeological Survey Methods

Field inspection of the proposed route was carried out on foot on 2 June 1998. The weather was fine and lighting conducive to the detection of surface materials. An inspection across all available surfaces was carried out within the study area targeting areas of low gradient and that had not been subject to major surface disturbance during earthworks for the Taree Bypass. Other potentially sensitive land-form elements outside of the study area, including the crest west of the old highway adjacent Cut B

The survey was completed as a series of longitudinal transects with the three surveyors walking approximately 5m apart and inspecting all available ground surface within their line of sight. The effective survey coverage can be viewed in Table 2 of Appendix E.

6.11.4 Archaeological Survey Results

No Aboriginal cultural materials were discovered within the area to be affected by the proposed quarry. One isolated stone artifact was recorded during the survey, approximately 45m south-west of the area known as Cut A (Site CBQ1). This area would not be affected by the proposed quarry. No additional cultural material was discovered on further inspection of the adjacent areas and the artifact is thus considered unlikely to be part of a larger scatter (open campsite). It was noted that much of the area other than the native vegetation remnant was actually stripped of topsoil or was overburden placed on the batters.

6.11.5 Archaeological Significance Assessment and Recommendations

Although no registered Aboriginal sites and no Aboriginal cultural material was located within the study area, there is the potential for a dispersed, low-density distribution of undiscovered stone artifacts to occur within the study area. It is considered likely that any undiscovered sites within the study area would no longer be in situ and would therefore have a low level of archaeological/scientific significance (Collins 1998).

As no archaeological sites were found within the study area, Collins 1998 did not make any site specific recommendations, however, as there is the potential for cultural material within the quarry area it was recommended that:

> All relevant contractors and employees are advised of their legal obligations with regard to Aboriginal cultural materials.
> Should any material thought to be of potential Aboriginal origin be uncovered or unearthed, all activities in the vicinity should cease until the relevant authorities have been consulted and clearance to continue has been given.
> The location of Site CBQ1 to the south of the quarry area, be clearly marked on construction plans and the area strictly avoided during works. All relevant contractors and employees are to be advised of the archaeological sensitivity of the site.

6.12 Non-Indigenous Heritage

As part of the investigations for the proposed fill material quarry, an assessment of the impact of the proposed works on the non-indigenous heritage resources within the study area has been undertaken.

A European heritage study of the Taree Traffic Relief Route was conducted by heritage consultant Wendy Thorp to identify any potential sites of heritage value within the corridors of the various options. It is noted in this report that there were no current heritage listings or gazetted by the National Trust, the Australian Heritage Commission, the NSW Heritage Council or within

the Taree Heritage Study or the Regional Environmental Plan for any items on the alignment of the Taree Traffic Relief Route including the quarry area, at the time of this report.

In order to confirm that there are no items or areas of heritage significance within the study area, the Australian Heritage Commission was consulted during the EIS study. Six items/areas listed on the Register of National Estate were identified in the region, however, none were located within, or in proximity to the study area. The closest area is Coocumbac Island Nature Reserve, south of Taree within the Manning River, approximately 4km north of the study area. The proposed quarry would not impact on this area. Apart from road construction associated with forestry and utilities no other evidence of post settlement occupation was apparent in the study area.

Summary of ESD Principles

Precautionary Principle	Intergenerational Equity	Conservation of Biological Diversity
There will be no impacts on any listed heritage items.	No loss of heritage items would result from the project.	N/A

6.13 Energy Statement

The major usage of energy for the proposal would be consumption during construction associated with earth moving and transport during quarry operations. The quantity of fill material that is expected to be eventually transported from the quarry site as part of this proposal is approximately 578,500m^3 (in situ). This material will have to be transported approximately 25km to the road construction site. This operation will require some fuel usage of approximately 600,000L based on a 25km one way trip and 34L of diesel fuel per 100km.

The operation of the quarry will require a range of earthmoving and associated equipment including excavators, bulldozers and rock hammers. The estimated overall fuel usage of this equipment would be approximately 500,000L of diesel fuel and some 5,000L of petrol for small vehicles.

6.14 Cumulative impacts

Many of the implications of the Pacific Highway reconstruction program including the sourcing of embankment material for local construction projects do not act in isolation and should be considered in the context of the relevant local and regional changes in land use and the need of competing projects for similar material.

The RTA has acknowledged the potential for network wide impacts of its overall reconstruction program for the Pacific Highway by the preparation of a Cumulative Impact Assessment (CIA) 1998 for the Pacific Highway. This builds on the RTA's Upgrading the Pacific Highway Discussion Paper (1997) State Road Network Strategy (1995) and North Coast Road Network Strategy (1992) (refer Section 3.2).

The Department of Urban Affairs and Planning and Local Government have sought to manage local and regional land use changes influenced by the Reconstruction Programme through planning instruments including the Hunter REP 1989 and Greater Taree City Council LEP 1995.

The major issues with which this project interacts are described below.

6.14.1 Cumulative Demand for Road Construction Materials

Pacific Highway upgrade projects in the low lying Manning River floodplain all require the import of significant quantities of fill. While the CIA indicates that at a regional level the availability of most road construction materials are generally well spaced, the availability of general fill is an important cost and resource allocation problem with respect to the proposal and adjacent projects. The CIA notes that the Coopernook Bypass is amongst the most distant site from existing known sources, for a range of materials including fill material and base material.

As a result the Pacific Highway Upgrade projects in the Manning Valley would compete with other local fill sources to supply the embankment material required. In recognition of te potential for local highway projects to completely exhaust local supplies and thus distort the market for these resources the RTA have proposed to independently source fill for the upgrade across the Manning floodplain. The use of the proposed fill source would therefore avoid a significant cumulative impact on the availability of local fill for the Manning region.

The highway projects will however considerable demands on hard rock quarries for sources of pavement materials needed for highway construction.

6.14.2 Cumulative Biodiversity Impacts

The development of the Pacific Highway including ancillary projects such as quarries would continue to result in habitat destruction fragmentation and isolation of habitat remnants with a potential outcome being a reduction in viability of remnant populations and loss of species diversity. The CIA emphasises that these effects should be avoided, minimised or mitigated in the planning and assessment stage.

In the study area and in an adjacent section of the Pacific Highway, habitat impacts are largely avoided by the quarry location adjacent to the existing highway alignment, avoidance of areas of undisturbed native habitat and a range of mitigation measures including landscaping using native species. Limiting the extent of the quarry to between the existing and former highways would result in the removal of already isolated and disturbed habitat and the avoidance of further habitat severance.

6.14.3 Avoidance of Cumulative Disruption During Construction

While noise, dust and traffic management delay nuisances are potential impact of the proposal the extent of cumulative impacts on local amenity of the quarry project will be minimised.

The likely simultaneous construction of the Taree Bypass to Coopernook and Coopernook Bypass project would reduce the time that the quarry is affected and the temporal extent of construction nuisances while the location of the quarry beside the existing highway would avoid the creation of a new noise source in a quieter environment.

The proposed quarrying of the Taree Cut batters that would otherwise require stabilization works would also reduce the cumulative disruption of work both at this site and the fill source as well as avoiding the unnecessary use of resources for both projects.

6.14.4 Cumulative Loss of Forest Resources

The area proposed to be quarried support less than ha of dry hardwood. This timber is not mature but would be savaged prior to clearing. The final batters would be planted with native timber species.

The short term loss in forest productivity would be compensated in land acquisition while in the long term the timber resource would be reestablished aver a larger area than currently existing.

6.15 Summary of Mitigation Measures

Table 6.2: Summary of Mitigation Measures

Impact	Mitigation Measure
All Construction and Operational Impacts	> Preparation of operational phase Environmental Management Plans incorporating obligations of EIS and condition of approval to ensure implementation of mitigation measures.
Dust Generation During Construction	> Watering of unsealed and disturbed areas. > Minimising the area disturbed at any one time. > Revegetating or otherwise stabilising disturbed areas as soon as practically possible. > Confining vehicle movement to designated areas.
Drainage and Water Quality - runoff during construction	> Implementation of an Erosion and Sedimentation Control Plan incorporating: - Buffer strips to be maintained and fenced off adjacent to drainage lines. - Diversion banks and channels to accommodate runoff from disturbed areas into waterways. - Sediments basins at the receiving end of the diversion banks to intercept and retain sediment from runoff. - Revegetation to prevent erosion. - Treatment of water prior to discharge to ensure water quality is acceptable. - Establishment of water quality baseline and ongoing monitoring during construction according to EMP. - Containment of runoff and spillage in Water Pollution Contro Ponds at sensitive locations consistent with RTA Water Policy. - Regular monitoring and maintenance of erosion control structures, especially after rain events. - Maintenance of checklists to verify periodic inspection and corrective action.
Noise and Vibration - high noise levels in some areas - ground vibration during construction	> Incorporation of a construction noise and vibration control plan in the construction stage EMP. > Selection of plant and equipment where practical on acoustic performance. > Implementation of a noise and vibration monitoring program to ensure best possible practices are being employed. > Restricted times of operation for construction plant and equipment. > Initiation of an information program to inform the local residents of the construction program and time periods when noise levels could exceed the recommended assessment guidelines (such as during blasting).
Flora and Fauna	> Preparation of Management Plan for revegetated final batters. > Placement of a geotextile silt fence around the construction site to prevent alteration of water quality. > Surface stabilisation and progressive revegetation using native species. > Maintenance and extension of existing Koala fence.
Visual Environment	> Rehabilitation at quarry site according to a Landscape Plan.
Heritage and Archaeology	> Provide appropriate induction for all site personnel regarding the protection of the existing Aboriginal artifact and the site procedures if any further cultural materials are discovered. > Should any material thought to be of potential Aboriginal origin be uncovered or unearthed, cease work in the vicinity until clearance has been given by the relevant authorities.

Impact	Mitigation Measure
Traffic	> The right turn bay at Fords Road provides ample capacity to accommodate the traffic associated with the construction activities under normal as well as extreme circumstances. > The three part contingency plan would be adopted to prevent over flow queues onto the main southbound carriageway of the highway. > The shoulder of the northbound carriageway would be appropriately line marked to function as a temporary acceleration lane for semi-trailers seeking entry to the new highway alignment from the old alignment. > Temporary signposting would be provided in accordance with the Australian Standards for work sites to provide ample warning for general traffic of the construction activities.

7

ENVIRONMENTAL MANAGEMENT

7. Environmental Management

Safeguards described in the EIS have been designed to minimise as far as practical the potential negative environmental, economic and social impacts of the proposal and to maximise the positive aspects of its implementation. The implementation of many of the actions which are not design related and require ongoing action by the RTA and other parties will occur both during and post operation.

Detailed design and specification of all environmental safeguards and management actions are beyond the scope of this EIS. The objective of this EIS is to demonstrate the environmental feasibility of the project. Should approval be given for the project to proceed, then a detailed quarry design would be prepared. In conjunction with this, an Environmental Management Plan (EMP) would be prepared to detail the procedures to be carried out, prior and during construction, in order to minimise and manage potential negative impacts of the proposed. The EMP would identify parties to be responsible for all required actions and would form an important element of the quality plan that would be required of the Contractor(s) appointed to construct the project. The EIS provides the basis for the preparation of the EMP by identifying the issues to be addressed (refer Section 7.4).

7.1 Environmental Strategies

In its 1995 "State Road Network Strategy", the RTA identified a range of proposed strategies which aim for substantial progress in the area of environmental management during inter-alia, network development.

Specific strategies relevant to any implementation of a proposal of this nature should:

> Work towards achievement of ecologically sustainable development (ESD) objectives by developing a corporate position to guide all RTA activities and assessments.
> Further develop the environmental management system to improve environmental performance.
> Examine, develop and support cost-effective means of improving energy efficiency, reducing fuel consumption and reducing 'greenhouse gas' emissions.
> Utilise renewable resources wherever practical.

7.2 If the Project is Approved

Should the project be approved, the following activities would be carried out by the RTA in full co-ordination with the Council:

> RTA acquisition of the site would be completed
> The local community would be notified of the decision via correspondence, newspaper notices and/or newsletters. This would include an indication of the anticipated timing and staging of construction works and contact details for the RTA
> Fords Road residents would be notified of the decision, with contact soon after to clarify the likely impacts on access, the anticipated timing and staging of any construction. Owners would be kept informed and consulted during all stages of the design and construction process to minimise any hardships and notify them of any temporary access changes or specific works
> A detailed EMP would be prepared by or on behalf of the RTA for both the construction and post construction phases of the project. The following documentation would also be prepared together with the EMP to ensure compatibility:
    - community consultation plan during construction
    - landscape plan
    - erosion and sedimentation control plan for construction in consultation with the Soil Conservation Service (DLWC)

7.3 Content and Structure of the EMP

The EMP would become the reference document that ensures the commitments for environmental protection and management given in this EIS and subsequent approvals are fully implemented by the RTA and its agents. It also serves as the framework for confirming the accuracy of impact predictions in this EIS and for measuring the effectiveness of these actions and procedures. The EMP would be prepared with relevance to the key stages of construction, dealing with specific areas and/or management issues as priorities dictate. An EMP would also be required to be subsequently prepared for the operation of the quarry and to co-ordinate ongoing monitoring and maintenance. To ensure that the requirements of the EMP are satisfied during the operation and construction of the quarry these requirements would be incorporated into contract conditions between the RTA and contractor(s).

The main features of the EMP would include:

- **Obligations** - a full account of the statutory and other obligations which the RTA would be required to fulfill during the project implementation including all approvals and consultations required with authorities and their stakeholders. The draft EMP would be issued to relevant authorities for endorsement before final adoption by the RTA.
- **Environmental Monitoring** - a regime of inspections, monitoring and testing would be carried out in accordance with the EMP. For each main element of the management system the EMP would define the performance criteria associated with each management objective, the specific tests and protocols, their frequency and location.
- **Audits** - to be assured that the environmental management system is working, a qualified and independent person would conduct audits in accordance with the schedule nominated in the EMP.
- **Reporting** - this is an important part of any quality system and requirements would be included in the EMP.
- **Communications and Environmental Training** - workforce awareness and responsibilities for environmental management would demand suitable induction and training for all contractors and RTA employees. This would be part of the system along with procedures for communication with project stakeholders.
- **Community Involvement** - to minimise impacts on the community the design, construction and operation phases of the proposal will encourage local community input. The Kooraingha / Fords Road community would be notified and kept informed of the project and any relevant issues raised would be considered.

7.4 Environmental Management Principles and Objectives

An EMP would be prepared by the RTA to manage the implementation of the environmental controls for the operation of the fill material quarry. The EMP would then be adopted by the contractor(s) through contractual agreements. The following outline provides the guiding principles of the EMP to meet the objectives of:

- preventing pollution of receiving waters
- avoidance of dust and noise nuisance to residents or motorists
- maintenance and regeneration of forest and native habitat
- ensuring traffic safety
- responsible disposal/reuse of waste

The EMP would be based on the following environmental management principles:

- Assess the site characteristics and contractor to prepare an Environmental Control Plan (ECP) which contains a detailed Erosion and Sediment Control Plan (ESCP) for the works consistent with the DLWC guidelines for erosion and sediment controls for access tracks.
- Devise a quarrying method and schedule which effectively integrates the environmental management activities for each stage of the quarry.

- Ensure erosion and sediment control works are in place prior to the commencement of works.
- Minimise the area cleared and disturbed at any one time by successive rehabilitation.
- Collect runoff from disturbed areas so that it passes through sediment control devices prior to release.
- Areas which are likely to remain disturbed for longer periods to have a temporary cover crop established.
- Maximise reuse of water on site.
- Treat excess water where necessary prior to release to ensure water quality of discharge is equivalent or better than receiving waters.
- Inspect all ESC structures regularly and maintain as appropriate.
- Revegetate or otherwise stabilise disturbed areas progressively and as soon as practicable.
- Ensure that any areas for the storage of oils and other hazardous liquids used during quarrying are surrounded by a bund to contain any spillage which could then be collected and disposed off site.
- Ensure appropriate site management procedures exist to prevent litter and other waste polluting watercourses.
- Dampen susceptible surfaces to minimise dust generation.
- Ensure plant is maintained to prevent excess emissions.
- Avoidance of work in strong winds in location where dust cannot be readily prevented from blowing towards the Taree Bypass.
- Burning of waste or vegetation should not be undertaken on site.
- Prevent the operation of excessively noisy machinery.
- Ensure construction work takes place within the prescribed hours of operation.
- Habitat removal to be minimised by the clear delineation of areas to disturbed using temporary fencing.
- Progressive revegetation of cleared areas with locally occurring species.
- Harvesting of all vegetation considered usable by State Forests prior to clearing.
- Mulching and chipping of all remaining vegetation where applicable.
- Ensure procedures are in place to manage any Aboriginal archaeological sites discovered during the works.
- Waste minimisation techniques to be employed as well as maximising reuse opportunities (eg. Mulching of vegetation and harvesting of timber).
- Safe disposal of any non-recyclable construction waste to approved facilities.
- Ongoing weed management strategies would be implemented in rehabilitated areas.
- Ongoing maintenance of long-term erosion and sediment control structures must be undertaken.
- Ongoing maintenance of any revegetated areas to be undertaken to ensure the endurance of these areas.
- Ensure appropriate measures are adopted to address the assessment of non-indigenous heritage sites and artifacts should they emerge during construction.

7.5 Post-Quarrying Environmental Management

The EMP would also include provisions for environmental management post-quarrying. Part of these provisions would identify the RTA as responsible for ensuring the adequate implementation of the Plan. The following environmental management controls, monitoring and auditing would be undertaken for a minimum period of 12 months following the conclusion of the entire works:

- Water quality monitoring would be continued to assess residual impacts in the first 1-2 years after rehabilitation.
- Landscaped areas would be monitored and maintained to ensure successful results are achieved.
- Consultation with individual property owners to ensure impacts are minimised and that the environment management activities are proceeding satisfactorily.

In the longer term, environmental management of the quarry site and in particular the condition of drainage and erosion control features and roadside landscape would come under the RTA's road

maintenance program.

8

CONCLUSION AND JUSTIFICATION

8. Conclusion and Justification

8.1 Summary of Matters for Consideration

Section 79C(1) of the Environmental Planning and Assessment Act 1979 includes the matters for consideration of relevance to a Development Application. A response in relation to these matters (a) to (e) has been prepared to assist Council in their assessment of the project. This section also forms the conclusion and justification for the proposal.

(a) The provisions of:

(i) any planning instrument

Section 1.3 of the EIS addresses the consistency of the proposed quarry operations and batter stabilisation with GTCCLEP 1995. The proposal is consistent with the general aims of the LEP to provide for future arterial road needs. Potential inconsistencies with the specific aims of the 1(f) Rural Forests zone are addressed according to Clause 10.1 the DCP which requires an environmental impact report to accompany DA's in such cases to justify any inconsistency. The EIS services this purpose.

It is further noted that Clause 35(2) of GTCCLEP 1995 does not allow council to consent to development of 1(f) zoned land for extractive industry if the development is accessed within 90m of an arterial road. A SEPP No.1 objection is lodged because the development controls are unreasonable and unnecessary in the circumstances of the case. In particular, compliance with this control would result in less safe and less practical ingress and egress to and from the quarry site during the period of its operation.

(ii) any draft environmental planning instrument

Not relevant.

(iii) Any development control plan

DCP 1995 has provided guidance on interpretation of the LEP in relation to the content of an environmental impact assessment report to accompany a DA for potentially inconsistent development.

(iv) the regulations (of the EP&A Act)

The DA and EIS are consistent with Clause 53C dealing with designated development and Clauses 54-56A dealing with the form and content of Environmental Impact Statements.

(b) the likely impacts of that development including environmental impacts on both the natural and built environments and social and economic impacts in the locality.

The key impacts of the proposal can be adequately mitigated and managed or are of a minor nature.

The control of noise at residences over the ridge crest 300 m to south west of the southernmost point of the quarry site would be achieved by minimising the period of quarry operation at this end by working from the north and by loading trucks below the edge of the cut batter. Other measures to control noise are included in Section 6.4.

Traffic safety of highway users, residents on Fords Road and haulage trucks is paramount. Analysis of truck movements have indicated that right turn storage bays will safely

accommodate entering trucks and protect other users of Fords Road, while traffic management measures set down in Section 6.7 will control the safe exit of vehicles onto the highway. The use of a traffic controller to prevent queuing of trucks entering the site is a further important management measure.

Notwithstanding the improvement of batter stability that would result from the proposal, the works will expose soils prone to erosion. An Erosion and Sediment Control Plan would be implemented prior to and throughout quarry operations to minimise potential sediment loss and water pollution as a result of the proposal.

Around 1.5ha of logged native forest regrowth would be removed by the quarry operation. The vegetation is not species rich and the habitat value of this area is limited due to its isolation between the Old Pacific Highway and the Taree Bypass. A landscaping plan using native seeds and plantings is proposed to be implemented on the final batters. It is further recommended that Koala fencing be extended to Fords Road from the north as batters will be less steep.

Other impacts including loss of forestry production opportunities, temporary disruption of Fords Road, dust control and the maintenance of access to the proposed Four Mile Hill Lookout are addressed in the EIS.

Community consultation initiatives have evoked a minimal response with no written responses yet received. The results of face to face meetings with the nearest residents is reported in Section 2 of the EIS.

The economic effects of the proposal are however, both positive and significant. The availability of a sufficient quantity of a reliable and relatively low impact fill material source for highway construction is essential to ensure the feasibility and eventual implementation of the RTA's program of upgrading the Pacific Highway in the Manning Valley. Given the scarcity of other fill material sources the use of this source would not deplete fill sources required for local projects.

c) *the suitability of the site for the development*

Given the lack of elevated land in the lower Manning floodplain traversed by the Pacific Highway, the proposed quarry area represents a relatively close source of suitable fill material for highway construction in the Taree-Coopernook area. The opening of the Taree Bypass provides an ideal opportunity to haul this material along a suitable road which would have minimal impact on the amenity of residences between the quarry and the construction site.

Other features which demonstrate the suitability of the site include:

> existing provision for access through the median into Fords Road from Taree Bypass.
> Opportunity to use former Pacific Highway for quarry access and egress.
> existing degradation and isolation of habitat between the former Pacific Highway and Taree Bypass will minimise the ecological impact of the proposal.
> proven suitability of the cuttings for use as general and select fill and as bridging layer material on the Taree Bypass.
> no residences in the immediate visual catchment of the quarry (nearest two dwellings are over a ridge 300m to south west).
> no up slope catchment would improve the ability of the ESCP to manage runoff in the study area.
> quarry operations will eliminate the need for further expense of public money in stabilising the cut batters.
> the proposal will improve safety and efficiency of the ultimate alignment of the Fords

Road intersection.

d) any submissions made in accordance with this Act or the regulations

No written submissions from the community have been received during the EIS preparation. Submissions from public authorities are discussed in Section 2.

e) the public interest

The proposal is in the public interest because there is a demonstrable need and clear benefits for the work to proceed. In addition, the environmental impacts can be mitigated and managed at an acceptable level during and after the quarry operation.

8.2 EPA Regulation, Schedule 2 Considerations

The Australian National Strategy for Ecologically Sustainable Development (ESD) (1992) states that:

> *"Ecologically Sustainable Development is using, conserving and enhancing the communities resources so that the ecological processes on which life depends, are maintained, and the total quality of life now and in the future, can be increased".*

In assessing the impacts of the bypass on ESD principles the following reports were reviewed: Commonwealth "Ecologically Sustainable Development Working Groups Final Report - Transport", AUSTROADS "Strategy for Ecologically Sustainable Development"; and Australian Road Research Board LTD Report No. 257 "Ecologically Sustainable Development".

Under Schedule 2 of the Environmental Planning and Assessment Regulation (1994), the following principles of ESD have been taken into account throughout the assessment of the Proposal.

8.2.1 Precautionary Principle

The Precautionary Principle has been applied to the current Proposal. The Precautionary Principle states 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".*

This principle has been applied by reliance on adequate data and argument to support the option selection process for the Taree Cut Batters Quarry, recognising the already degraded nature of the site and its ideal location adjacent to an access corridor.

8.2.2 Intergenerational Equity

The quarry is regarded as an important measure to best assure the implementation of the Pacific Highway Upgrade Projects proposed. These projects offer a range of local and regional benefits which have been identified and discussed in the Coopernook Bypass EIS (Connell Wagner, 1997).

Significantly the expansion of the existing cut batters as a source of fill material would not impact on the existing market for commercial fill and quarry material. Importantly by sourcing the fill material from the cut batters the project will not exhaust local established quarries whose sustainability and ongoing operation offers a valuable extractive resource in the area.

8.2.3 Conservation of Biological Diversity and Ecological Integrity

The selection of the proposed quarry area was intended to minimise the effect of the proposal on natural habitats, targeting already degraded vegetation isolated between the Pacific Highway and Taree Bypass.

Biodiversity is the variety of life forms, the different plants, animals and micro-organisms, the genes they contain, and the ecosystems they form (NPWS, 1997). As a signatory to Agenda 1, Rio Earth Summit, the Australian Government is bound by international agreement to conserve biological diversity through the prevention of species extinctions and promotions of habitat conservation.

In terms of environmental impact assessment, Agenda 21 specifies that appropriate procedures should be introduced for proposed projects likely to have significant impacts upon biological diversity, and such assessment should include suitable information for public participation. The potential impacts of the current Proposal on the viability of flora and fauna communities in the study area and the integrity of the ecological systems have been previously discussed in Section 6.5. This included details of the strategies that would be implemented to mitigate adverse biological impacts. In this regard, the safeguards and management strategies contained within this document fulfills the obligations of Agenda 21. The National Biodiversity Strategy has been considered in Section 6.5.

8.2.4 Improved Valuation and Pricing of Environmental Resources

The analysis and relative comparison of fill material options combined with the environmental economic assessments described in Section 6.16.2 of the Coopernook EIS represent a proxy economic analysis of the proposal in which the issues of environmental significance are valued and (where impacted), remedied through sometimes costly mitigation measures which reflect the value of the resource affected. In particular the cost of a range of environmental management measures described in Section 7 indicate the implicity value society places on avoiding environmental impacts.

9

REFERENCES

9. References

Atkins Acoustics (1998) Noise and Vibration Assessment Fill Material Quarry on the Cut Batters of the Taree Bypass, Koorainghat. Prepared for the RTA NSW.

Colleran, JR & Gearing, D (1980) A Visual Assessment Method for Botany Bay. In Landscape Australia, 3/1980, August

Connell Wagner (1997) Coopernook Traffic Relief Route Environmental Impact Statement. Prepared for the RTA NSW.

Department of Conservation, Forests and Lands, Division of Forests (undated). Summary of the Visual Management System

Department of Planning (1988) Rural Land Evaluation Manual

Gutteridge, Haskins & Davey Pty Ltd (1990) Taree Traffic Relief Route - Environmental Impact Statement. Prepared for the Roads and Traffic Authority NSW.

Forestry Commission of NSW (1985) Management Plan for Taree Management Area.

Jacqueline Collins (1998) Proposed Fill Material Quarry on Cut Batters of the Taree Bypass, Archaeological Survey for Aboriginal Sites. Prepared for the RTA NSW.

Robert Carr and Associates (1998) Geotechnical Review of Batter Extraction Material Quality and Excavatability, Cuts A and B, Pacific Highway Taree Bypass. Prepared for the RTA NSW.

State Pollution Control Commission (1981). Guidelines for Visual Assessment and Management of Coastal Landscapes

SWC Wetlands & Ecological Management Consultancy (1993) State Highway No 10. Pacific Highway Taree Traffic Relief Route - Fauna Impact Statement. Prepared for the Roads and Traffic Authority NSW.

United States Forest Services, United States Department of Agriculture (1974). National Forest Landscape Management Agriculture Handbook Number 462, Chapter 1 - The Visual Management System

Wright, G (1973) Landscape Quality: A Method of Appraisal. In Royal Australian Planning Institute Journal. October 1973.

APPENDIX A
DUAP EIS REQUIREMENTS

New South Wales Government
Department of Urban Affairs and Planning

RECEIVED - CONNELL WAGNER

27 JUL 1998

Mr John Brockhoff
Connell Wagner Pty Ltd
116 Military Road
NUETRAL BAY NSW 2089

PROJECT/FILE No: DOC No:

Contact: Chris Ritchie

Our Reference: N98/00224/Pt1

Your Reference:

Proposed Fill Material Quarry,
on the cut batters of the Taree Bypass

Dear Mr Brockhoff,

Thank you for your letter of 18 June 1998 seeking consultation with the Director-General for the preparation of an environmental impact statement (EIS) for the above development.

I note in your letter that you regard the proposal as a designated development under Part 4 of the Environmental Planning and Assessment Act (1979). However, I understand that under the current zoning of the subject land the proposal would be prohibited. These requirements are issued on the basis that the permissibility issue is clarified with Greater Taree Council. The Director-General's requirements do not have any bearing on the permissibility of the development.

Under clauses 55 and 85 of the *Environmental Planning and Assessment Regulation 1994* (the Regulation), the EIS should specifically address the key issues outlined below.

Key Issues

- consideration of proposal with respect to the Hunter Regional Environmental Plan (1989); and,
- impacts on the Kiwarrak State Forest.

Attachment No. 1 outlines the statutory matters that must be included in any EIS under clauses 54 and 54A, and 84 of the Regulation.

The Department's EIS Guideline '**Extractive Industries - Quarries'** contains the type of information most likely to be relevant to your proposed development. Not all the matters it contains may be appropriate for consideration in your EIS; equally, it is not exhaustive. The Guideline is available for purchase from the Department's Information Centre, 1 Farrer Place, Sydney or by calling (02) 9391 2222.

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

Telephone: (02) 9391 2000
Facsimile: (02) 9391 2111

Under recent changes to the *Environmental Planning and Assessment Act 1979*, development applications are considered as "integrated development", where certain licences or other approvals are required from "approval bodies" after development consent has been granted. As you may also require a licence or approval listed in Attachment No. 2, you must consult each relevant approval body and have regard to their requirements when preparing your EIS.

You should consult with Greater Taree City Council and take into account any comments Council may have in the preparation of the EIS. The EIS should also address other issues that emerge from consultations with relevant local, State and Commonwealth government authorities, service providers and community groups.

Please contact Chris Ritchie on (02) 9391 2085 if you require any further information regarding the Director-General's requirements for the EIS.

Yours sincerely,

David A Mutton 21/7/98

David Mutton
Acting Director
Sustainable Development and Assessment
As Delegate for the Director-General

DEPARTMENT OF URBAN AFFAIRS AND PLANNING

Attachment No. 1

STATUTORY REQUIREMENTS FOR THE PREPARATION 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 54A 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 78A(8) 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 57 to 61 of the Regulation.

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

Note

If the development application to which the EIS relates is not exhibited within 2 years from the date of issue of the Director-General's requirements, under clause 55(7) of the Regulation the proponent is required to reconsult with the Director-General.

– ✧ –

ATTACHMENT No. 2.

EXTRACT FROM EP&A ACT 1979

(effective from 1 July 1998)

91 What is ``integrated development''?

1. Integrated development is development (not being complying development) that, in order for it to be carried out, requires development consent and one or more of the following approvals:

Act	Provision	Approval
Fisheries Management Act 1994	s 144	aquaculture permit
	s 201	permit to carry out dredging or reclamation work in any waters
	s 205	permit to cut, remove, damage or destroy marine vegetation on public water land or an aquaculture lease, or on the foreshore of any such land or lease
Heritage Act 1977	s 58	approval in respect of the doing or carrying out of an act, matter or thing referred to in s 57 (1)
Mine Subsidence Compensation Act 1961	s 15	approval to alter or erect improvements within a mine subsidence district or to subdivide land therein
National Parks and Wildlife Act 1974	s 90	consent to knowingly destroy, deface or damage or knowingly cause or permit the destruction or defacement of or damage to, a relic or Aboriginal place
Pollution Control Act 1970	s 17A (including s 17C and s 17D)	licence in respect of any one or more of the following: (a) scheduled premises or scheduled equipment within the meaning of the *Clean Air Act 1961*, (b) the pollution of waters within the meaning of the *Clean Waters Act 1970*, (c) a drain which discharges or is likely to be used for discharging any pollutants into any classified waters within the meaning of the *Clean Waters Act 1970*, (d) scheduled premises within the meaning of the *Noise Control Act 1975*
	s 17I	pollution control approval
Rivers and Foreshores Improvement Act 1948	Part 3A	permit under Part 3A
Roads Act 1993	s 138	consent to: (a) erect a structure or carry out a work in, on or over a public road, or (b) dig up or disturb the surface of a public road, or (c) remove or interfere with a structure, work or tree on a public road, or (d) pump water into a public road from any land adjoining the road, or (e) connect a road (whether public or private) to a classified road

Act	Provision	Approval
Waste Minimisation and Management Act 1995	s 44	licence to occupy a controlled waste facility
Water Act 1912	s 10	licence to construct and use a work, and to take and use water, if any, conserved or obtained by the work, and to dispose of the water for the use of occupiers of land
	s 13A	licence to construct a supply work and to take and use water obtained thereby
	s 18F	permit to construct and use a work, and to take and use water, if any, conserved or obtained by the work, and to dispose of the water for the use of occupiers of land for any purpose other than irrigation
	s 20B	authority to take water from a river or lake for the purposes of a joint water supply scheme
	s 20CA	authority to construct a supply work and to take and use water conserved or obtained thereby
	s 20L	group licence
	s 116	licence to commence sinking a bore or to enlarge, deepen or alter a bore
	Part 8	approval to construct a controlled work

(2) Development is not integrated development in respect of the consent required under section 90 of the *National Parks and Wildlife Act 1974* unless:

(a) a relic referred to in that section is known, immediately before the development application is made, to exist on the land to which the development application applies, or

(b) the land to which the development application applies is an Aboriginal place within the meaning of that Act immediately before the development application is made.

NB. The above Section 91 of the Act does not come into effect until 1 July 1998. All development applications for State Signficant Development lodged after 1 July 1998 MUST have considered the above section while preparing environmental impact statements.

APPENDIX B
AUTHORITY CORRESPONDENCE

Your reference

Our reference 1415

RECEIVED - CONNELL WAGNER

26 OCT 1998

PROJECT / FILE No: DOC No:

Connell Wagner P/L
PO Box 538
NEUTRAL BAY NSW 2089

STATE FORESTS

Attention: John Brockhoff

State Forests of
New South Wales

Manning Region
PO Box 692
Taree NSW 2430
Phone (02) 6551 0074
Fax (02) 6551 2326

Further to our inspection of 15/6/98, your fax of 11/6/98 and letters of 22/10/97 and 12/6/98.

Clearly SF NSW wishes to transfers ownership of the lands to RTA, so as they can own the quarry project. This will only be possible if fair and reasonable compensation is paid to SF NSW for gravel quantities and land values. SF NSW desires prompt action and settlement. Please include this in your EIS deliberations and DA negotiations.

SF NSW seeks more information on the proposed location and volume of gravel involved. Please forward any DA papers as soon as possible.

Yours faithfully,

K Carter
REGIONAL OPERATIONS & FIRE MANAGER
MANNING REGION

23 October, 1998

ION STAMP - PROJECT
RECD: 26/10/98 C.W. DOC. No: 5606.01
DES: JB FILE No: 1-1

ACTION REQUIRED

JB | TO EIS. App. B. | 26/10/98

State Forests is the registered business name of the Forestry Commission of New South Wales.

\data\tmj\ofm\1415

COPY FOR YOUR INFORMATION

1415

RTA
Major Projects Office
PO Box 147
PORT MACQUARIE NSW 2444

Attention: Jeff Thompson

DA Consent for RTA Quarry, Kiwarrak SF

Further to our field inspection on 15/6/98 with Connell Wagner staff, State Forests of NSW has no objections to the Development Application for extraction of gravels from nominated cut batters on the Taree Bypass - being an area within Kiwarrak SF.

As the land management authority consent to the project is given subject to the payment by RTA of compensation for:

- The land value of the Bypass area, and other acquired lands between the new and old highway.
- Loss of timber productivity in the future by removing these lands from producing timber in perpetuity.
- The value of the gravels removed in the quarry project, being exported from the site.
- Reimbursement of construction costs to SF NSW to establish a parallel fire trail along the eastern edge of the new highway.

Full details have been provided in a separate letter to RTA of this same date 23/10/1998.

Please include these conditions in the DA submitted to Greater Taree Council.

Yours faithfully,

K Carter
REGIONAL OPERATIONS & FIRE MANAGER
MANNING REGION

23 October, 1998

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Greater Taree
CITY COUNCIL

Administration Centre 2 Pulteney Street
PO Box 482, Taree NSW 2430
DX 7020, Taree

Phone 02 6591 3399
Fax 02 6591 3311

File No: R3635-3
Letter 100
BB:ms
Enquiries: Bruce Byatt

25 June 1998

Mr J Brockhoff
Connell Wagner
P O Box 538
NEUTRAL BAY 2089

Dear Sir

RE: TAREE BYPASS CUT BATTERS EIS

I refer to your letter of 12 June concerning the Environmental Impact Statement your company is preparing on behalf of the RTA.

My letter of 12 January 1998 confirmed that the matters outlined in your letter of 17 September 1997, together with visual impact and the impact of further clearing on threatened species, would need to be addressed.

As you are aware, Council and Taree Lions Club propose to construct a rest/barbeque/observation area on Forestry land adjacent to the Old Highway north of the Fords Road intersection. This will require the maintenance of access to this area following the proposed works. I attach for your information a copy of a letter to State Forests, together with a map showing the approximate location of the proposed area. Council would require that the EIS address this issue. Further information can be obtained by contacting Council's Director Engineering, Mr Ian Angus on 23 65 913340.

I trust the above assists you in the preparation of the necessary documentation.

Yours faithfully

Bruce Byatt
Manager
DEVELOPMENT CONTROL

LEADER:
TO
ACTION REQ
No.:
TIONED
E

Brockhoff

P43-1

ILA:BJK

Enquiries: Ian Angus

4 June 1998

State Forest of NSW
PO Box 692
TAREE NSW 2430

ATTENTION: MR KEVIN CARTER

Dear Sir

TAREE SOUTH OBSERVATION SITE

I refer to our on site visit and discussion Monday 1 June 1998.

Before the Taree By Pass was constructed Taree Lions Club had developed a travellers rest at the top of the "4 Mile". This was destroyed with the By Pass. It is proposed to have a replacement on the site visited with access via Fords Road, the old highway and then the forest road with a turn around loop on top of the spur. It would require some clean out of under storey material and the thinning of intermediary tree growth to create a window overlooking Taree.

The Lions Club have undertaken to carry out clearing/clean up, placement of small shelters with tables and seats and bar-b-que units. The Council would be the proponent of the scheme utilising Lions labour and some basic road development.

Would you please grant approval for the project to proceed and the conditions you require to be met.

Yours faithfully

IAN L ANGUS
DIRECTOR ENGINEERING
G\DIRECTOR\LETTERS\STATE FOREST 2-6-98/BK

Environment Australia

Biodiversity Group

GPO Box 636 Canberra ACT 2601 Ph (06) 250 0200 Fax (06) 250 0399

Your ref: 5606LUCE\kb

Mr John Brockhoff
Study Manager
Connell Wagner
PO Box 538
NEUTRAL BAY NSW 2089

Dear Mr Brockhoff

Environmental Impact Statement - Fill Material Quarry on the Taree Bypass Cut Batters for Pacific Highway Upgrade

Thank you for your letter of 18 June 1998 regarding the preparation of an Environmental Impact Statement for the fill material quarry for the Pacific Highway upgrade.

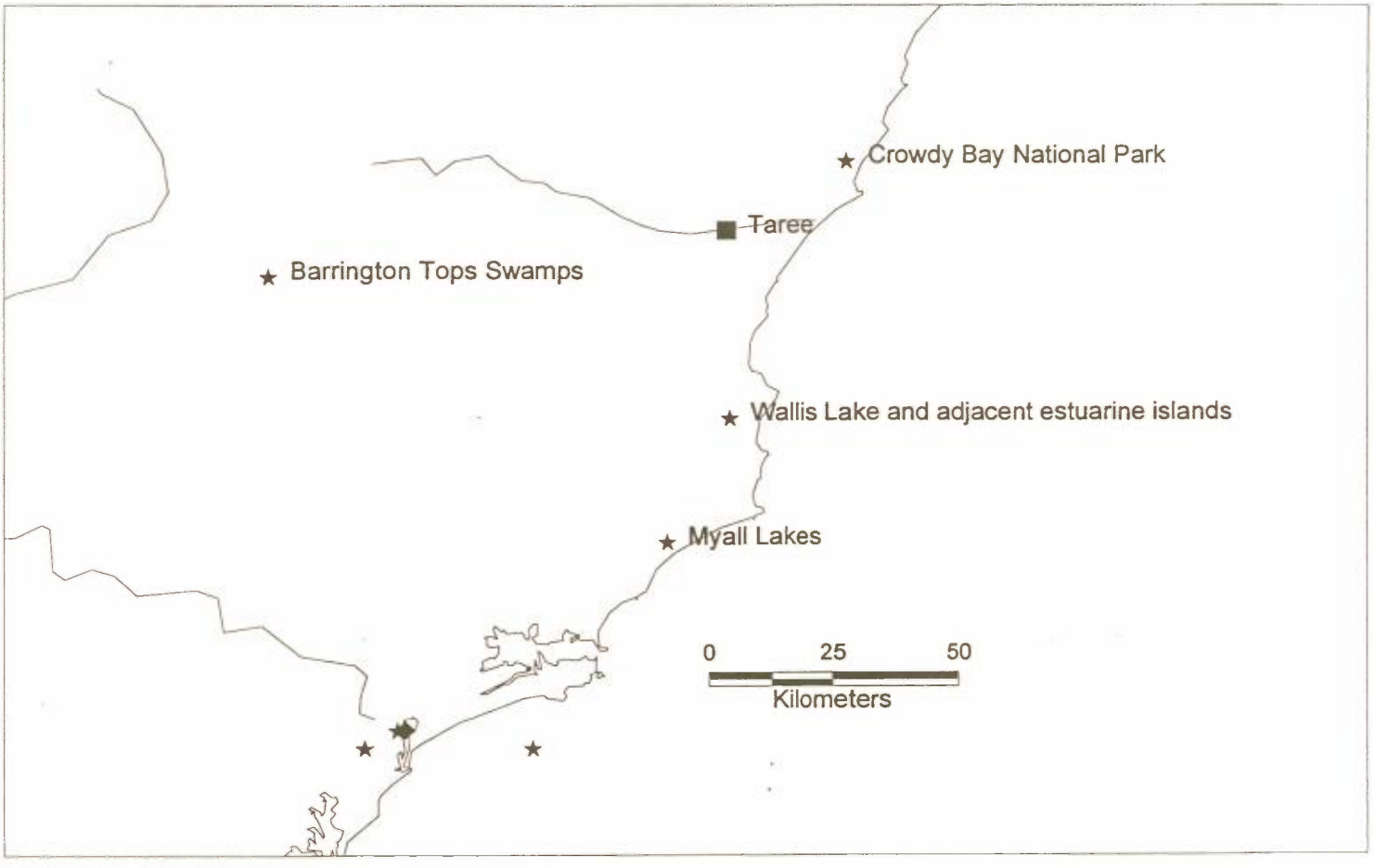
Crowdy Bay National Park is the closest wetland of national significance, as listed in *A Directory of Important Wetlands in Australia, Second Edition,* to the proposed quarry site. Situated approximately 30 kilometres to the north east, the wetland is not in close proximity to the proposed project. I have enclosed a map indicating the location of nationally important wetlands in the region.

Australia is a Contracting Party to the Ramsar Convention on Wetlands of International Importance, and is obliged to promote the wise use of all wetlands. Furthermore, the *Wetlands Policy of the Commonwealth Government of Australia* supports the promotion of a more integrated approach to wetland conservation and management within a total watershed framework. The Policy also encourages the preparation of environmental impact assessments for proposals having a significant impact on the environment.

Thank you for the opportunity to comment on this proposal. If you require any further information, please contact Trevor Costa on (02) 6250 0791.

Yours sincerely

Louise Rose
A/g Director
Wetlands Unit
13 July 1998


Crowdy Bay National Park
Taree
Barrington Tops Swamps
Wallis Lake and adjacent estuarine islands
Myall Lakes
0
25
50
Kilometers

16 June 1998

NSW NATIONAL PARKS AND WILDLIFE SERVICE

Connell Wagner Pty Ltd
PO Box 538
Neutral Bay
NSW 2069

CONNELL WAGNER

23 JUN 1998

CW FILE No: DOC No:
PROJECT No.: C.W. DOC. No.:
P. LEADER: FILE No.:

TO	ACTION REQUIRED	ACTIONED BY/DATE

Our reference: DB:db3051-3
Your reference:

ATTENTION: John Brockhoff

Dear Sir

Re: Environmental Impact Statement for the Taree Bypass cut batters quarry

Thank you for your request dated 11 June 1998 for issues relating to the Environmental Impact Statement (EIS) for the Taree Bypass cut batters quarry for fill for the Taree to Coopernook section of the Pacific Highway upgrade.

National Parks and Wildlife Service (NPWS) acknowledges that the environmental assessment for this project has been upgraded from a Review of Environmental Factors to an EIS. It is also noted that NPWS has previously supplied preliminary information on environmental issues to be addressed. NPWS also notes that the consultants have concluded that there is not expected to be a significant effect on any threatened species as a result of the proposal.

NPWS notes that the reports provided describe the area as being considerably altered from its natural state, and that a total of approximately one hectare of native vegetation in several small patches is to be removed.

Although indications are that there will not be significant natural heritage issues involved with the proposal, NPWS recommends that consideration be given to the following factors:

- Proximity of the development to existing fauna underpasses associated with the Taree Bypass.
- Protection of the Koala movement corridor that has been identified during the haulage stage of the proposal, particularly given that four Koala road kills have been reported within the Kiwarrak State Forest. This may include the need to establish strategic fencing during this period.
- Investigate the potential to provide Koala-proof fencing along the old highway.

Northern Zone
GIO House
24 Moonee Street
Coffs Harbour NSW
Australia
PO Box 914
Coffs Harbour 2450
Tel: (02) 6651 5946
Fax: (02) 6651 6187

Head Office
43 Bridge Street
Hurstville NSW
Australia
PO Box 1967
Hurstville 2220
Tel: (02) 9585 6444
Fax: (02) 9585 6555

Australian-made 100% recycled paper

- Incorporate appropriate native plant species into the revegetation program, particularly those species which are to be removed as part of the proposal.

- In addition to the above considerations, the RTA may wish to consider the following threatened fauna that have been recorded within Kiwarrak State Forest:

  Birds:
  Glossy Black-Cockatoo
  Powerful Owl
  Square-tailed Kite
  Sooty Owl

  Non-flying mammals:
  Brush-tailed Phascogale
  Koala
  Squirrel Glider
  Tiger Quoll
  Yellow-bellied Glider

  Flying mammals:
  Miniopterus australis
  Myotis adversus

Please accept our apologies for not attending the site inspection due to late notice of the inspection.

If you require any further information please contact Dianne Brown on (02) 6659 8273.

Yours faithfully

JANELLE BROOKS
Manager, Environmental Planning Unit
Northern Zone

for DIRECTOR-GENERAL

MCW MIDCOAST WATER

57-61 Albert Street
PO Box 671
Taree 2430
Phone (02) 6592 4801
Fax (02) 6557 8010

Progress No. 1270.1

6 August, 1998

Enquiries: Ian McCubbin

Connell Wagner Pty Ltd
124 Waymouth Street
Adelaide South Australia 5000

Attention: Glen Passfield

Dear Sir,

PROPOSED QUARRY, PACIFIC HIGHWAY, TAREE.

Thank you for notification of the proposed quarry on the Pacific Highway 5km south of Taree and my apologies for the delay in responding.

Plans of existing watermains in the vicinity of the quarry are attached. Our only area of concern is excavation adjacent to the crossing under the dual carriageway and former highway. Could you please provide detailed plans of the excavation between chainages 161800 and 161950 so that the impact of the proposed work may be better assessed.

The roof on Koorainghat Reservoir is vermin-proof but not dust-proof.

Yours faithfully,

I H McCubbin
Technical Officer

LAND & WATER CONSERVATION

Contact: Jeff Hunt
Phone: (02) 4929 9850
Fax: (02) 4929 6364

Our Ref: ER564
[U:\ER564.DOC]

The Manager
Connell Wagner Pty Ltd
PO Box 538
NEUTRAL BAY NSW 2089

Attention: Mr John Brockhoff

RECEIVED - CONNELL WAGNER
24 JUN 1998
PROJECT / FILE No:

24 June, 1998

Dear Sir

Re: Taree Bypass Cut Batters Quarry EIS

In reply to your request of 12 June 1998 on this matter. We have reconsidered the proposal and conclude that our reply of 22 October 1997 (copy attached) adequately covers the issues of concern to our Department.

Yours faithfully,

Jeff Hunt
Resource PlanningManager
Hunter Region

Suite 8 464 King Street Newcastle West NSW 2302 PO Box 2213 Dangar NSW 2309 DX 4335 Newcastle West
Telephone (02) 4929 4346 Facsimile (02) 4929 6364 Email www.dlwc.nsw.gov.au

your ref:
our ref: ER 564

LAND & WATER CONSERVATION

THE MANAGER
CONNELL WAGNER
P.O. BOX 538
NEUTRAL BAY. 2089

FAXED 22-10-97

ATTENTION: K. Buckley

Wednesday, 22 October, 1997

Dear Sir

REF REGARDING FILL MATERIAL QUARRY, CUT BATTERS OF THE TAREE BYPASS.

I refer to your letter dated 17 September 97 requesting this Department's comments in regard to the above proposal. I apologise for the delay, but the Department has now reviewed this matter and provides the following information addressing the principle issues:

EROSION CONTROL

The Department recommends that the development be conducted to result in negligible off-site impacts from soil erosion and sedimentation. To achieve this, the proponent will need to prepare an Erosion and Sediment Control Plan (ESCP) to Departmental standards for both the cut and fill sites . The REF should contain the strategy to be employed to achieve effective erosion and sediment control.

GROUNDWATER

The REF must address potential impacts to quality and quantity of groundwater if any excavations intercept groundwater during or after quarrying.

All works which intercept groundwater (test pits, excavations, test bores, test wells....) must be licensed with the Department of Land & Water Conservation prior to their construction.

FLOODING IMPACTS

The REF must consider the impact of the proposal on flooding on adjacent lands. This will include examination of the proposed hydrological regime, a description of any diversion of floodwaters that is planned and the current and expected flood heights in the area.

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 02 4929 4346.

Yours Faithfully

Jeff Hunt, CATCHMENT PLANNING MANAGER
for MANAGER, RESOURCE ASSESSMENT AND PLANNING
HUNTER REGION

464 King Street Newcastle West NSW 2302 PO Box 2213 Dangar NSW 2309 DX 4335 Newcastle West
Telephone (049) 294 346 Facsimile (049) 298 364

AUSTRALIAN HERITAGE COMMISSION

PHONE : (02) 6217 2111
TOLL FREE : 1800 020 652
FACS : (02) 6217 2095

INTERNET: http://www.ahc.gov.au/

FACS NUMBER : 02 9465 5598

TO : JOHN BROCKHOFF

ORGANISATION : ...

FROM : NORM STEVENSON
(Ph 02 6217 2155)
Register of the National Estate Section

SUBJECT : ...

DATE : 24/6/98 TIME SENT : 12:10 am/pm PAGES : 7

COMMENT :

ATTACHED ARE LOCATIONS OF RNEDB PLACES WHICH HAVE TABLE AS USEFUL TOOL - IT DOES APPEAR THAT THEY IMPACT ON STUDY AREA

REGARDS

NORM S

POSTAL ADDRESS : GPO Box 1567
CANBERRA ACT 2601

: MTA HOUSE
39 Brisbane Avenue
BARTON ACT 2600

RECEIVED - CONNELL WAGNER
24 JUN 1998
DOC NO
PROJECT / FILE NO

Register of the National Estate Database
Place Report - Location Details

Name of Place:	Lansdowne Reserve			
Former/Other Names:	Sandy Point Reserve			
Reference Nos.:	019530	1/18/143/0010		
Status:	Indicative Place	Not Assessed		
Nearest Town:	Lansdowne		**State:**	**NSW**

Location/Boundaries

Southern, western and south-eastern boundary formed by Lansdowne River (tributary of Manning River); northern boundary formed by main north coast railway line; eastern boundary formed by Lansdowne Road.

• • • End Of Report • • •

Register of the National Estate Database
Place Report - Location Details

Name of Place:	Old Bar - Farquhar Inlet			
Former/Other Names:				
Reference Nos.:	018854	1/18/143/0008		
Status:	Indicative Place	Not Assessed		
Nearest Town:	Old Bar		**State:**	NSW

Location/Boundaries

The area including the whole of Farquhar Inlet and surrounding Crown Lands being Portion 246 Parish of Stewart, Charleys Island, within the inlet, the sand bar known as The Old Bar, the area of Old Bar Park being Crown Reserve and the two unnamed islands adjacent to Mudbishops Point.

• • • End Of Report • • •

Register of the National Estate Database
Place Report - Location Details

Name of Place:	Crowdy Head Lighthouse			
Former/Other Names:	Crowdy Head Lightstation			
Reference Nos.:	003496	1/18/143/0005		
Status:	Registered	Registered		
Nearest Town:	Crowdy Head		**State:**	NSW

Location/Boundaries
Crowdy Head, 30km east-north-east of Taree.

• • • End Of Report • • •

Register of the National Estate Database
Place Report - Location Details

Name of Place:	Saltwater Aboriginal Place			
Former/Other Names:	Wallabi Point Area			
Reference Nos.:	016030	1/18/143/0004		
Status:	Registered	Registered		
Nearest Town:	Old Bar		**State:**	NSW

Location/Boundaries

13ha, 5km south-west of Old Bar, at Wallabi Point.

• • • End Of Report • • •

Register of the National Estate Database
Place Report - Location Details

Name of Place:	Coocumbac Island Nature Reserve			
Former/Other Names:	Big Goat Island, Allambie Island			
Reference Nos.:	003495	1/18/145/0002		
Status:	Registered	Registered		
Nearest Town:	Taree		**State:**	NSW

Location/Boundaries
5.06ha, in the Manning River at Taree.

• • • End Of Report • • •

Register of the National Estate Database
Place Report - Location Details

Name of Place:	Taree Courthouse			
Former/Other Names:				
Reference Nos.:	003500	1/18/145/0001		
Status:	Registered	Registered		
Nearest Town:	Taree		**State:**	NSW

Location/Boundaries
85 Albert Street, Taree.

• • • End Of Report • • •

FAX MESSAGE

ENVIRONMENT PROTECTION AUTHORITY

TO : Connell Wagner
116 Military Road
Neutral Bay NSW 2089

FAX 029465 5598

ATTENTION : John Brockhoff or Glenn Passfield.

SUBJECT : TAREE BYPASS CUT BATTERS QUARRY EIS

I refer to your letter of 12 June 1998 requesting further requirements for the above EIS. This is to advise you that we have no further requirements to those outlined to you in our letter of 13 October 1997 ref. 272598A1.

If you have any further enquiries on this matter please contact the sender on 0249 269966.

SENDER : Shane Trengove for Head Operations Unit - Hunter Environment Protection Authority

PHONE : 0249 269966

FAX : 0249 296712

DATE : 18 June 1998

RECEIVED - CONNELL WAGNER

1 8 JUN 1998

PROJECT / FILE No. DOC No.

PROJECT No.: O.W. JOB No.:
P. LEADER: FILE No.:

TO	ACTION REQUIRED	AC

PROJECT No.: _____ C.W. DOC No.: _____
PROJECT LEADER: FILE No.: RECEIVED

ACTION REQUIRED	ACTIONED BY/DATE
	16 OCT 1997

PROJECT/FILE No:

DOC No:

8

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

[redacted]
Connell Wagner Pty Ltd
PO Box 538
NSW 2089

Our Reference: 272598A1

Your Reference:

13 OCT 1997

Contact: Colin Halverson

Dear Kym

REVIEW OF ENVIRONMENTAL FACTORS REGARDING FILL MATERIAL QUARRY ON CUT BATTERS OF THE TAREE BYPASS

I refer to you letter of 17 September 1997 seeking advice on issues the Environment Protection Authority (EPA) considers should be addressed in a Review of Environmental Factors for the above proposal.

In general, the EPA would expect that the REF demonstrates that the activities associated with the project can be undertaken without detrimental impacts on the quality of water in local waterways in the short and long term and without adversely affecting local amenity (eg local air quality and noise levels).

The EPA's detailed comments on environmental issues arising from this proposal are set out in the attached Schedule. Other matters which the EPA believes are relevant to the project include the following:

Environmental Management Plan

To assist in focussing on the management of environmental issues in the course of this work, the EPA suggests that a comprehensive Environmental Management Plan (EMP) be drawn up to cover the whole of the extraction site and incorporated in the REF. This plan should include, but not necessarily be limited to:-

- Water Quality Monitoring Program (for surface and ground water)
- Pollution Incident Management Plan
- Site Rehabilitation Plan
- Sediment and Erosion Control Plan (including dust suppression initiatives)
- Noise Management Plan

Pollution Control Approval

Section 27(2) of the Noise Control Act 1975 requires that a pollution control approval must be obtained from the EPA by the occupier of any premises who is carrying out work that would cause the premises to become scheduled premises. Scheduled premises include any premises

> "having a site area of 20,000 square metres or more that is available to be worked and any part of which is used for entrances, mining, excavating, dredging or quarrying of rock, coal, metalliferous ores, precious metals, sand, soil, clay, mud or any material of a similar nature, whether at the surface or underground, for the purpose of winning the material for sale or for use at other premises."

The REF should indicate whether or not the site falls within this definition. If so, a Pollution Control Approval for the project will be required for the purposes of the Noise Control Act 1975.

The RTA will also require a pollution control approval for runoff control works associated with the project. In addition, any individual items of equipment to be used during the work which may be scheduled (eg under the Clean Air Act) will need to hold appropriate approvals and licences. These items would include mobile crushing and screening equipment.

Section 17J(1)(b) of the Pollution Control Act requires that an application for pollution control approval must be "accompanied by ....details of the work proposed to be undertaken, together with details of the methods intended to be adopted so as to control pollution".

As you can appreciate from the above legislation, the EPA is not legally entitled to issue approval without having the appropriate details regarding works and methods intended to be adopted for the control of pollution.

In order to satisfy the above, the EPA requires a copy of the final Environmental Management Plan and a copy of site plans showing the notional location and design parameters of all pollution control works and facilities which are the subject of an approval application.

I trust that this information is of assistance to you. If you have any further queries please do not hesitate to contact me on (02) 49 269 968.

Yours sincerely

C J Halverson

COLIN HALVERSON
Head Regional Operations Unit, Hunter
for Director General

OPTUS

communications pty limited
ACN 052 833 208

ASSET LOCATION REPLY

NETWORK OPERATIONS CENTRE
LEVEL 1,
65 EPSOM ROAD
ROSEBERY NSW 2018
AUSTRALIA

TELEPHONE: (+61 2) 9342 0930
FACSIMILE: (+61 2) 9342 0931

FAX COVER SHEET

TO:	JOHN BROCKHOFF
COMPANY NAME:	CONNELL WAGNER
DATE:	12/6/98
FAX NUMBER:	02 9465 5598
FROM:	VESNA RADOJCIC
NUMBER OF PAGES:	1 (including cover sheet)

RECEIVED CONNELL WAGNER
12 JUN 1998
PROJECT / FILE No: DOC No:

Dear Sir/Madam,

OPTUS Communications asset location reference No. COMMS37160

One Call Service Reference No (if applicable): N/A

With reference to your enquiry of: 11/6/98
Address/area of proposed works:
TAREE BYPASS, PACIFIC HIGHWAY AND FORDS ROAD **TAREE/COOPERNOOK** **NSW**

After referring to OPTUS Communications existing asset plans, OPTUS Communications finds that here are **EXISTING OPTUS COMMUNICATIONS ASSETS** within the vicinity of the proposed works:

This request has been forwarded to your local OPTUS Communications NFO External Transmission group for actioning. If you do not receive a response from that group 48 hours prior to your works commencing, please reconfirm your locate request by calling (02) 9342 0930 or *FREECALL* 1800 505 777.

OPTUS Communications thank you for your inquiry and appreciate your continued usage of the One Call Service and/or OPTUS Communications *FREECALL* 1800 505 777 locate service.

This reply relates directly to the location requested. Where additional works occur that have not been specified within the location request, OPTUS Communications require that an additional location request be submitted. In the case of no additional location requests being submitted, OPTUS Communications will hold the relevant party responsible for any damage to, or expenses incurred by, OPTUS Communications.

• Important •
The contents of the facsimile (including any attachments) may be confidential and privileged. Any unauthorised use of this document or its contents is prohibited. If you have received this facsimile in error, please notify us by telephone immediately and then shred this document. Thank you.

APPENDIX C
TRAFFIC ANALYSIS

1. EXISTING SITUATION

Intanal

Main Help General Volume Lanes Calc Delay D/SAt Phases Flows PRint Save

AM	AM Peak Vol	Sat	Phse	Yval	Utrn	PM PEAK Vol	Sat	Phse	Yval	Utrn	BUSINESS Vol	Sat	Phse	Yval	Utrn
1L	0		A			0		A			0		A		
1T	506	1893	A	0.32		522	1893	A	0.33		360	1900	A	0.23	
1R															
2L															
2T															
2R															
3L															
3T	506	1884	AB	0.33		490	1884	AB	0.32		348	1892	AB	0.23	
3R	25	1850	B	0.02		25	1850	B	0.02		10	1850	B	0.01	
4L	0		BC			0		BC			0		BC		
4T															
4R	10	1850	C	0.01		10	1850	C	0.01		7	1850	C	0.01	

A	Min	ELI	H%AM	H%PM	H%B	L/S	PD-L	PD-R	Sign	Hold	LKph
1	5	4.0	20	20	20	0'	0				25
2											
3	5	4.0	24	24	24	0'		0			
4	5	4.0	100	100	100		0	0	G	M	25

File = TRI
Type = T4

<F3> = [Heavy%-Signs-よよよ-Platoon%]

1(a) TRAFFIC VOLUMES

Intanal

Main Help General Volume Lanes Calc Delay D/SAt Phases Flows PRint Save

File = TRI TCS = 0 Type = T4

AM Peak PM Peak Business SIgnals SIgns Roundabout Q/STop/よよD

A M	DS	Total Entry Capac	Delay Geom Rate	Delay Geom Sec/V	Delay Rate	Gap Accept	Delay Total Rate	Delay Averge Sec/V	Queued Veh's	Queue Length Metres	Stops Total Hour
1 L											
1 T											
1 R											
2 L											
2 T											
2 R											
3 L											
3 T											
3 R	0.05		0.0	5.4	0.0		0.1	8.4	1	6	2
4 L											
4 T											
4 R	0.07	268	0.0	5.6	0.1	5.0	0.1	14.7	1	6	1
TOT	0.07		0.1	0.2	0.1		0.2	0.4			3

TOtal Delay Average Sec/V = (Seconds Delay) / (All Vehicles on all Movements)

1(b) AVERAGE DELAY

Intanal

Main Help General Volume Lanes Calc Delay D/SAt Phases Flows PRint Save

Phse	AM Peak PT%o	CLo	Yo		PM PEAK PT%o	CLo	Yo		BUSINESS PT%o	CLo	Yo	
A	85.7	130	0.35		85.8	130	0.36		85.0	121	0.25	
B	7.4				7.3				7.6			
C	6.9				6.9				7.4			
D		よよよ	@ CLm=	140		よよよ	@ CLm=	140		よよよ	@ CLm=	140
E		Delo	DSm=	0.39		Delo	DSm=	0.40		Delo	DSm=	0.27
F		0	Ym=	0.35		0	Ym=	0.36		0	Ym=	0.25
G			Delaym=	2.02			Delaym=	2.03			Delaym=	1.33
Seq	ABC				ABC				ABC			

	Signals	Signs	Round	Signals	Signs	Round	Signals	Signs	Round
Delo	2.8	0.2	1.2	2.8	0.2	1.2	1.3	0.1	0.8
Stpo	269	3	17	271	3	17	178	1	8
D/So	0.39	0.07	0.46	0.40	0.07	0.45	0.28	0.04	0.32
L/So	A	B	A	A	B	A	A	A	A

File = TRI

Required Bays

A	RHT Lanes Length	No.	LHT Lanes Length	No.
1				
2				
3	10	1		
4	10	1		

Type = T4

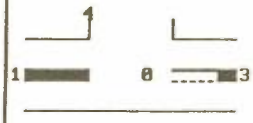
1(c) DEGREE OF SATURATION & LEVEL OF SERVICE

2. EXISTING SITUATION + CONSTRUCTION TRAFFIC (HOLIDAYS)

Intanal

Main Help General Volume Lanes Calc Delay D/SAt Phases Flows PRint Save

AM	AM Peak Vol	Sat	Phse	Yval	Utrn	PM PEAK Vol	Sat	Phse	Yval	Utrn	BUSINESS Vol	Sat	Phse	Yval	Utrn
1L	0		A			0		A			0		A		
1T	1616	1883	A	1.03		1616	1883	A	1.03		1131	1883	A	0.72	
1R															
2L															
2T															
2R															
3L															
3T	1616	1874	AB	1.03		1616	1874	AB	1.03		1131	1874	AB	0.72	
3R	25	1850	B	0.02		25	1850	B	0.02		18	1850	B	0.01	
4L	0		BC			0		BC			0		BC		
4T															
4R	10	1850	C	0.01		10	1850	C	0.01		7	1850	C	0.01	



A	Min	ELI	H%AM	H%PM	H%B	L/S	PD-L	PD-R	Sign	Hold	LKph
1	5	4.0	20	20	20	0'	0				25
2											
3	5	4.0	20	20	20	0'		0			
4	5	4.0	100	100	100		0	0	G	N	25

File = TRI1 <F3> = [Heavy%-Signs-***-Platoon%]
Type = T4

2(a) TRAFFIC VOLUMES

Intanal

Main Help General Volume Lanes Calc Delay D/SAt Phases Flows PRint Save

File = TRI1 TCS = 0 Type = T4

AM Peak PM Peak Business Signals Signs Roundabout Q/STop/***D

A M	DS	Total Entry Capac	Delay Geom Rate	Delay Geom Sec/V	Delay Rate	Gap Accept	Delay Total Rate	Delay Averge Sec/V	Queued Veh's	Queue Length Metres	Stops Total Hour
1 L											
1 T											
1 R											
2 L											
2 T											
2 R											
3 L											
3 T											
3 R	0.21		0.0	5.7	0.2		0.3	30.7	1	6	6
4 L											
4 T											
4 R	1.43	14	0.0	0.2	10.0	5.0	10.9	1953.2	11	82	22
TOT	1.43		0.1	0.1	11.0		11.1	10.2			28

TOtal Delay Average Sec/V = (Seconds Delay) / (All Vehicles on all Movements)

2(b) AVERAGE DELAY

Intanal

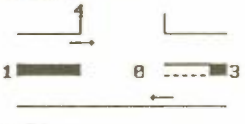
Main Help General Volume Lanes Calc Delay D/SAt Phases Flows PRint Save

Phse	AM Peak PT%o	CLo	Yo		PM PEAK PT%o	CLo	Yo		BUSINESS PT%o	CLo	Yo	
A	87.1	140	1.12		87.1	140	1.12		87.1	140	0.78	
B	6.4				6.4				6.4			
C	6.4				6.4				6.4			
D		***	@ CLm=	140		***	@ CLm=	140		***	@ CLm=	140
E		Delo	DSm=	1.22		Delo	DSm=	1.22		Delo	DSm=	0.86
F		0	Ym=	1.12		0	Ym=	1.12		0	Ym=	0.78
G			Delaym=	325.71			Delaym=	325.71			Delaym=	6.57
Seq	ABC				ABC				ABC			

	Signals	Signs	Round	Signals	Signs	Round	Signals	Signs	Round
Delo	325.7	11.1	2502.8	325.7	11.1	2502.8	76.6	8.4	4.6
Stpo	22426	28	5428	22426	28	5428	1151	5	231
D/So	1.22	1.43	***	1.22	1.43	***	0.86	0.25	1.00
L/So	F	F	F	F	F	F	A	F	A

File = TRI1

Required Bays Check Roundabout Data.

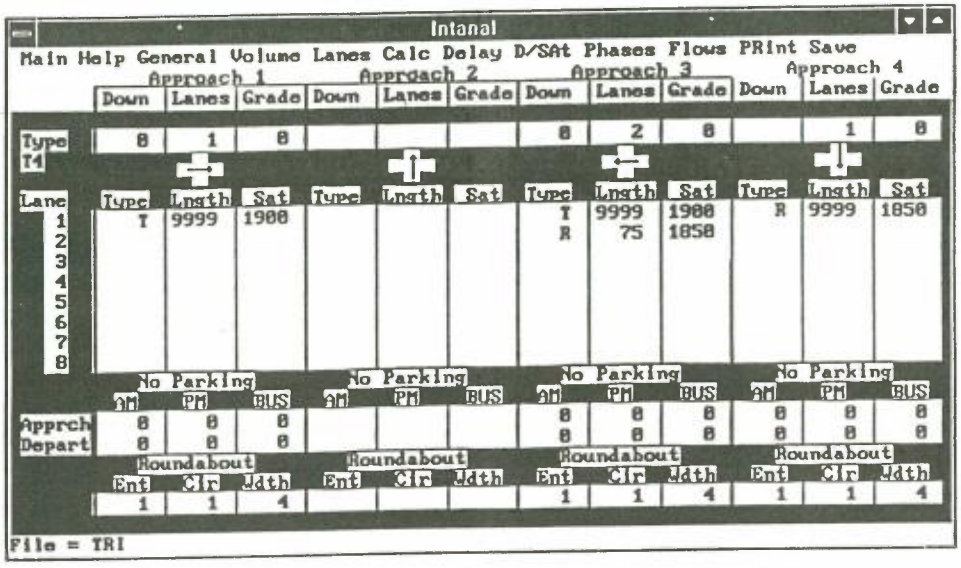


A	RHT Lanes Length	No.	LHT Lanes Length	No.
1				
2				
3	10	1		
4	10	1		

Type = T4

2(c) DEGREE OF SATURATION & LEVEL OF SERVICE

3. LANE CONFIGURATION



APPENDIX D
GEOTECHNICAL STUDY

GEOTECHNICAL REVIEW

PACIFIC HIGHWAY BYPASS

TAREE

Prepared for

CONNELL WAGNER PTY LTD

Prepared by

ROBERT CARR & ASSOCIATES PTY. LTD.

Report No. 827

September 1998

Robert Carr
& Associates Pty Ltd
GEOTECHNICAL
ENVIRONMENTAL
A.C.N. 063 515 711

28 September 1998
JN 827

Connell Wagner
PO Box 538
Neutral Bay NSW 2189

Attention: Mr. J. Brockhoff

Dear Sirs

RE: GEOTECHNICAL REVIEW OF BATTER EXTRACTION MATERIAL QUALITY AND EXCAVATABILITY, CUTS A AND B, PACIFIC HIGHWAY TAREE BYPASS.

1.0 Introduction

Studies carried out by Connell Wagner (ref 1) have identified that construction of the Coopernook Bypass across the Lansdowne River floodplain will require importation of large quantities of fill (approximately 240,000m^3). In addition, potential future upgrade of the Pacific Highway between Cundletown and Moorland would create a significant demand for fill materials.

Quarrying of the existing road cut batters is proposed on the western (left) side of the Pacific Highway between chainage 161600 to 162400 (cut A) with additional sources comprising re-alignment of the Fords Road intersection and between chainage 160800 to 161100 (cut B). Material excavation is proposed to:

- provide materials for earthworks construction on the Coopernook bypass, and
- reshape the existing cut batters to a long term stable profile.

Connell Wagner (ref 2) has carried out a review of environmental factors for the proposed quarry source.

This report provides a geotechnical review of the materials to be encountered in proposed batter extraction and their suitability for earthworks construction. Comments on excavatability are made together with comments on existing batter stability.

2.0 Available Geotechnical Data

Geotechnical data involving bore and test pit logs, seismic refraction traverses and laboratory testing is available from the site investigation works for the bypass (ref 3). Additional data comprises:

- California bearing ratio (CBR) test results carried out on materials won from the cuts and compacted as fills during road construction,

- Review of cut batter stability and treatment requirements (ref 4),
- Discussion with RTA personnel in relation to cut excavation characteristics of the cuttings, and
- Site appraisal / mapping by a senior engineering geologist on the 12th June, 1998.

The approximate location of bores, test pits and seismic lines with in the study area is shown on Drawing 827-1.

Construction documentation numbers the road cuttings sequentially from the south. Table 1 shows the correlation between the construction numbering of the cuts and the proposed borrow cuts.

Table 1 Cut Numbering

Construction Cut Number	Proposed Borrow Cut
2	B
3	Fords Road
4	A
5	
6	

2.1 Geology

The Hastings 1:250,000 Geological Sheet indicates that proposed cut areas A and B are underlain by the Kooraingha t Beds of Devonian Age. The Kooraingha t Beds are noted as comprising mudstone, laminite, lithic sandstone, tuff, minor limestone and conglomerate rock types.

Review of available reports and mapping of the existing cuttings indicates the rock:

- comprises predominantly rock of sedimentary origin with some interbedded volcanic rock,
- is deformed with steeply dipping beds (between 45° and vertical). Reference 3 notes a general bedding dip to the west or north west (ie. dipping into the western (left) cut batters), however brief mapping of the cuttings has indicated the presence of some beds dipping to the east (ie out of the cut).
- has been subject to low grade metamorphism which has resulted in some silicification of the rockmass,
- contains some shear zones and igneous dykes, and
- is variably fractured with a general close fracture spacing.

2.2 Boreholes, Test Pits and Seismic Refraction Lines

Available boreholes, test pits and seismic lines undertaken within the study area prior to construction are shown in Table 2 and on Drawing 827-1. In general they are located along the road alignment to the east of the proposed batter excavation areas.

Table 2 Available Subsurface Data

Data Source	Number	Chainage	Reduced Level (m, AHD)
Borehole	RC3	160990	95.9
	RC4	161211	112.3
	RC5	161732	100.3
	RC6	162030	99.9
	RC7	162402	94.0
Test Pit	7	160959	90.9
	8	161057	84.3
	9	161248	110.0
	10	161419	93.4
	11	161482	81.1
	12	161549	90.4
	13	161720	100.6
	14	161891	84.6
	15	161927	82.1
	16	162041	100.0
	17	162142	81.1
	18	162159	77.7
	19	162228	92.4
	20	162412	93.8
Seismic Line	Line 7	161110 – 161425	Longitudinal
	Line 8	161220	Transverse
	Line 9	161550 – 161880	Longitudinal
	Line 10	161700	Transverse
	Line 11	161945 – 162160	Longitudinal
	Line 12	162035	Transverse

The profile noted in the test pit logs typically comprises:

- Residual clay soils with siltstone rock fragments to a depth mostly less than 1m, over
- Siltstone rock, fractured with excavator bucket refusal in most pits at a depth of less than 2m with some pits excavated up to 3m without refusal.

The profile encountered in bores RC3 to RC7 typically comprised:

- Residual clay soils

The subsurface profile at bores RC 4 to RC7 is shown in Drawings 827 –2 to 5 together with existing and proposed sections.

2.3 Laboratory Testing

Laboratory testing of rock materials within the study area has comprised:

- Atterberg limit, particle size distribution and CBR testing on material recovered from test pits at depths generally less than 2m. Results from this testing are attached with Atterberg limits plotted in Figure 1 and particle size distribution in Figure 2.
- CBR testing on compacted cut materials during construction. Results are presented in Table 3 and Figure 3. These results represent conformance testing undertaken on compacted material at upper formation levels including pavement subgrade level. As such they may not be representative of all the materials excavated as higher quality rock fill materials may have been selectively utilised in the upper formation layers. Figure 3 indicates that CBR values of materials encountered at shallow depth in cut areas are generally similar in value to materials used in the upper formation layers during construction with some lower values associated with clay soils rather than rock fill material. This suggests that in general the material used and tested in the upper formation layers is likely to be a reasonable representation of materials to be won from the overall cuts.

No unconfined compressive strength testing was carried out on rock core from the bores due to the fractured nature of the core. Only limited point load strength testing was carried out on core from bores 6 and 7 only. The strength characteristics of the insitu rock materials as presented in the geotechnical report has been based predominantly on visual - tactile assessment only.

Figure 1 indicates that the fines (-425μm) of the shallow excavated rock material are clayey in nature and typically of medium plasticity. Figure 2 indicates that of the 6 samples tested, five had clay and silt (fines) content of less than 15% with one sample having 27%. The fines content of the rock materials is likely to generally decrease with excavation depth. Breakdown of the materials during handling and compaction is likely to result in an increased fines content.

Based on the particle size distribution and Atteberg Limits, the rock excavated from the shallow pits would be classified as gravel, with some sand and clay fine with some clayey gravel material.

Figure 1 Atteberg Limits (Shallow test pit samples)

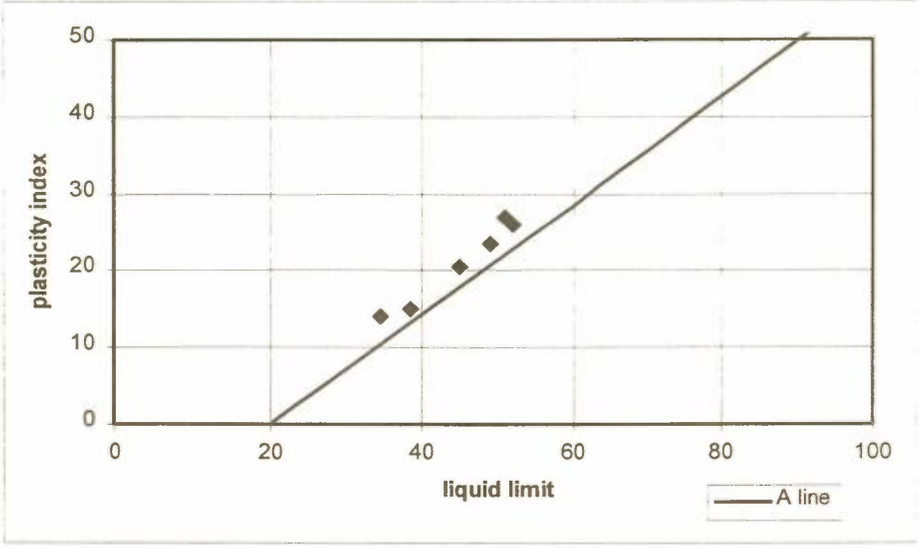
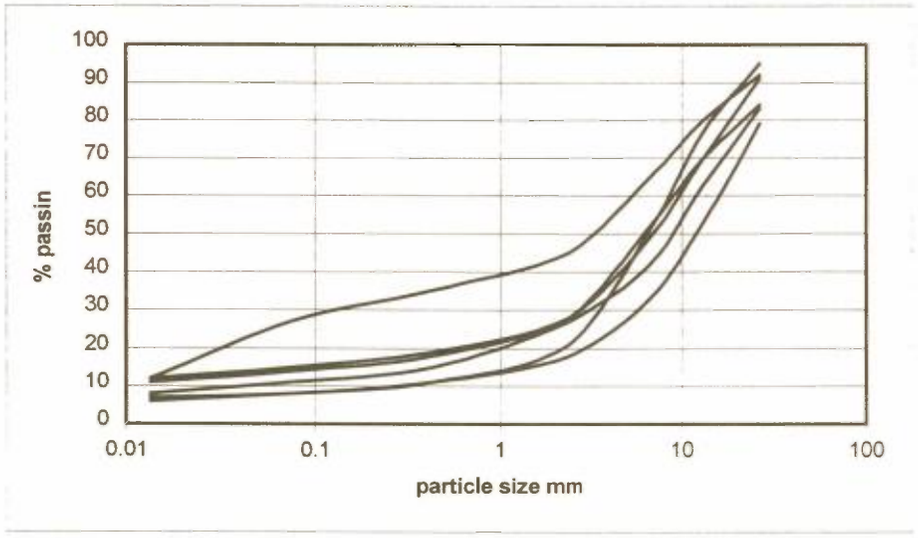
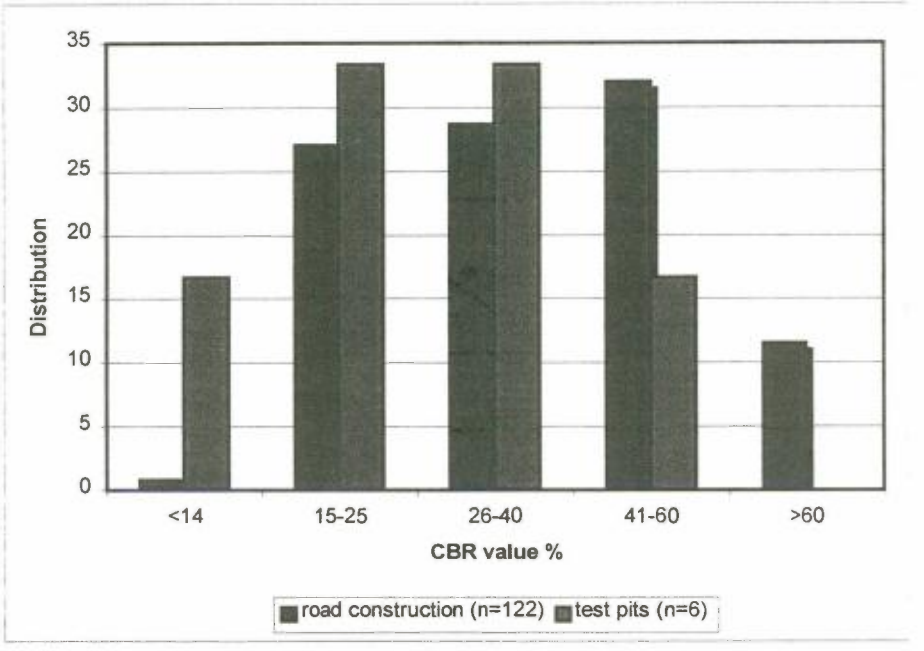


Figure 2 Particle Size Distribution (Shallow test pit samples)



Results of 10 day soaked CBR tests carried out on rock materials excavated from shallow test pits (6 samples) and on rock materials won from cuts and compacted as fills during construction (122 samples) are presented Figure 3. Results indicate a similar distribution of CBR values with slightly lower values in the shallow pits as would be expected. In general there does not appear to a significant increase in CBR values with increasing depth of excavation. Some breakdown could be expected during handling and compaction, and as such the construction CBR values are likely to be indicative of lower bound CBR strengths.

Figure 3 Distribution of CBR Values, Shallow Pits and Road Construction.



The average construction CBR results from cuts 3 to 6 are shown in Table 3 and indicate a similar value of about 40%. The CBR values also show a similar range / distribution of values indicating that on a statistical relationship there is little variation in CBR strength properties between the different cuts.

Table 3 CBR Test Results – Construction

Cut	Samples	Average CBR %	Standard Deviation
3	29	42	19
4	23	42	20
5	38	39	19
6	32	43	17

2.4 Batter Stability

The existing cuts are battered mostly between 50° and 60° (2H : 3V) with extensive batter treatment involving shotcrete application and rock bolting undertaken on the eastern (right) cut batters. Benches up to 4m in width occur where depth of cut is in excess of about 6m.

The existing western (left) batters in cuts 3, 4 and 5 are noted in reference 4 as requiring extensive treatment or batter reduction if they are to be regarded as permanent slopes. In their existing state they should be regarded as temporary slopes requiring regular inspection with traffic prevented from parking beneath.

Cut 6 at present in being laid back to a gradient of 2H : 1V (26.5°) to provide material for continuing construction on the northern part of the Taree Bypass.

Observation of cut batters during site appraisal confirms that the existing batters should be regarded as temporary slopes. Active batter erosion is occurring in places and this will require an increasing level of maintenance unless batter improvement works such as shotcreting or batter gradient reduction undertaken. The risk of rock falls occurring will increase with time as the surface materials under go progressive erosion and deterioration.

3.0 Construction Information

Discussions with RTA personnel involved in the construction phase of the project have provided the following information on material excavatability, handling and usage.

Excavation was undertaken by a D10 bulldozer with a D11 towards the toe of some cuts where material excavatability was marginal. Excavation problems were generally confined to the presence of a hard blue rock (`greywacke') that occurred in 'zones, veins and knobs'at the base of the cuts. Available information suggests that blasting was mostly confined to cuts 3 and 7 with some limited blasting of hard veins in cuts 5 and 6. Information noted included:

- Cut 3 – pre-splitting and blasting towards the base of the cut with an estimated volume of 20,000 m^3. An area of hard blue rock can be observed at the base of the eastern (right) batter as shown in photograph 10.
- Cut 4 – no blasting or presplitting required.
- Cut 5 – minor blasting in isolated vein.
- Cut 6 – some blasting of hard veins and presplitting. The old Pacific Highway was closed during blasting in cuts 6 and 7. Photographs 8 and 9 show the presence of the blue rock material towards the base of cut 6 where batter reshaping is being carried out.

It is understood that excavation resulted in some oversize material. Where used as general or select fill, it was broken down on placement by the use of grid rollers or compactors. Occasional large oversize boulders up to 2 m^3 were encountered as shown in photograph 11.

Material usage and preparation comprised:

- Bridging material in poor subgrade areas.
- General embankment fill with oversize material broken down by grid roller or compactor.
- Select fill with a minimum CBR value of 15% and oversize material broken down by grid roller or compactor.
- Drainage layers up to 0.5m thick beneath pavement areas in cuts. Oversize material was removed on a 150mm screen with specification on the percent finer than 19mm.

The general material was found to be unsuitable for use as gabion or rock fill due to the presence of some rock material that is susceptible to long term breakdown.

At the time of site appraisal, borrow excavation at Cut 6 was being carried out with batters regraded to 1V : 2H.

Localised shotcrete treatment of weak seams in the lower batter of cut 4 has been undertaken as shown in photographs 3 and 4.

4.0 Site Evaluation

Site mapping confirmed the subsurface profiles as presented in the cored bore logs. The profiles exposed in the cuts comprise a highly deformed sequence of interbedded siltstone, laminite and sandstone materials that have been subject to a degree of metamorphism. Some secondary lithification / cementation of the strata appears to be associated with the metamorphism. Some silicified and annealed fractures can be noted in the rock mass.

Shear and clay seams occur throughout the rock mass at various orientations with thickness ranging from 0.1m to in excess of 2m. Materials in these seams on excavation will comprise predominantly gravelly clays.

The rock exposed in the cuts is generally moderately weathered with weathering developed along defects and micro fractures. Some highly weathered zones occur within the upper sections of the cuts with some slightly weathered materials towards the base. Rock strength appears to be typically of high strength with some medium (laminite and some siltstones) and very high strength (blue greywacke). Defect spacing is generally less than 0.2m.

Some rock materials were noted to be susceptible to breakdown on weathering exposure. Some siltstone and laminite rock appears to undergo fretting on exposure as shown in photograph 6. The extent of these materials exposed was relatively limited.

During cut excavation it is understood that a hard blue rock was encountered in 'zones, veins and knobs' at the base of the cuts and required blasting. A very high strength blue lithic sandstone or greywacke was noted to occur in areas of cuts 4, 5 and 6. The material appears to be strongly cemented with some secondary silicification of fractures resulting in a wider effective defect spacing. This material is shown in photograph 8 and 11 where relatively closely spaced fractures can be observed, however they are cemented to the degree that bulldozer tyne penetration is difficult.

Stockpiles of excavated material were noted at the crest of cut 4. Photograph 4 shows part of the stockpile where rain infiltration has washed out the fines (clay and sand) from between the rock fragments. The rock fragments are predominantly angular to sub-angular and 30mm to 150mm in size with some fragments up to 400mm. Recently excavated material with fines present is shown in photograph 5. In general the material appears to excavate as a gravel with some clay and sand fines to a clayey gravel.

The depth of topsoil materials requiring stripping from the cut areas appears to be minimal with atypical thickness of about 0.1m. Topsoils should be stockpiles for landscaping re-use. The depth of residual clay and gravelly clay soils over the rock is generally about 1m or less.

This material may be suitable for re-use as general embankment fill subject to moisture conditions at the time of excavation.

At cut 2 there appears to a layer of fill materials in the area of the old highway located between the crest of the new cut section and the base of the old highway cut. A section sketch across this area (Drawing 827-6) suggests the fill may be up to 4m deep. The nature of the fill has not been ascertained, however it is likely that the fill comprises unsuitable or topsoil material. This could be confirmed by excavation of backhoe pits.

5.0 Proposed Quarry Design

Two cuttings (A and B) have been identified as potential fill sources. Cut B is located adjacent to the northbound carriageway between chainages 161600 and 162400 and cut A between chainages 160800 to 161100. Cut B comprises RTA numbered cuts 4, 5 and 6 and Cut A number 2. Survey sections by the RTA showing existing and proposed cuts (ref 10/426.1363) are available for cuts 3 to 6 and have been used in preparation of the attached section drawings.

The extent of proposed excavation in cut B is variable ranging from depths of 10m to 20m with a width of 40m to 110m. Maximum batter gradients are 1V : 2H (26.5°). The total volume of material potentially available in cut B has been assessed Connell Wagner as 400,000m^3.

No survey data or proposed excavation detail is available for Cut B. It is understood that cut B is proposed as a secondary source of material and the potential volume has been assessed as 40,000m^3. A sketch section has been mapped at chainage 160980 and is shown in Drawing 827-6.

The maximum suggested batter slopes for the materials to be encountered in batter excavation are:

- 1V : 2H in soil and extremely weathered rock
- 1V : 1.5H in highly to moderately weathered rock which comprises the majority of the existing cuttings
- 1V : 1H in slightly weathered rock encountered at depth in the existing cuts.

It should be noted that provision for surface drainage to limit scour erosion should be made where laterally extensive batter slopes are proposed. The spacing of drains will depend on surface gradient and overland flow paths and should be subject to specific design. Benching of the cut slopes would be required to accommodate drainage. Where cuts are battered at 1V : 1H or flatter, it is suggested that benching be incorporated in batter design to facilitate maintenance and provide protection from scour erosion. In general, benching should be undertaken on the basis of vertical cut height with a maximum height of about 7m between benches, or in accordance with RTA guidelines. Minimum bench width should be 3m with benches graded at a minimum slope of 1 in 20 (5%) back into the batter for drainage. For a batter gradient of 1V : 2H, the maximum slope length between benches would be in the order of about 15m.

Erosion protection measures should comprise:

- Provision of lined catch drains along the crest of all cuts with upslope catchment and along the rear of all cut benches. The drains should be discharged into the road drainage system or existing watercourses in a controlled manner.
- Vegetation by seeding, hydromulching or similar of all soil and weathered rock batters. The maximum slope batter to facilitate topdressing for vegetation is about 1V : 2H. Establishment of topsoil on batters steeper than 1V : 2H will require the use of geocells or geomats. On weak rock batters up to 1V : 1H, vegetation can be established by cutting serrations (steps) into the batter and filling with chain spread topsoil.
- Shotcrete and drainage treatment of low strength seams and zones within rock batters.

6.0 Material Excavatability

Seismic refraction studies were carried out along the route by RTA Material Services in 1992 / 1993 (reference 3). Longitudinal refraction lines were undertaken parallel and in proximity to the centreline with oblique or normal transverse lines at each cut location. Seismic data was noted to be of fair to good quality and was considered adequate for interpretation which was carried out using the computer program REFRACT. The approximate location of the longitudinal and transverse lines are shown on Drawing 827-1.

Results as summarised in Table 3 of the seismic refraction investigation report (reference 3) are reproduced in Table 4.

Table 4 Summary of Seismic Refraction Interpretation Results

Cut	Line	Surface	Intermediate 1		Intermediate 2		Basal	
		Seismic velocity (m/s)	Seismic velocity (m/s)	Depth (m)	Seismic velocity (m/s)	Depth (m)	Seismic velocity (m/s)	Depth (m)
3	7 L	450 -1000	1200 -2150	0.5 -3.2	1850 -3000	2.7 -11.0	3000 –4000	12.2 -33.6
	8 T	500 -900	1200 -2000	1.1 -3.9	2050 -2250	1.6 -10.4	3000	14.2 -18.9
4	9 L	400 -1100	1300 -2400	0.1 -5.0	2000 -3000	1.3 -10.5	2700 –3700	8.2 -29.2
	10 T	400 -900	1400 -2400	0.5 –3.5			2500 –2800	5.6 -9.7
5	11 L	600 -1150	1600 -2300	0.2 –3.6			3100 –3800	8.8 –19.7
	12 T	550 -900	1300 -2100	1.1 –5.1			2700 –3100	11.9 –26.0
6	13A L	500 -1000	1400 -2500	0.1 –4.9			2500 –4500	7.6 –16.8
	14A T	600-1100	1050 -1900	1.2 –5.2			3300 –3700	8.6 –20.1

L = longitudinal
T = transverse

A broad assessment of rock mass excavation characteristics can be undertaken to assess the extent of potentially rippable rock strata and areas of non-rippable rock strata requiring blasting during earthwork excavation. The assessment is based on cored bore logs and seismic refraction data from the site investigation, discussion with RTA personnel and mapping of the cuttings.

The seismic refraction traverse data can be summarised into three layers for the purposes of broadly assessing excavation characteristics. Layers are shown on the attached section drawings. They are:

1. Less than 1500 m/s
2. 1500 – 2500m/s
3. > 2500m/s

On the basis of seismic velocity alone, it would be reasonable to assume that layer 1 could be excavated by bulldozer tyne and layer 2 by a large bulldozer (D9 or larger) with marginal excavation towards the base requiring a D10 or D11 with some localised blasting required. Layer 3 may locally be marginally excavated by bulldozer (D10 or D11), however excavation will predominantly require blasting. As shown in Table 5, the depth of the layers is variable. In general layer 1 appears to extend to a depth of 1m to 3m and this correlates with the depth of excavator bucket refusal in the test pits. Layer 2 occurs to a depth ranging between about 6m and 12m.

In general the seismic velocity layers and boundaries identified in the seismic lines are not readily discernible on a rock material or structure basis in the cut profiles. As the material strength of the rock substance appears to be relatively high, the spacing and orientation of rock mass defects will predominantly control rippability.

Defects within the rock mass are relatively closely spaced, however defect orientation and continuity appears to be variable resulting in an interlocking structure. Localised areas with defect spacing up to 0.5m occur together with zones where secondary silicification of fractures has increased the effective spacing.

It should be noted that even a general assessment of rippability is very subjective and is influenced by factors such as:

- The definition of rippable versus economically rippable (ie. the rock may be able to be ripped, however production rates are such that it is more economical to preblast).
- The volume of unsuitable oversize material produced by ripping may be reduced by initial blasting or pre-splitting before ripping in order to reduce the nominal size.
- The size of the bulldozer, the type of tyne/shank used and traction available.
- Rock mass characteristics such as rock type, strength, abrasiveness, density, weathering, seismic velocity, defect spacing and orientation, defect roughness, infill and aperture, and groundwater.

Based on past excavation performance in the cuttings, it is likely that excavation can be predominantly carried out by large dozer (D10 or D11), with localised blasting confined to isolated zones of blue greywacke and the base of deep cuts (ie 15m or deeper). Assessment of potential rippability of the proposed excavations is difficult as the materials that require blasting are not uniformly distributed or layered. Where tyne refusal is met in isolated zones, hydraulic rock hammer excavation can be undertaken (refer to photograph 9), however this is unlikely to be feasible where extensive non-rippable areas occur.

On the basis of seismic velocity profiles, rock strength and existing performance, sections of the proposed excavation profiles will be require blast excavation, particularly as the depth of proposed excavation exceeds that for the existing cutting at some locations. For planning purposes and noise and vibration assessment only, the following can be allowed for in terms of assessing the extent of blasting required:

- Cuts generally rippable by large dozer to depths of up to 10m with some treatment of isolated areas by rock hammer,
- Cuts 10m to 15m are likely to have marginal rippability. The extent of some of these areas is likely to be such that rock hammer excavation would not be economically feasible and blasting would be required, and
- Cuts deeper than 15m are likely to require extensive blast excavation or loosening.

Considering the gentle gradient of the rock batters, pre split drilling is unlikely to be feasible for blast excavation and as such difficulty may be encountered in forming uniform batter gradients.

Additional seismic traverses and core drilling should be undertaken in the proposed cut areas if specific documentation is required for contract excavation purposes.

7.0 Construction Material Suitability

Excavation of the rock profiles in the cut batters will yield a rock fill material with variable clay and sand fines content. Minor clay and gravelly clay materials will be derived from the shallow residual soil profiles overlying the rock.

7.1 Bridging and Drainage Material

Bridging layers are usually required for construction across low lying areas where shallow groundwater and low subgrade strength conditions occur. Bridging material is required to provide a firm base for the compaction of subsequent embankment layers. The thickness of the bridging layer required to achieve this will depend upon the subgrade conditions. Bridging layer materials are generally granular sands or rock fill materials whose strength properties are largely independent of moisture content.

The rock derived materials contain a variable amount of clay and sand fines that may affect the capacity of the materials to provide effective bridging properties in subgrade conditions where they are likely to wet up. Screening to remove fines may be required to produce a granular rock fill material suitable for bridging material use.

The rock derived materials have been utilised as drainage layers / blankets up to 0.5m thick beneath the pavement areas in the existing cuts of the Taree Bypass. This has involved a grading specification with removal of oversize material on a 150mm screen and limiting the percentage finer than 19mm. Based on existing usage, these materials are suitable for use as drainage layers, however the presence of rock fragments susceptible to breakdown and weathering will need to be assessed.

7.2 General Embankment Fill

The rock derived materials are suitable for placement and compaction as general fill embankments. On compaction further breakdown of the rock fragments can be expected resulting in mostly a rock fragment supported fill with a clay and sand matrix infill of the void spaces. This is likely to result in an interlocking structure of very low compressibility with high shear strength (CBR >20%).

Some breakdown of oversize rock fragments by grid roller or compactor may be required to meet oversize specification.

Clayey fill materials derived from the shallow soil and extremely weathered rock profile are suitable for use as embankment fill subject to meeting moisture control specification. It is envisaged that these materials are likely to have a CBR value in the range of 4% to 10% depending on the gravel content.

The clayey fill materials with low CBR values should preferably be used in the lower embankment layers.

7.3 Select Material

The rock derived fill materials have been utilised as select fill on the Taree Bypass. Contract specification for select material on the project was a minimum 10 day soaked CBR value of 15%. As noted in Table 3, CBR testing undertaken on materials derived from cuts 3 to 6 returned an average of 40%, well in excess of the specification. Based on existing usage and the properties described in Section 7.2, the rock derived materials are suitable for use as select fill and are likely to achieve an average CBR value in excess of 25%.

7.4 Pavement Material

Pavement materials for construction of the Taree Bypass were imported to the site. The rock fill materials are unlikely to meet RTA specification (3051) for sub-base or basecourse layers due to the strength and weathering variability of the various interbedded rock types.

7.5 Bulking Factor

The bulk density of materials present in the batter slopes will be different from the bulk density of those materials once excavated and compacted as part of earthworks specification. Discussion with the RTA Site Office on the Taree Bypass Project has indicated that the rock fill material (ie CBR > 15) has a typical bulking factor from cut to fill of about 8% with compacted maximum dry densities typically of 2.2 to 2.3 t / m^3. No data is available on the insitu dry density of rock materials, but based on the above information a value of 2.4 to 2.5 t / m^3 for the insitu rock prior to excavation can be assumed.

7.6 Conclusion

The material to be won from the proposed batter extraction sites will predominantly comprise a rock fill material with a variable fines content with minor (ie <15%) clay and gravelly clay materials derived from the shallow soil and extremely weathered rock profiles.

The material is judged to be suitable for use as bridging material (some screening may be required), general embankment fill and select fill for the construction of the Coopernook Bypass and the upgrade of the Pacific Highway between Cundletown and Moorland. In terms of material quality, batter extraction from the Taree Bypass has the potential to meet the material requirements apart from the pavement layers, for embankment construction on the above projects.

References

1. Connell Wagner, 1998, Coopernook Traffic Relief Route Environmental Impact Statement for the RTA.

2. Connell Wagner, 1998, Fill Material Quarry on the Cut Batters of the Taree Bypass, Review of Environmental Factors, Draft Report for the RTA.

3. Roads and Traffic Authority of NSW, 1993, SH10, Pacific Highway, Stage 4 Taree Bypass 160km000 to 167km200 North of Newcastle, Geotechnical Reports, Volumes 1 to 12.

4. RTA Scientific Services, 1997, Taree Bypass Section 4, Batter Treatment, Cuts 3, 4 and 6, Draft reports G2806/2 & 3.

Yours faithfully
ROBERT CARR & ASSOCIATES PTY LTD



Mark Delaney
Senior Engineering Geologist

Attachments Photographs 1 to 11
Drawing 827-1 Location Plan
Drawings 827-2 to 6 Section Plans

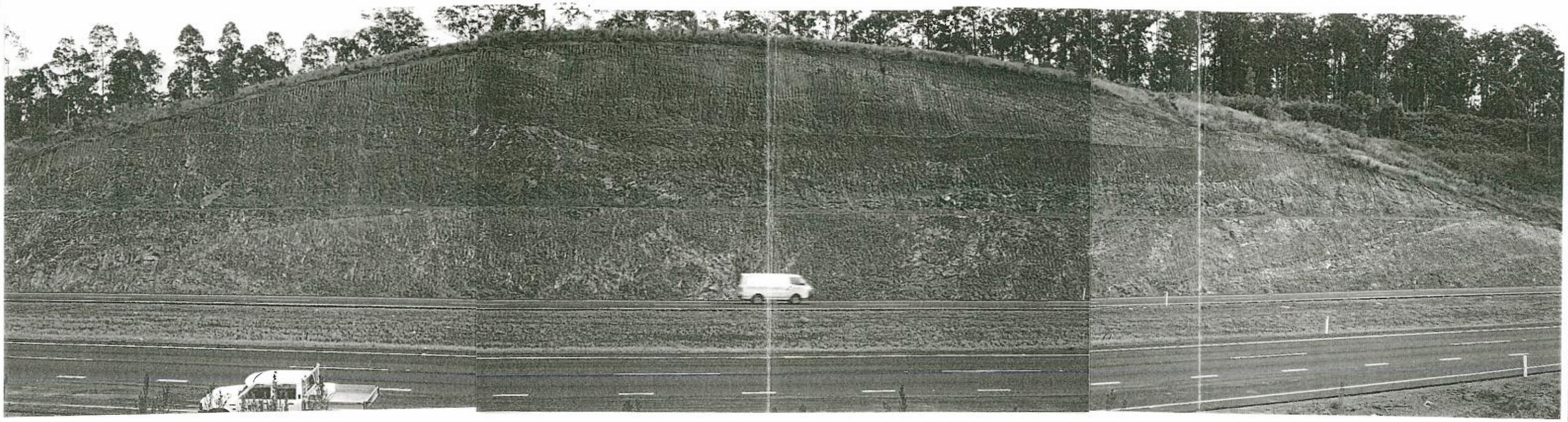


PHOTO 1 — Cutting 5



PHOTO 2 — Cut 4, note shotcrete treatment



PHOTO 3 — Cut 4, note shotcrete treatment

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TITLE: PHOTOGRAPHS — TAREE BYPASS
BATTER EXTRACTION

CLIENT: Connell Wagner | PROJECT No: 827

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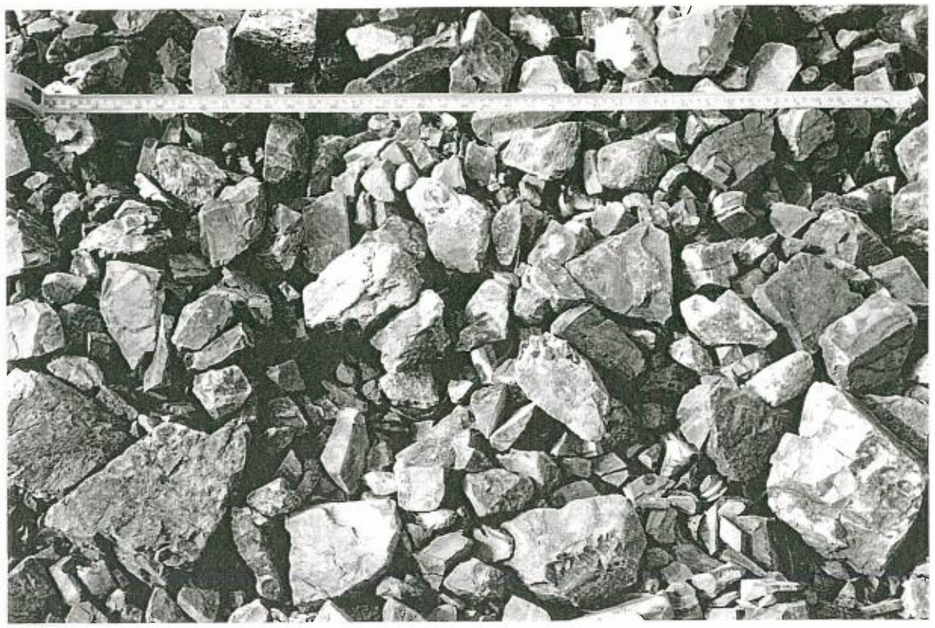


PHOTO 4 – Stockpile above Cut 4. Surface fines washed out by rainfall. Tape 1m long



PHOTO 5 – Recently excavated material, Cut 6



PHOTO 6 – Siltstone rock fretting and breaking down on exposure



PHOTO 7 – Cut 3 looking north to Fords Road and Cut 4

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TITLE: PHOTOGRAPHS – TAREE BYPASS BATTER EXTRACTION

CLIENT: Connell Wagner | PROJECT No: 827

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PHOTO 8 – Zones of blue 'greywacke' material resistant to tyne excavation , (28 tonne excavator) Cut 6



PHOTO 9 – Hydraulic rock hammer excavation of blue 'greywacke' material, Cut 6

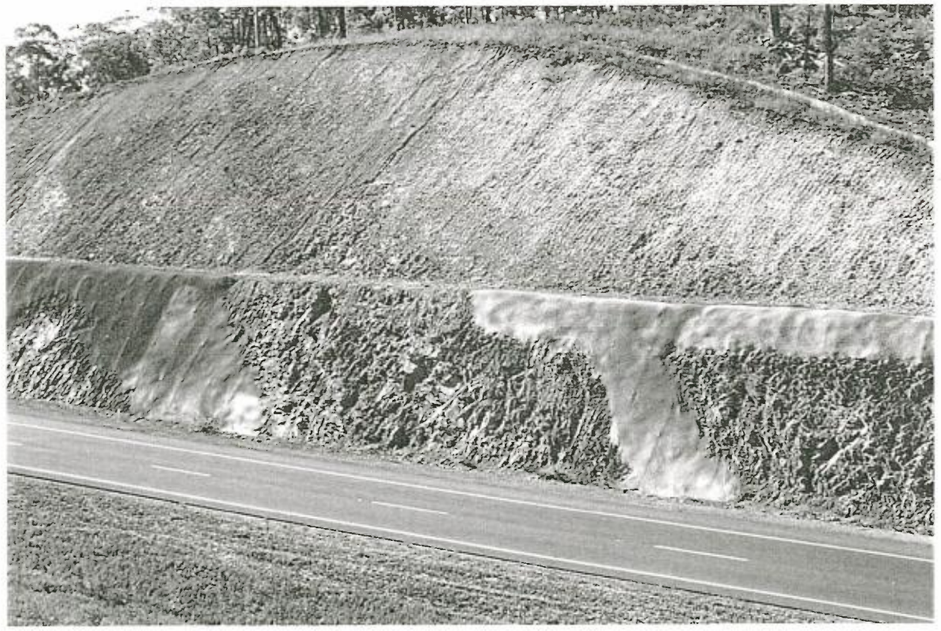


PHOTO 10 – Eastern (right) batter of Cut 3.
Blue 'greywacke' material exposed between shotcrete zones. Localised blasting required during construction excavation

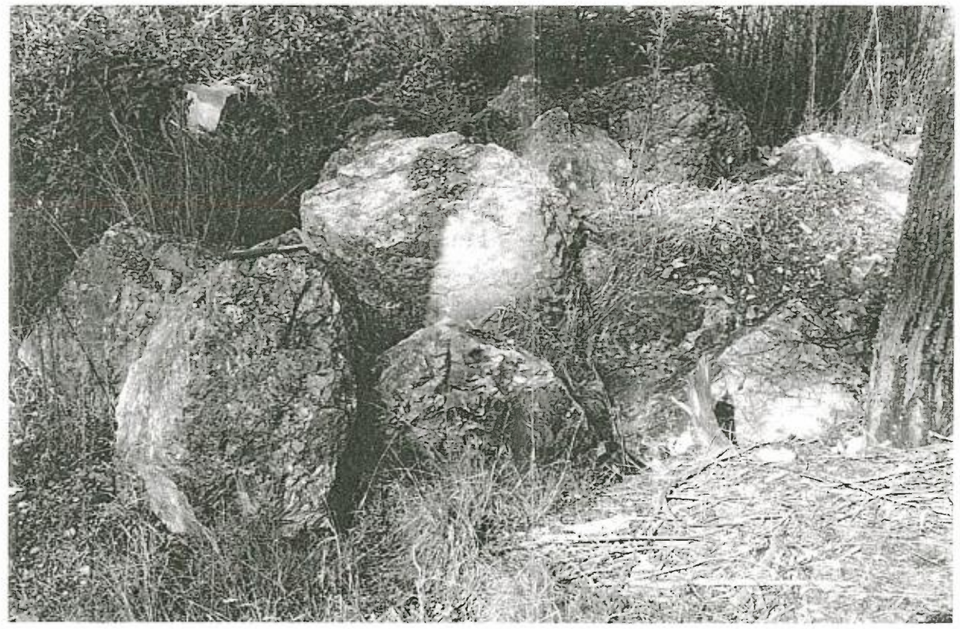


PHOTO 11 – Oversize material up to $2m^3$, Cut 4

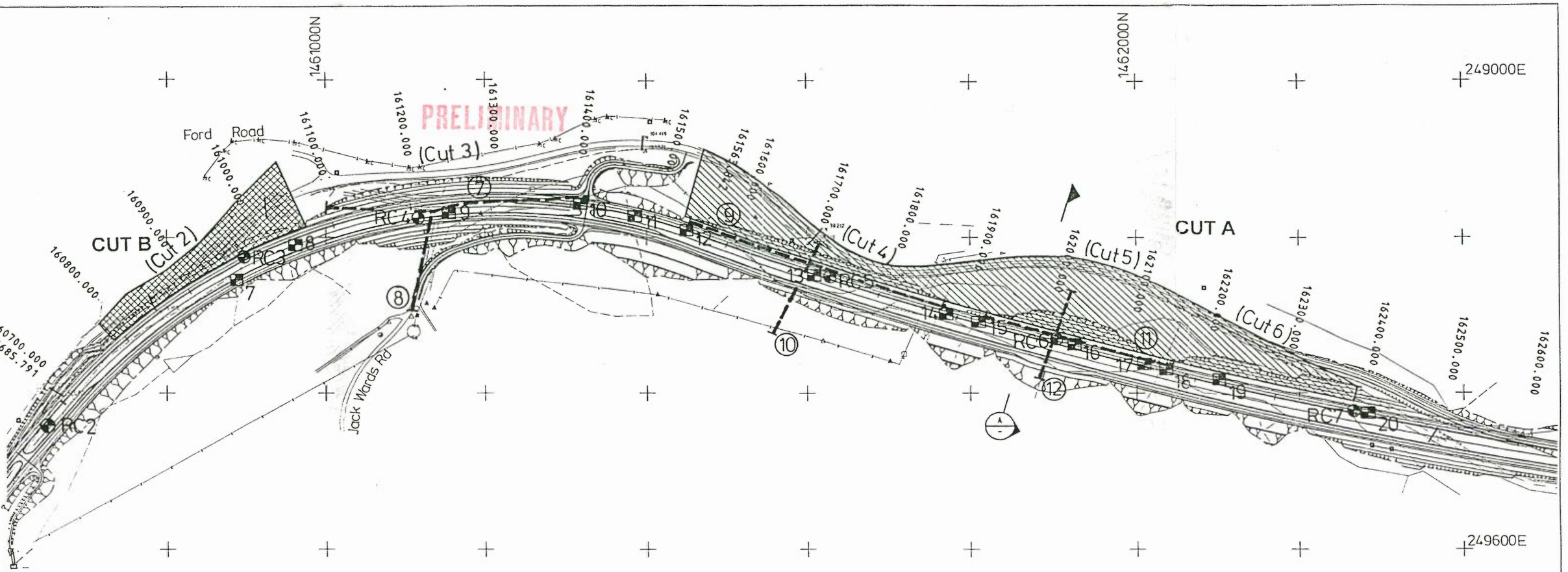
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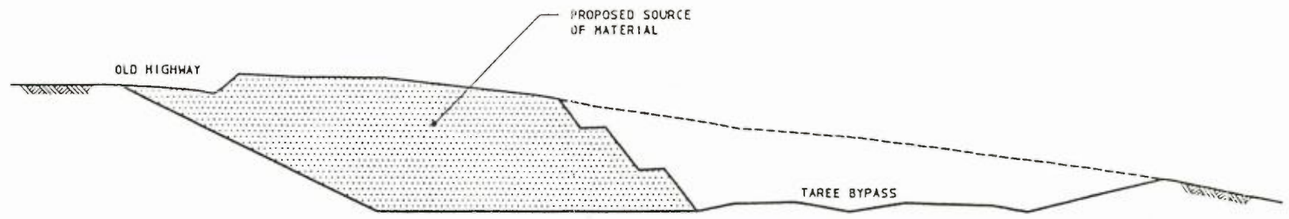
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TITLE: PHOTOGRAPHS – TAREE BYPASS BATTER EXTRACTION

CLIENT: Connell Wagner | PROJECT No: 827



PLAN



SECTION A

LEGEND

- Bore hole
- Test pit
- (Cut 1) Cut Number reference (RTA)
- Seismic refroction line
- Primary source of material approximate volume available 400,000m³
- Secondary source of material approximate volume available 40,000m³

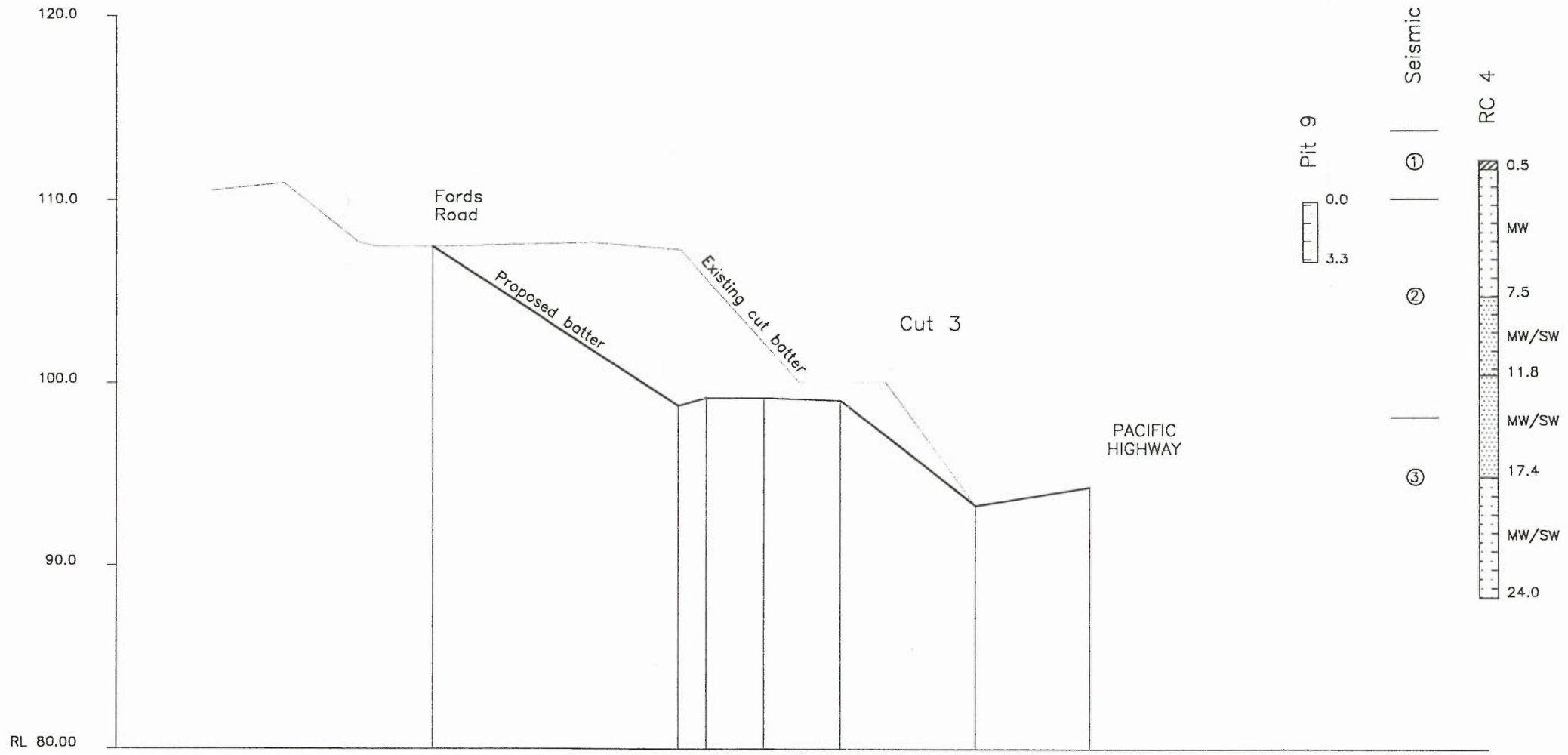
NOTE: Adapted from drawing supplied by Connell Wagner
Figure 2.1 – Location of Cut Areas and Typical Cross Section

Liability is limited by the Professional Engineers Scheme

E-A3-00

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Geotechnical & Environmental Testing Services

TITLE: FIELD DATA LOCATION PLAN CUT BATTER BORROW SOURCE TAREE BYPASS			
CLIENT: Connell Wagner			PROJECT No: 827
DRAWN BY: AG	SCALE: 1 : 5000		DRAWING No: 1 REV: 0
APPROVED BY: MD	DATE: 10/6/98		OFFICE: NEWCASTLE



LEGEND

	Clay
	Siltstone
	Interbedded Siltstone and Sandstone
	Sandstone
MW	Moderately weathered
SW	Slightly weathered

① Typical seismic velocity <1500m/s

② Typical seismic velocity 1500–2500m/s

③ Typical seismic velocity >2500m/s

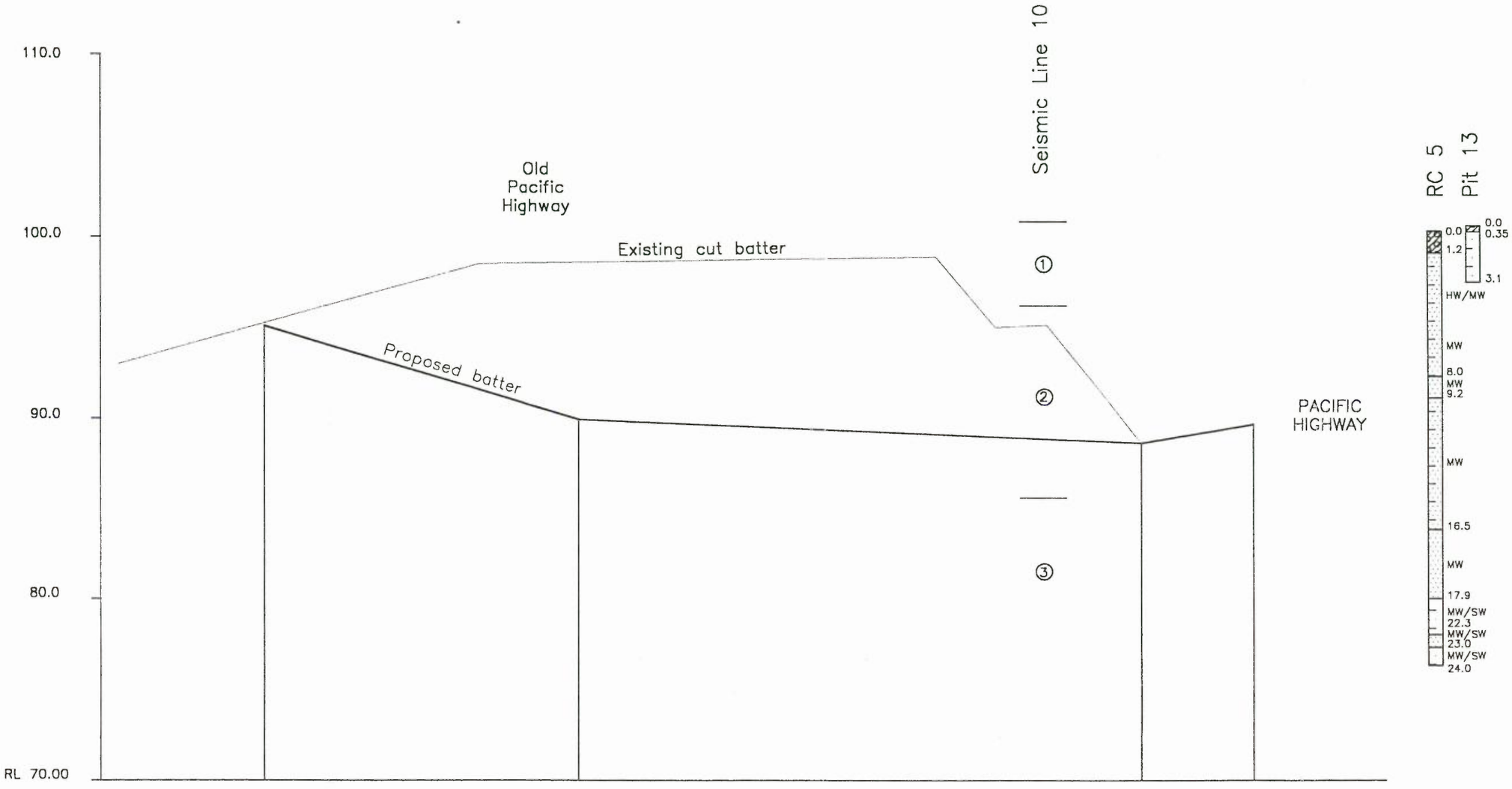
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Geotechnical & Environmental Testing Services

TITLE:
SECTION 161200
TAREE BYPASS

CLIENT: Connell Wagner			PROJECT No: 827
DRAWN BY: AG	SCALE: 1 : 250		DRAWING No: 2 REV: 0
APPROVED BY: MD	DATE: 10/6/98		OFFICE: NEWCASTLE



LEGEND

- Gravelly Clay
- Siltstone
- Interbedded Siltstone and Sandstone
- Sandstone
- HW Highly weathered
- MW Moderately weathered
- SW Slightly weathered

① Typical seismic velocity <1500m/s
② Typical seismic velocity 1500–2500m/s
③ Typical seismic velocity >2500m/s

psc Liability is limited by the Professional Engineers Scheme

E-A3-00

ROBERT CARR & ASSOCIATES PTY LIMITED
Geotechnical & Environmental Testing Services

TITLE:
SECTION 161720
TAREE BYPASS

CLIENT: Connell Wagner			PROJECT No: 827
DRAWN BY: AG	SCALE: 1 : 250		DRAWING No: 3 REV: 0
APPROVED BY: MD	DATE: 10/6/98		OFFICE: NEWCASTLE

120.0
110.0
100.0
90.0
RL 80.00

Existing Cut batter

Proposed batter

Seismic Line 12

Cut 5

RC 6

Pit 16

0.0 MW
1.4 MW
3.3 HW/MW
MW
10.2 MW/SW
11.5 MW
17.4 MW
18.8 MW
MW/SW
27.8

0.0
0.7 Excavator refusal

LEGEND

- Siltstone
- Sandstone
- Chert band
- Interbedded chert and siltstone
- HW Highly weathered
- MW Moderately weathered
- SW Slightly weathered

① Typical seismic velocity <1500m/s
② Typical seismic velocity 1500–2500m/s
③ Typical seismic velocity >2500m/s

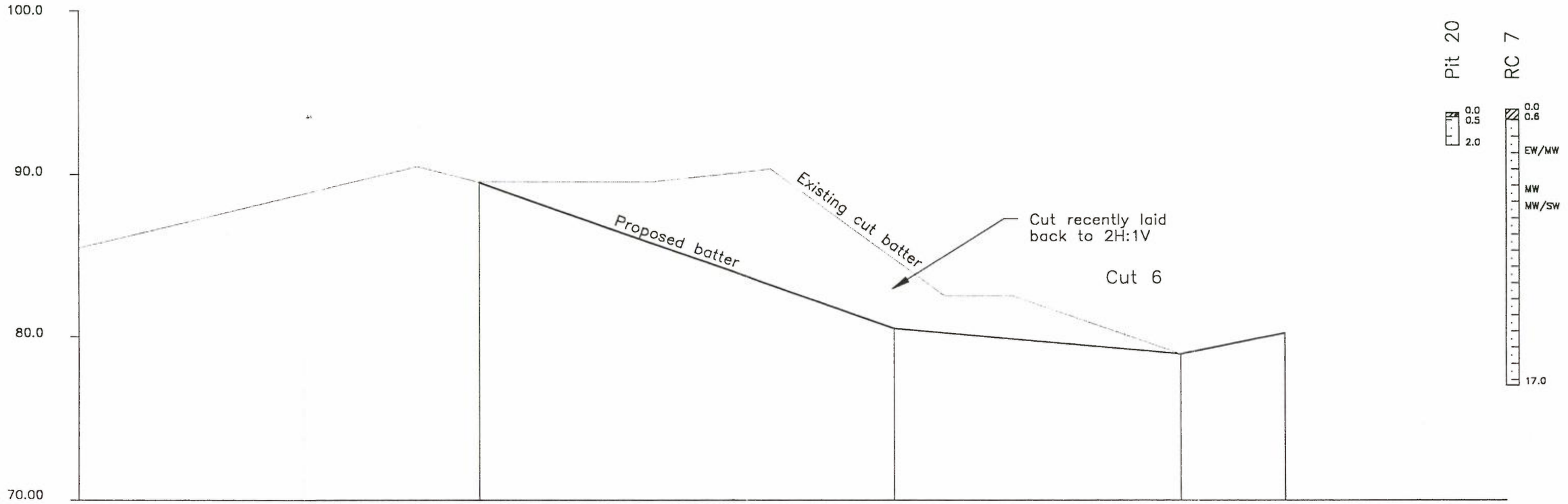
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E-A3-00

ROBERT CARR & ASSOCIATES PTY LIMITED
Geotechnical & Environmental Testing Services

TITLE:
SECTION 162040
TAREE BYPASS

CLIENT: Connell Wagner				PROJECT No: 827	
DRAWN BY: AG	SCALE: 1 : 250			DRAWING No: 4	REV: 0
APPROVED BY: MD	DATE: 10/6/98			OFFICE: NEWCASTLE	



LEGEND

	Clay
	Gravelly Clay
	Siltstone
EW	Extremely weathered
MW	Moderately weathered
SW	Slightly weathered

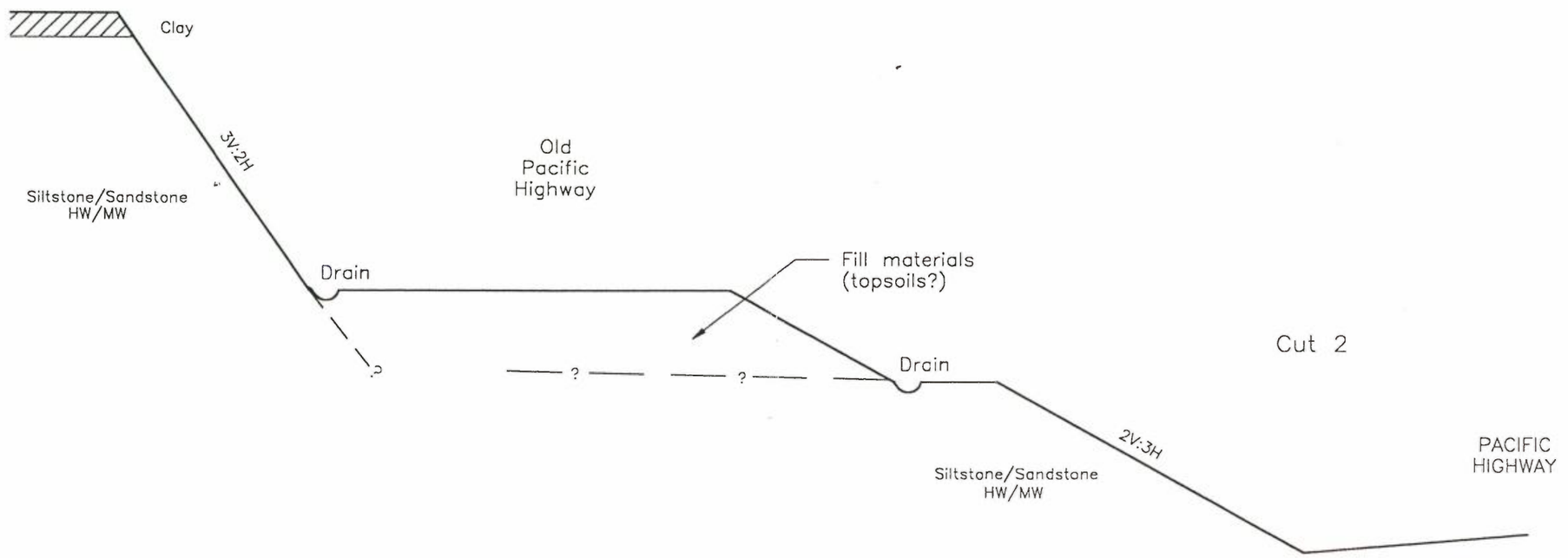
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E-A3-00

ROBERT CARR & ASSOCIATES PTY LIMITED
Geotechnical & Environmental Testing Services

TITLE:
SECTION 162400
TAREE BYPASS

CLIENT: Connell Wagner				PROJECT No:	827
DRAWN BY:	AG	SCALE:	1 : 250	DRAWING No: 5	REV: 0
APPROVED BY:	MD	DATE:	10/6/98	OFFICE:	NEWCASTLE



LEGEND

HW Highly weathered

MW Moderately weathered

NOTE: No survey data available

E-A3-00

psc Liability is limited by the Professional Engineers Scheme

ROBERT CARR & ASSOCIATES PTY LIMITED
Geotechnical & Environmental Testing Services

TITLE:
SECTION 160980 (sketch)
TAREE BYPASS

CLIENT: Connell Wagner				PROJECT No: 827	
DRAWN BY: AG	SCALE: 1 : 250			DRAWING No: 6	REV: 0
APPROVED BY: MD	DATE: 17/6/98			OFFICE: NEWCASTLE	

APPENDIX E
ABORIGINAL ARCHAEOLOGICAL STUDY

-PACIFIC HIGHWAY-

Proposed Fill Material Quarry on the Cut Batters of the Taree Bypass:

Archaeological survey for Aboriginal sites

A report to-

CONNELL WAGNER PTY LTD

PO Box 538,

Neutral Bay NSW 2089

Prepared by-

JACQUELINE COLLINS

Consultant Archaeologist

9 Unique Close,

Dunbogan NSW 2443

September 1998

LOCATIONAL DETAILS OF THE PROPOSED QUARRY

Local Government area:	City of Greater Taree
County:	Gloucester
Parish:	Bohnock
1:25,000 topographic map:	Taree 9334-2-S
Local Aboriginal Land Council:	Purfleet-Taree

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1. INTRODUCTION

The NSW Roads and Traffic Authority (RTA) proposes to realign a section of the Pacific Highway to bypass the village of Coopernook and create a new crossing of the Lansdowne River 21km. north of Taree on the NSW mid-north coast. A large quantity of fill is needed to form the planned dual carriageway embankments across the Lansdowne River floodplain, and cuttings for the proposed Coopernook Bypass itself will not provide sufficient fill to raise the carriageway to the 1:20 year flood immunity level. The cut batters on the Taree Bypass south of Purfleet (chainages 160700 to 162500), which in the absence of the current proposal would require extensive stabilisation works, have been identified as appropriate to sustain the significant quantity of suitable fill material which would be required for the Coopernook Bypass as well as the future extension of dual carriageways between Cundletown, Coopernook and Moorland. In essence, the cut batters would become a quarry to supply fill for these projects (Connell Wagner 1998:2).

This report was prepared for the RTA on behalf of Connell Wagner and forms the Aboriginal archaeological component of an Environmental Impact Statement for the proposed Taree Bypass Cut Batters Quarry ('the study area'). In order to comply with the provisions of the National Parks and Wildlife Act (1974) and the Environmental Planning and Assessment Act (1979), the field survey documented in the report aimed to determine whether Aboriginal cultural materials are present within the proposed extraction area, and if so, to recommend management procedures appropriate to their level of cultural and scientific significance.

1.1. Location of the proposed Cut Batters Quarry

The two cuttings (Cut A and Cut B) identified as a potential quarry source are located on the Taree Bypass approximately 3.5km. south of Purfleet on the NSW mid-north coast (Figures 1 & 2). Immediately north of the Fords Road intersection, Cut A encompasses the area west from the shoulder of the northbound carriageway between chainages 161500 and 162400 (900m.) and the western margin of the Old Highway. The maximum width of this cut would be c.80m. at chainage 162100 (Figure 3a).

Cut B edges the northbound carriageway between chainages 160800 and 161100 (300m.), 350m. south of the Fords Road intersection. Straddling the Old Highway, Cut B would have a maximum width of c.45m. at chainage 160950 (Figure 3b).

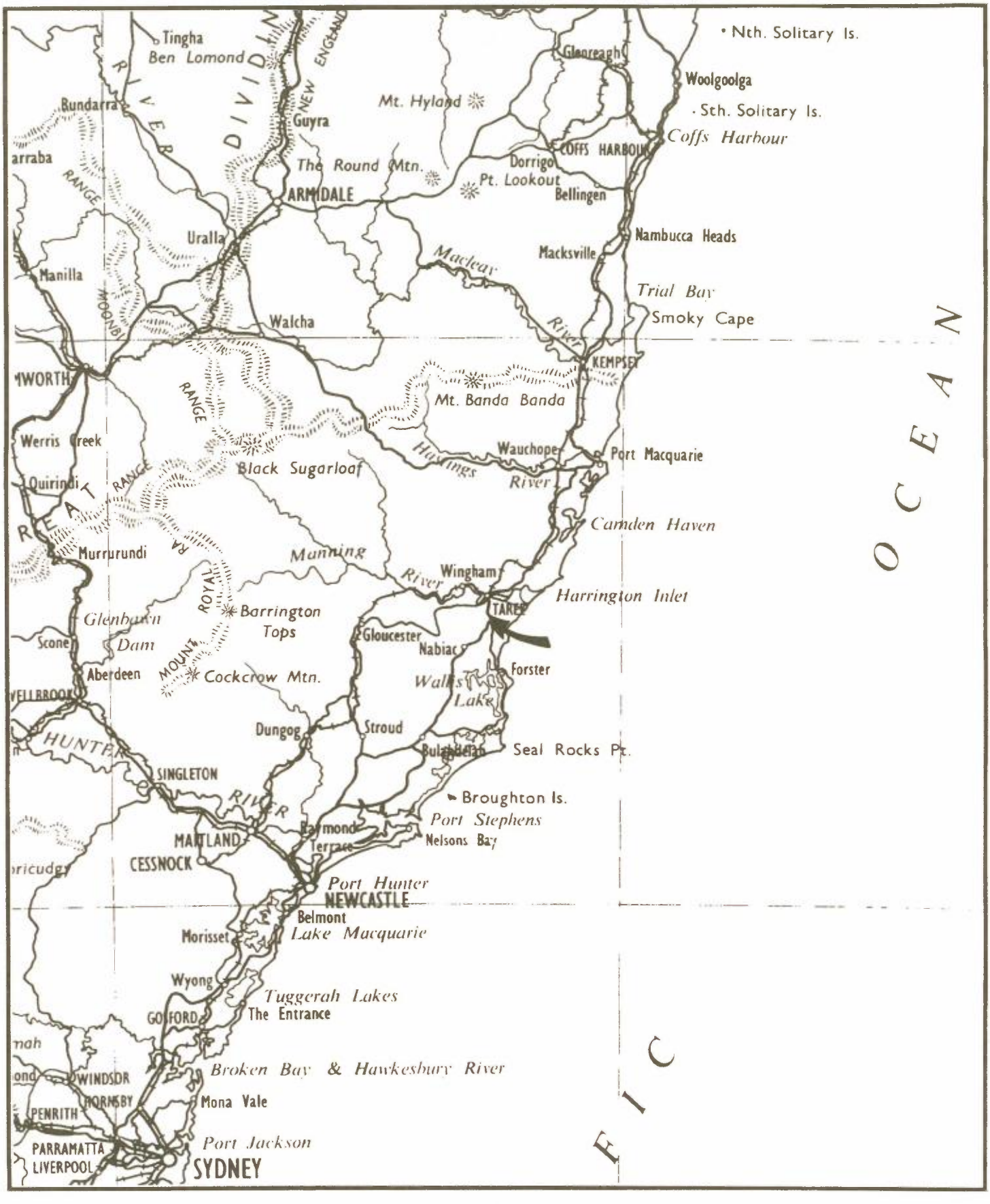


FIGURE 1: General study locality south of Taree on the NSW mid-north coast

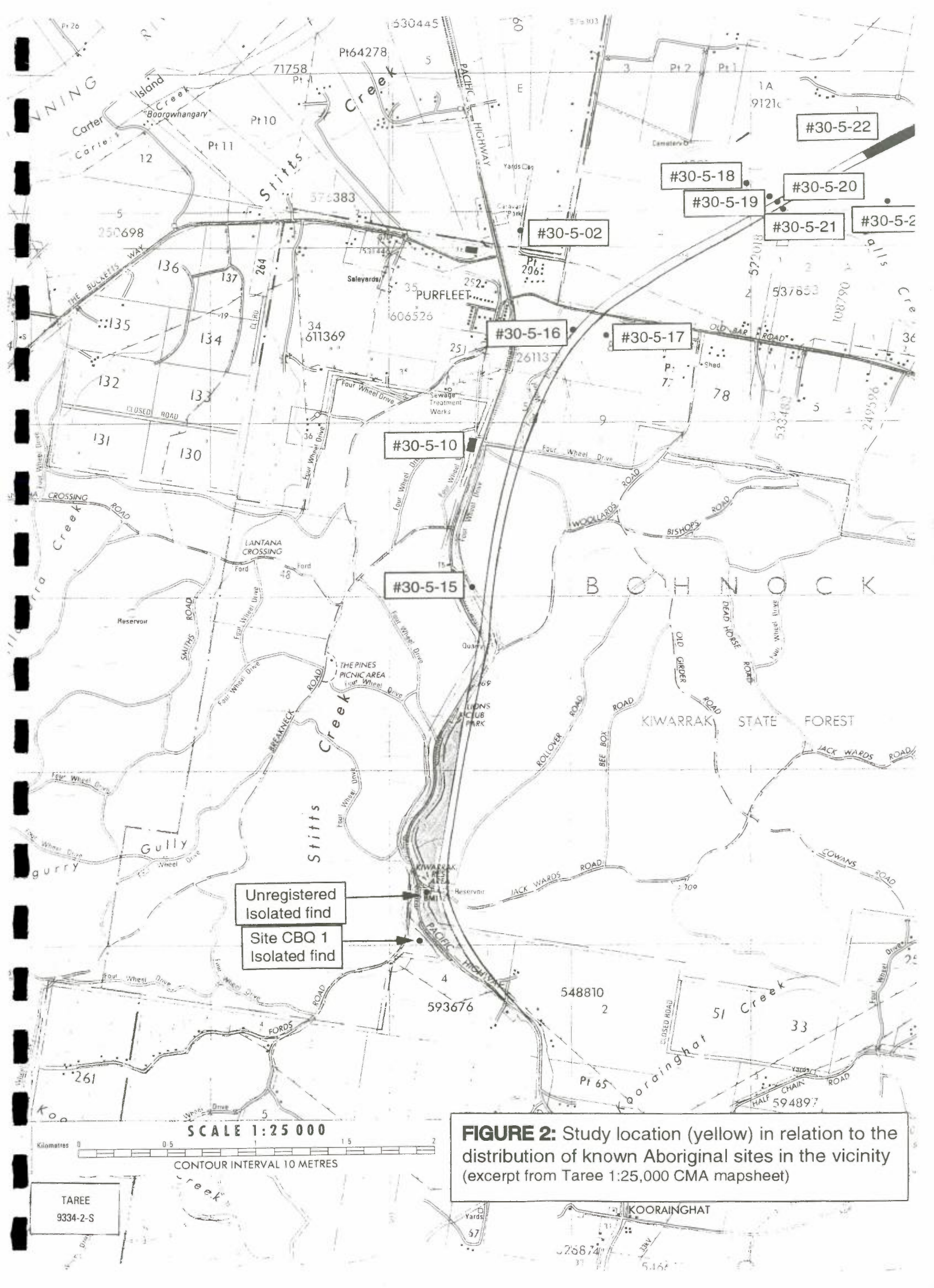
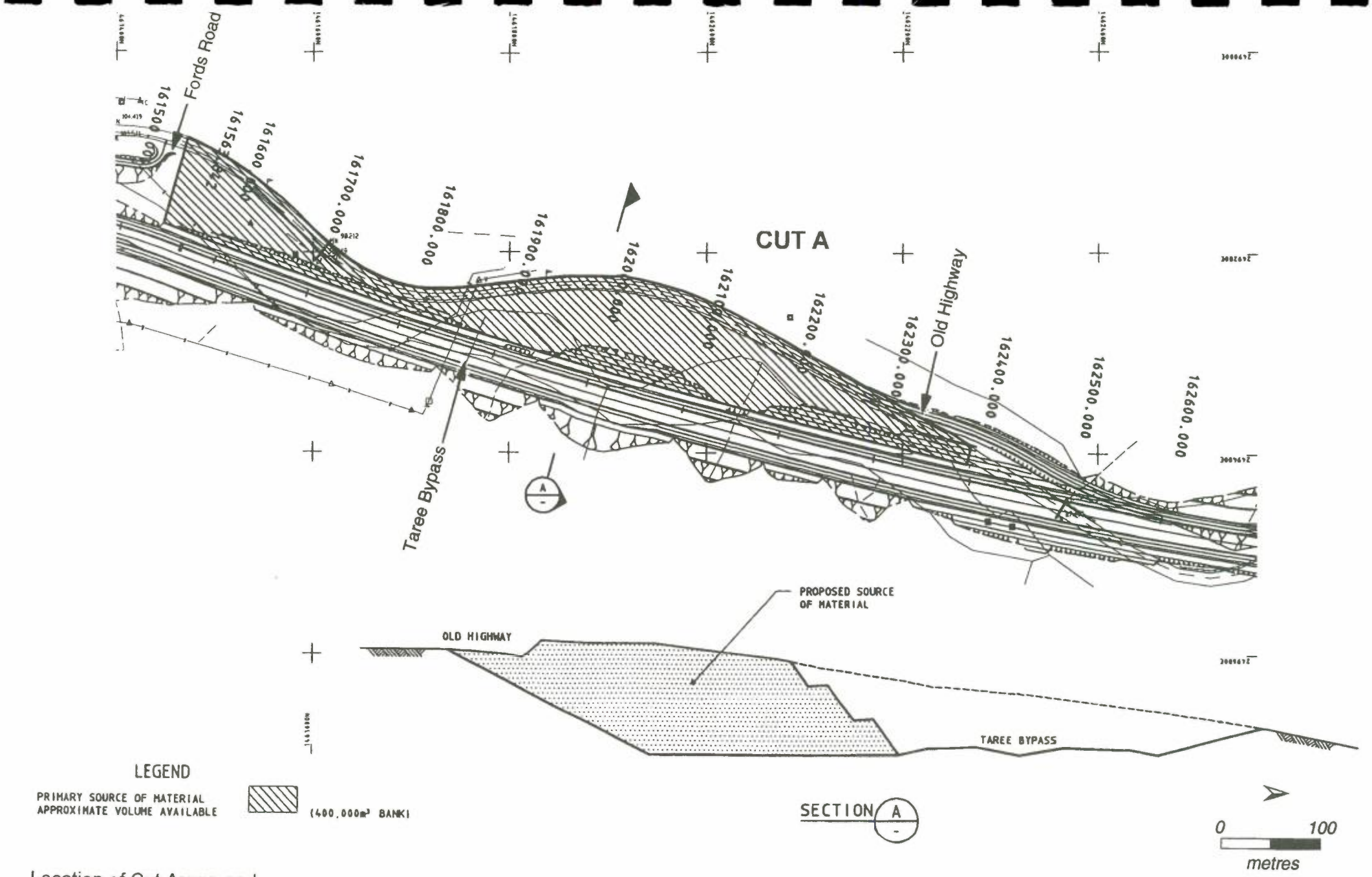


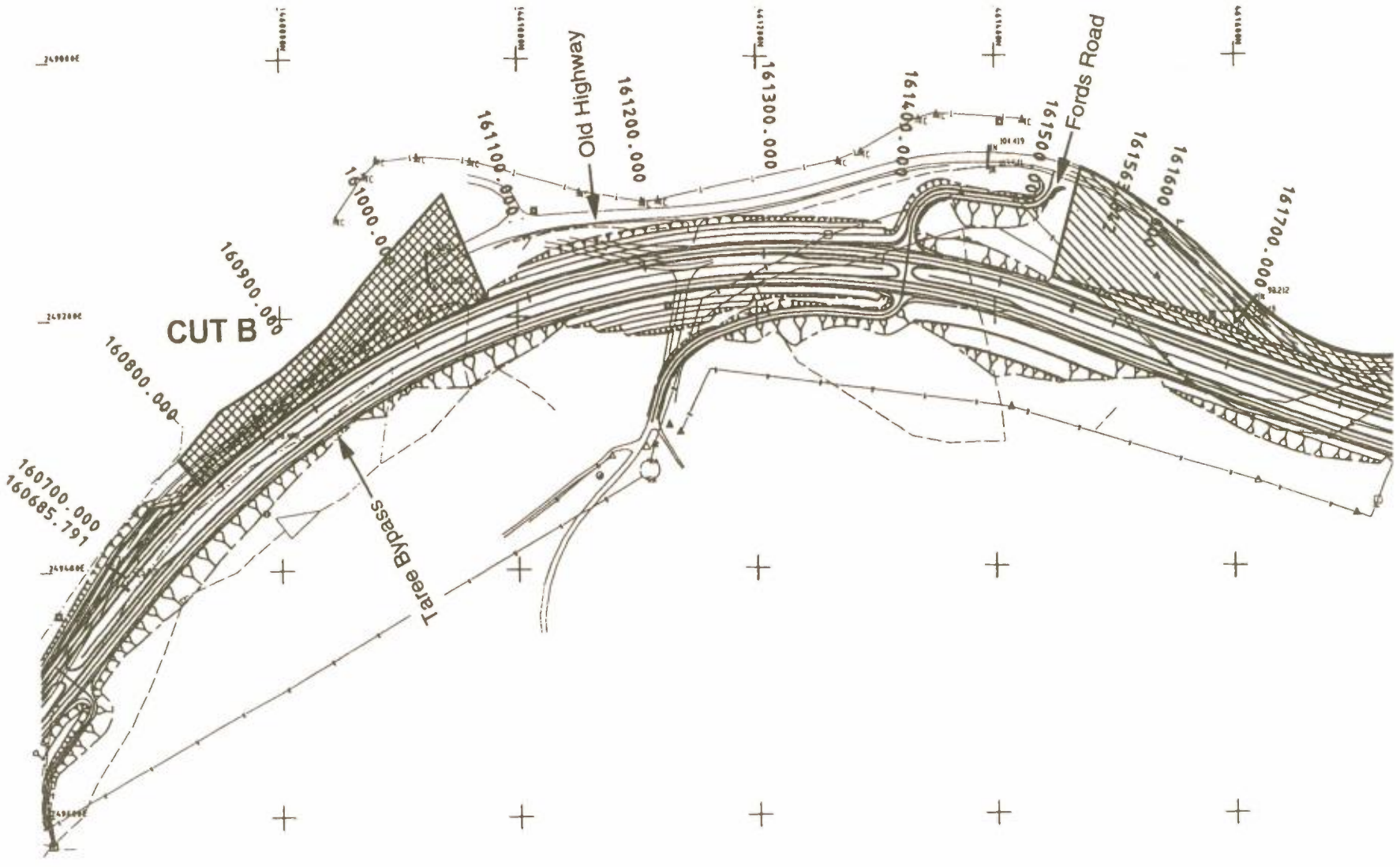
FIGURE 2: Study location (yellow) in relation to the distribution of known Aboriginal sites in the vicinity (excerpt from Taree 1:25,000 CMA mapsheet)



Location of Cut Areas and Typical Cross Section

Connell Wagner

FIGURE 3a: Detail of proposed Cut Batters



Location of Cut Areas and
Typical Cross Section

FIGURE 3b: Detail of proposed Cut Batters

Connell Wagner

1.2. The extraction proposal and potential impact on Aboriginal sites

The proposed quarrying would affect approximately 5.5ha. of land and involves the progressive removal of the fill material at a rate to suit the construction needs of the Coopernook Bypass project. Following vegetation clearance, topsoil would be stripped and stockpiled, and catch drains established. The majority of extraction activities would be achieved by ripping using bulldozers, excavators, loaders and trucks. Drilling and presplitting will be necessary for any hard rock, while blasting may be required if very hard rock is encountered.

The extraction of fill material from Cut A and Cut B would effectively remove any remaining ground surface within the areas shown on Figures 3a and 3b. Clearly, any archaeological materials occurring within these areas will be under threat of destruction. Although stone artefacts may survive within the stripped topsoil to be spread across the surface once extraction work is completed, the spatial integrity of any such artefacts will be lost, along with a considerable proportion of their research value. However, while the quarry proposal will potentially destroy and/or adversely affect the scientific value of Aboriginal sites, the entire study area has been excavated, modified or otherwise disturbed and there is little doubt that its archaeological potential has been substantially reduced as a result of roadworks associated with construction of both the old Pacific Highway and the Taree Bypass.

1.3. Summary of results and recommendations

No archaeological materials were found within the proposed Cut Batters Quarry area itself, nor are there specific Aboriginal cultural concerns with the subject area. On the basis of the field survey results the area is considered to have a low level of further potential and it is recommended that the proposed fill extraction be allowed to proceed providing the general recommendations made in Section 11 are implemented.

2. ABORIGINAL INVOLVEMENT

The proposed Taree Bypass Cut Batters Quarry falls within the territory administered by the Purfleet-Taree Local Aboriginal Land Council (LALC). Land Council Co-ordinator Gillian Donovan was contacted on commission of the consultant and it was arranged that sites officers Vienna Maslin and Ralph Saunders would provide field assistance. On completion of the survey, the results were discussed with Vienna Maslin and Ralph Saunders and the recommendations presented in Section 11 were developed through this discussion. A report on the field survey prepared by Vienna Maslin is contained in Appendix 1.

A draft copy of this report was subsequently supplied to the Purfleet-Taree LALC to enable the survey findings and provisional recommendations to be presented to a wider cross-section of the Aboriginal community, and to determine whether any culturally-significant sites/locations would be affected by the proposed extraction work. To this end, the report was tabled and discussed at a full meeting of the Land Council on 10 August 1998. The survey results were accepted by members and the recommendations were endorsed (see arising correspondence, Appendix 2).

In an effort to further determine whether the integrity of any culturally-significant sites/locations would be threatened by the proposed quarry, Birpai Elder Willie Bungie was consulted during the course of the study. However, Willie Bungie was not aware of any archaeological sites or of any sites of spiritual/ceremonial importance in the wider Purfleet-Koorainghat area which would be adversely affected by the proposal and had no objection to it proceeding. Nevertheless, a number of culturally-significant ceremonial sites do occur/once occurred across the ridge system in the wider study locality. These include a carved tree which once stood beside a small creek in dissected country 6.5km. west of the study area (#30-5-12), and a stone arrangement and initiation ground with associated stone artefacts (#38-2-19) on a hill slope approximately 3km. south of the carved tree. This latter site was used into the contact period and has been partially destroyed by forestry operations in recent years (W. Bungie pers. comm.).

3. ENVIRONMENTAL CONTEXT

Although the nature and distribution of archaeological sites in any landscape will have been ultimately underwritten by cultural choices, it is evident that such choices were often strongly influenced by environmental factors such as climate, topography, bedrock geology and associated soil and vegetational regimes. Because these factors dictate the availability of food, water and other desirable resources, they are expected to have played a key role in determining the location of prehistoric campsites and the pattern and intensity of past Aboriginal use. Erosional and depositional processes are also dictated by environmental variables and these, in tandem with the affects of European landuse, can either expose and in many cases destroy archaeological sites, or bury them, preventing their discovery during surface inspection.

Given these considerations, an understanding of the study environment was a necessary prerequisite to the field survey and is valuable in helping determine the potential sensitivity of those areas where survey inspection was hampered by vegetation cover or recent disturbance.

3.1. Topography and general setting

The study area, 10.5km. inland of the coastline and 4km. south of the Manning floodplain, encompasses part of a moderate to steep ridge system which forms the watershed between creeks flowing northward into the Manning River and those flowing south into Khappinghat Creek. At a maximum elevation of around 100m. AHD, the Old Highway along the western margin of the study area mounts flanking slopes before traversing the crest of an east trending ridgeline (in the vicinity of the former Kiwarrak Rest Area) and its north-east trending spur (later followed by Woollards Road before falling to the floodplain near Old Bar Road)(Figure 2).

The Taree Bypass, which generally crosses lower terrain east of the Old Highway, has been downcut to form a gently undulating carriageway. As a result, much of the east-facing ridge/spur slope between the Bypass and Old Highway has been modified, with gradients substantially steeper than they would have naturally been.

3.2. Climate

The Manning Valley lies toward the southern extremity of the subtropical zone and the climate is comparatively mild at all times of year. In the eastern section of the valley, mean summer temperatures vary between 28°C and 18°C, and cool north-east breezes often temper the effects of midsummer highs. With winter minimums of between 6°C and 8°C, the several light frosts experienced each year are generally confined to the valley lowlands (Birrell 1987:15).

Average rainfall is highest near the coast, with mean precipitation tending to decrease with inland distance. On the floodplain, annual rainfall exceeds 1,000mm., though seasonal variability is sometimes extreme. Excessively high summer falls result from southward extensions of tropical cyclones and on such occasions flood conditions develop along the Manning River and its tributaries. Periods of high rainfall also frequently occur in June and July, with a short dry season during late winter and early spring. Extreme drought conditions have been recorded at this time, occurring at a rate of around one year in twelve (Birrell 1987:18-19).

While the cooler winter temperatures, periodic floods and short dry season may not have unduly affected the comfort of the Manning Valley's Aboriginal inhabitants, together these factors are likely to have been sufficient to limit the seasonal availability of some food resources, and if so, may well have influenced prehistoric landuse and subsistence patterns.

3.3. Geology and soils

The study area is based on the Carboniferous sedimentary rocks of the Koorainghat Beds which include lithic sandstone, greywacke, laminite, tuff and shale (Hastings 1:250,000 Geological mapsheet). Mudstones are associated with the Kiwarrak Beds to the area's immediate south.

Although also based on the Koorainghat Beds, low ridges edging the floodplain in the Halls Creek locality little more than 4km. north of the study area feature a diverse range of stone materials which were used to produce Aboriginal flaked tools (Collins 1994). These include pebbles and cobbles of mudstone, chert, jasper, quartz, quartzite and various volcanic stones.

Lateritic podzolic soil has developed through the decomposition of the underlying rocks on the study ridge/spur. This is a well-drained, low-nutrient, and strongly textured soil, interspersed with yellow and brown podzols (Soil Conservation Service 1995 *in* Connell Wagner 1998:10).

3.4. Vegetation

Surrounded by the Kiwarrak State Forest, vegetation in the study area ranges from regenerated grassland in extensively modified areas, to an open dry sclerophyll forest in areas which have suffered least disturbance. This forest is dominated by Grey Gum and Grey Ironbark with overstorey components including Forest Oak, Spotted Gum and White Mahogany. The understorey of this community is relatively open, with a sparse ground cover of Blady Grass, Bracken Fern and introduced Lantana and Paspalum (Connell Wagner 1998:17).

The isolated strip of forest (3.5ha.) between the Taree Bypass and Old Highway which would require removal if the quarry proposal proceeds has been altered from its natural state and appears to have been extensively logged in the past. The majority of trees are of uniform age with few having a breast height diameter greater than 30-40cm. (Connell Wagner 1998:16-17).

4. CULTURAL CONTEXT

The original inhabitants of the Manning Valley belonged to the Birpai tribe, speaking a closely-related variant of the Kattang language (Holmer 1966). While there is some confusion as to the location of tribal boundaries, particularly north of the Manning River (cf.Eades 1979; Tindale 1940:193; Radcliffe-Brown 1931; Fitzpatrick 1914:32), it is generally conceded that the Birpai occupied land (encompassing the study area) west to the Gloucester River and south to around Forster.

Little archaeological or anthropological work has been completed for the coastal/subcoastal stretch between the Macleay and Hunter River Valleys and as a result the traditional lifestyle of the Birpai people is difficult to reconstruct. However, as with regions to both the north and south, it is likely that the family group formed the basic socio-economic unit, and that several families would co-operate as a highly flexible 'clan' to exploit a defined territory. Movement beyond the clan estate was only undertaken by pre-arrangement with adjoining groups for the purposes of meeting specific ceremonial and social obligations (Belshaw 1966; Chevally 1946), apparently utilising defined transit routes which linked both the coastal areas themselves, and the coast with the New England Tableland (cf.Collins & Morwood 1991; Connors 1985). Groups from the Manning Valley are known to have participated in ceremonies as far afield as the Hunter (O'Sullivan White 1850 *in* Belshaw 1966:9) and Hastings Rivers (Fitzpatrick 1914:124), and a gathering of 300 Aborigines was observed near the Manning River above Wingham in 1828 (Letters of John Guilding, the Colonial Secretary, to Dawson *in* Birrell 1987:31).

Within the clan estates a seasonal landuse pattern seems to have been followed. In summer, when fish and shellfish were plentiful, clan groups reportedly occupied the lowlands close to the river and its tributaries, or close to the sea. In autumn or early winter these groups migrated to the higher parts of their territory to avail themselves of terrestrial foods (interview with Ella Simon *in* Ramsland 1987:180). While the names and geographic limits of the Manning's traditional clan groups are unknown, one early settler claimed that at least four separate 'tribes' inhabited the area between the coast and 'No. 1 Station' on the upper river (Fitzpatrick 1914:37). According to Simon (1987:3), the coastal 'Mariket' and upriver hill country 'Winmurra' people were both physically and socially differentiated, although they apparently intermarried.

Pierce (1971:82-83) used early historical information to estimate prehistoric population numbers for north-eastern NSW. His evidence indicated that the bulk of the population inhabited the riverine plains and coastline, and that densities diminished not only with distance inland, but with distance south. On the far-north coast a density of 2-3 persons per km.^{2} was estimated, while a density of only one person per km.^{2} was estimated for Port Stephens. Pierce attributes this discrepancy to the decreasing productivity of aquatic zones with distance south along the coast. Coleman (1978), on the other hand, places the prehistoric population at between one and three persons per km.^{2} for the lower Macleay, suggesting that densities in productive parts of the mid-north coast rivalled those further north. While an early European settler reported a greater density of Aboriginal settlement near the mouth of the Manning than further up-river (Fitzpatrick 1914:37), there are no accounts detailing traditional use of the floodplain's flanking ridge country by which to gauge the study area's context, frequency, or duration of occupation.

Contrary to the suggestion that the NSW mid-north coast was depauperate when compared with the far north coast (Pierce 1971:82), early descriptions indicate that the lower Manning Valley provided a rich resource base. Fish, shellfish and other marine resources were plentiful and the forests abounded with animals (Ramsland 1987:180; Birrell 1987:32). According to one source, the Birpai's principal foods were koala, possum, pademelon, wallaby, bandicoot, kangaroo rat, flying fox, echidna, snakes and lizards, as well as various fish and shellfish together with native fruits and tubers (Fitzpatrick 1914:43-44). Material culture included the bark canoes which were seen in large numbers on the Manning by European settlers, nulla-nullas, and two-piece barbed spears. Although hunting spears, fighting spears and up-river fishing spears were fitted with fire-hardened Ironbark prongs, fishing spears on the coast and lower river were "always pointed with a piece of flint or quartz" (Fitzpatrick 1914:41).

The intrusion of Europeans into tribal lands was initiated in 1824 when the Australian Agricultural Company began pastoral activities between Port Stephens and the Manning River. By 1850 most of the floodplain had been appropriated and traditional landuse patterns were severely affected. Deprived of their economic base the Birpai were soon forced to depend on handouts of food and blankets, many becoming fringe-dwellers on the edges of European settlements and rural properties. By 1890 there were five major fringe camps on the Manning (at Brown's Hill, Larry's Flat, Kimbriki, No. 1 Station and Saltwater Beach), and a number of smaller ones. In 1900, Purfleet Station was officially established by the Aborigines Protection Board (APB), and the 78 Aborigines surviving in the Taree district were moved onto it (report of the APB 1899 *in* Ramsland 1987:189). Purfleet soon became the focus of Aboriginal life on the lower Manning, and it remains so today. A detailed account of life at Purfleet and the surrounding locality, spanning the years from 1902 to 1981, is given by Ella Simon (1987) in her autobiography.

5. ARCHAEOLOGICAL CONTEXT

5.1. Recorded sites in the study locality

Although many occupation sites have been recorded along the local coastline and the lower reaches of the Manning River channels (cf.Klaver & Heffernan 1991), comparatively few have been discovered in the elevated coastal hinterland. Nevertheless, 13 sites have been recorded within five kilometres of the study area (Table 1), one of which, an isolated stone artefact (reported in Rich 1990:35) occurred 30m. east of the Old Highway near the Kiwarrak Rest Area. This Rest Area, which has since been levelled for construction of the Taree Bypass, was once situated approximately mid-way between proposed Cut A and proposed Cut B. The remaining 12 sites (at least five of which are associated with the post-contact period) are all located in more gently-undulating country north and north-east of the study area, although a carved tree (#30-5-12) has been recorded in dissected terrain near a small tributary of Peg Leg Creek 6.5km. west of the area. Those sites recorded in the study vicinity are plotted on Figure 2.

TABLE 1: Recorded sites within 5km. of the study area

NPWS ID No.	Site type	Environmental context (location/feature)
30-5-02	Aboriginal Area	Post-contact site- (Purfleet Mission)
30-5-10	Cemetery	Post-contact site- (Purfleet Mission cemetery)
*30-5-15	Water hole/well	Post-contact site- (ridge spur, former quarry)
*30-5-16	Scarred tree/well	Post-contact site- 40m. from creek in paperbark forest (Halls Creek)
*30-5-17	Scarred tree	Gentle hillslope (Old Bar Road)
*30-5-18	Open campsite/ceremonial	Post-contact site- Ridge footslope near 2ndry creek (Halls Creek)
*30-5-19	Open campsite/scarred tree	Edge of tidal creek near swamp (Halls Creek)
*30-5-20	Scarred trees (3)	Post-contact site (?)- Paperbark swamp near tidal creek (Halls Creek)
*30-5-21	Open campsite	Low spur near tidal creek & swamp (Halls Creek)
*30-5-22	Open campsite	Ridge crest, edge of floodplain/swamp (Halls Creek)
*30-5-23	Scarred tree	Ridge top in wet sclerophyll forest (Halls Creek)
*30-5-43	Open campsite	Ridge crest, edge of floodplain/swamp (Halls Creek)
* -	Isolated find	Ridge crest (Kiwarrak Rest Area)

* Site recorded during survey for the Taree Bypass project (Rich 1990; Collins 1994)

5.2. Previous surveys in the study locality

In the absence of any academic research, virtually all that is currently known of the Manning region stems from the results of field surveys and site-specific investigations which have been completed for impact assessment ahead of development. Many of these surveys have focussed on the immediate coastal strip (e.g.Brayshaw 1983,1990,1994; Collins 1993; Crew 1989), and are thus not relevant to the present study. However, results of surveys and investigations which have been conducted in hinterland areas are pertinent, and these are reviewed in this section to establish the contexts in which local sites occur, and to provide a baseline against which to assess the proposed quarry area's archaeological potential.

Although most of the hinterland surveys have yielded negative results (Brayshaw 1977; Williams 1980; Palmer 1986; Dean-Jones 1989; Navin 1992; Sullivan 1996), Rich (1990) recorded 11 Aboriginal historic and prehistoric sites during her survey of the Taree Bypass corridor, and 10 sites (five open campsites, two scarred trees, one bora/ceremonial ground, one burial area and one natural mythological site) were recorded on 'undulating to hilly' terrain during the course of field surveys for the Greater Taree Aboriginal heritage study (Klaver & Heffernan 1991:30).

Given that she recorded all but three of the sites listed in Table 1, and that the present study area was included in her survey corridor, Rich's (1990) results are particularly relevant. The 16km. long and 400m. wide Taree Bypass study corridor traversed the hills and ridges on the southern side of the Manning floodplain, stretching north across the floodplain itself. All 11 of the sites recorded by Rich occurred between the Kiwarrak Rest Area (formerly within the immediate study locality) and the floodplain margin. Several of the sites, including waterholes, scarred trees, a cemetery and a campsite/corroboree ground, are associated with post-contact use by the Purfleet Aboriginal community.

Three of the campsites discovered by Rich contained stone artefacts. Of these, one (#30-5-19) covered a 50m.^{2} exposure on the bank of a small tidal creek (Halls Creek, 3.5km. north of the study area), one (#30-5-21) was situated on a low spur above Halls Creek close to backing swamp and was considered likely to cover an area of around 12,000m.^{2}, while the other (#30-5-22) lay on a prominent ridge edging the floodplain and an expanse of swampland and covered an area of some 120,000m.^{2}. Due to its geographical similarity to the Site #30-5-22 ridge, Rich considered that an additional open campsite could occur on an adjoining ridge were access had been denied during her survey. The presence of such a site (#30-5-43, 'TTRR 14') was confirmed during the course of a later archaeological inspection (Collins 1994).

The artefacts recorded by Rich include 13 at Site #30-5-19 made on chert, silcrete, mudstone, quartz and amorphous siliceous materials, 20 at Site #30-5-21 made on mudstone, quartz and amorphous siliceous materials, and a sample of 25 from Site #30-5-22 made on mudstone, chert, quartzite, silcrete and amorphous siliceous materials. As a consequence of its size, apparent low level of disturbance and the range of artefact types identified, Rich (1990:44) assessed Site #30-5-22 ('TTRR 9') to be of outstanding archaeological interest.

Prior to commencement of construction works on the Taree Bypass, those parts of Sites #30-5-22 ('TTRR 9') and #30-5-43 ('TTRR 14') lying within the impact corridor were salvaged and their stone artefact assemblages analysed (Collins 1994).

Before any clearing was undertaken on the recently-logged Site #30-5-43 ridge only 100 surface artefacts could be found, although a further 148 were exposed after logging debris had been removed. However, the salvage operation, which employed both hand excavation and mechanical trenching techniques, revealed that the majority of this site's artefacts lay *within* rather than *on* the thin topsoil layer, making them impossible to detect without subsurface investigation. The excavated sample yielded 995 stone artefacts, allowing a minimum population of some 5,864 artefacts to be estimated, and indicating that as little as 1.7% of the site's total assemblage was evident during the initial inspection even though the ridge offered a relatively stable surface. Findings were similar at Site #30-5-22, where 137 surface artefacts were recovered compared with a minimum population estimate of 581 artefacts (23.6% represented at the surface). The results of this investigation serve to illustrate that, even in ridgeline contexts, neither the extent nor the significance of an open campsite can necessarily be assessed on the basis of surface evidence alone, and that only a fraction of any site's contents is likely to be observable during an archaeological survey.

Analysis of the salvaged Site #30-5-22 and Site #30-5-43 artefacts suggested contemporaneous use of the two adjacent ridges and although there were demonstrable differences, they were closely associated both functionally and technologically. The sites represent an occupation based around a ridgeline of naturally outcropping nodules of mudstone, chert, jasper, quartz, quartzite, volcanics and other sedimentary stones. Although specialist strategies aimed at microblade and other flaked tool reduction were identified at Site #30-5-43, it primarily represented a place where stone was procured and tested, and where the early stages of core reduction were performed. In contrast, Site #30-5-22 displayed a far greater emphasis on tool production and use, and it was considered likely that its high-quality stone materials had been selected at, and brought from, the Site #30-5-43 ridge for the more advanced finishing work (Collins 1994:115).

6. ARCHAEOLOGICAL EXPECTATIONS FOR THE STUDY AREA

6.1. Potential site types

On the basis of information gained through a review of ethnohistorical sources (Section 4), the distribution of known sites (Section 5.1.) and the results of past surveys in the Manning hinterland (Section 5.2.), it is clearly possible that unrecorded Aboriginal sites will exist within the general study locality. Given the extent of modification and disturbance evident in the study area itself, however, many of the site types recorded elsewhere in the Manning hinterland (e.g.carved and scarred trees, stone arrangements, bora/ceremonial grounds) could not have survived, and an absence of suitable rock outcrops precludes the occurrence of occupation shelters, rock art sites and axe grinding grooves. The only three site types which are considered to have any potential to be found are defined below:

6.1.1. Isolated stone artefacts

These can occur anywhere in the landscape and represent either the remnants of a dispersed open campsite (artefact scatter), or the simple loss or random discard of artefacts. Given that an isolated artefact was found within the now-removed Kiwarrak Rest Area, the study locality was obviously visited by Aboriginal people and additional isolated artefacts are likely to be present within the general area.

6.1.2. Open campsites

Open campsites often occur along the edges of creeks and swamps but may also be found in other open locations. Early illustrations and descriptions show these sites to have consisted of shelters of branches and bark surrounding a central area where cooking and other domestic activities were carried out. However, as a result of exposure and weathering the actual occupation deposit rarely survives, leaving only stone artefacts and possibly some bone and charcoal at the surface to indicate past Aboriginal activity. Because few habitable rockshelters exist in most coastal areas open campsites are a common site type (Byrne 1989:10).

Although open campsites may be present within the study area, like isolated artefacts, these will be difficult to detect in vegetated and disturbed contexts.

6.1.3. Stone quarries/stone extraction sites

As the locations of stone sources exploited by Aborigines, quarry sites usually show evidence of procurement and preliminary processing activities, and may be found where outcrops of suitable siliceous or igneous rocks occur. While quarry sites may be represented by as little as one or two flaked boulders or a single extraction pit, most contain a cluster of quarry pits and/or flaking floors where the stones have been trimmed to sizes suitable for transport (NPWS 1988:18-19).

The study area offers a relatively abundant outcropping source of fine-grained greywacke cobbles and pebbles with conchoidal fracture properties. Because this greywacke would have been conducive to the production of flaked stone tools, it may have been exploited by Aboriginal groups and evidence of quarrying activities has the potential to occur within the study area. Unfortunately, the area has been subject to widespread mechanical disturbance which has caused fracturing of the greywacke. As a result, it will be difficult to discriminate between pieces which are attributable to Aboriginal industry and those attributable to mechanical action.

6.2. Site distribution

Ethnohistorical reports and the distribution of the recorded sites suggest that the sandy coastal strip and the lower estuarine system provided a focus for Aboriginal occupation in the Manning Valley. With the singular exception of the isolated find in the Kiwarrak Rest Area, all of the prehistoric occupation sites discovered during impact assessment for the Taree Bypass project occurred either along the banks of a tidal creek, or on the crests of low bedrock ridges/spurs which interfinger with the depositional sediments on the southern rim of the floodplain (Table 1). Both of the open campsites recorded in this latter context were situated directly above a productive expanse of swamp.

Unfortunately, no systematic archaeological survey work has been conducted in the Kiwarrak State Forest (or in other State Forests of the lower Manning district). As a result, the archaeological record of the ridge systems has not been documented to an extent sufficient for developing a regionally-specific model of site patterning. Even so, it is widely recognised that Aboriginal sites are not evenly distributed across the landscape, and a correlation between site locations and suitable low-gradient camping areas and reliable food and water resources has been repeatedly identified (cf.Collins 1995; Hall & Lomax 1993; Packard 1992). Surveys of coastal hinterland forests with topographic characteristics similar to the current study area have revealed a strong preference for occupation sites to be located in reasonably level areas on the more elevated parts of the toposequence- ridgelines, crests, ridgeline saddles, spurs or their upper slopes (Packard 1992:Table 1; Hall & Lomax 1994:65).

Although the presence of a carved tree and a stone arrangement/initiation ground testifies to the fact that parts of the ridge system were used in a ceremonial capacity, no campsites have so far been discovered in the general study locality and the Kiwarrak Rest Area artefact (a retouched indurated mudstone flake with usewear along two margins [Rich 1990:35]) provides the sole potential evidence of subsistence activities. On the basis of the results of both Rich's survey and the results of the forest surveys mentioned above, and given the study area's environmental and disturbance context, it is expected that archaeological evidence will be restricted in its distribution to the upper slopes and crest in the central section of proposed Cut A. This evidence is likely to take the form of isolated stone artefacts or small scatters of stone artefacts (open campsites) which will have been dispersed during past roadworks. Outcropping greywacke is also largely confined to this crest and evidence of Aboriginal stone extraction/reduction may occur. However, like isolated artefacts and artefact scatters, any debris attributable to quarrying and its associated activities will have been disturbed.

7. FIELD SURVEY

7.1. Detection-limiting factors

7.1.1. Disturbance

Although we can use available evidence in an effort to understand how specific landsystems were used by Aboriginal groups, the current location and condition of archaeological sites, along with their potential for discovery during survey, is determined by many factors other than where and how cultural materials were originally discarded. Apart from natural attrition, the major determinants of present site location and condition are destructive elements, including those stemming from European development. Given that the Kiwarrak Rest Area was levelled to make way for the Taree Bypass, road construction in particular has obviously already had an adverse affect on the study locality's archaeological resource.

Focussed as it is on the narrow strip of land sandwiched between the Taree Bypass and old Pacific Highway, the entire study area has been subject to a level of modification such that it would be virtually impossible for *in situ* sites to survive. With the exception of some small parts of the proposed Cut A slopes where disturbance appears to have been restricted to timber harvesting activities, the natural surface has been either completely removed (downcut) or badly churned during the course of mechanical clearing and road construction. As a result, most of the area, including the proposed Cut A crest and the upper slopes in Cuts A and B, has a hummocky microrelief and is littered with fragmented shale and greywacke.

7.1.2. Ground surface exposure

Because archaeological surveys are designed to discover materials present on the ground surface, their effectiveness is necessarily linked to the frequency with which surface exposures occur. Where deposited sediments or a thick covering of vegetation blankets the original surface, survey inspection alone may not always be adequate for assessing archaeological potential, and in some instances a subsurface investigation may be warranted.

As an outcome of its development history, surface exposures are relatively common across the study area. These range from scattered mechanical exposures on the cleared and disturbed central crest in proposed Cut A (5% mean visibility), to fully-exposed cuttings along the margins of the Old Highway. The lowest overall surface visibility was encountered in the open depression north of the Cut A crest, where dense lantana and other weeds restricted the survey to a single unformed vehicle track (80% visibility).

7.2. Survey strategy and implementation

Totalling 12 person hours, field survey of the study area was undertaken on foot by the consultant with the assistance of Purfleet-Taree LALC sites officers Vienna Maslin and Ralph Saunders on 2 June 1998. The weather was fine and lighting was conducive to the detection of surface materials. Relevant environmental observations were noted in a field logbook, and photographs were taken to document the various levels of surface exposure and visibility. Selected Plates have been included in this report to offer the reader a general overview of survey conditions.

Given its small size (approximately 5.5ha. including unsurveyable cuttings/batters) it was decided to undertake as thorough a survey as possible across the study area, targeting all reasonably intact low-gradient (≤10°) surfaces. The survey was conducted as a series of parallel transects, with the distance between surveyors tailored to suit the type of exposure being traversed. On vehicle tracks, for example, the surveyors were spaced to enable one to inspect the track surface while the others inspected the verge to either side, while inspection of transects across wider areas was achieved by the three surveyors spaced approximately 5 metres apart, resulting in coverage of all exposures within a 15 metre wide strip.

In view of the constraints to site preservation and discovery imposed by widespread surface disturbance, and in an effort to enable the study area's archaeological potential to be more securely assessed, the field survey was extended to include those potentially sensitive landform elements (total area of 0.94ha.) which offered improved conditions immediately beyond the study boundary. In order to adequately inspect the logged crest adjacent to proposed Cut A west of the

Old Highway, each surveyor carried a garden rake and the ground surface was cleared of leaf litter at regular intervals to expose the ground surface.

7.3. Effective survey coverage

Land covered during the survey, representing almost 68% of the non-downcut section of the study area, and including all of the potentially sensitive locations as identified in Section 6.2., is shown on Figures 5 and 7 in relation to the various landform elements present. Summary details of the surveyed areas, including those beyond the study boundary, are presented in Table 2. The given measurements have been simply calculated by multiplying the length of each survey block or transect by its width to offer a rough guide to the relative size of the survey areas. Information provided in Table 2 has then been used to produce Table 3 which details coverage of the identified landform elements.

The concept of coverage analysis has been developed as a means of specifying the proportion of a surveyed sample which permitted the detection of sites. With respect to the more unobtrusive types of sites such as scatters and isolated stone artefacts, site detection can be partially or even completely impaired by surface vegetation, slope-washed and wind-blown sediments, modern land modification, gravelly surfaces and/or poor lighting conditions (cf.Witter 1992:85-87). Once the impediments imposed by a lack of surface exposure are taken into account (by multiplying the area of each survey block/transect by its mean surface visibility), it is estimated that almost 22% (0.44ha.) of the 2.16ha. of land surveyed (within the study area itself), and 8% of the entire study area, was subject to effective survey coverage (Table 3). With the exception of very dense vegetation and possible slope-washed sediments within the open depression in proposed Cut A, however, the overridging constraint to the effectiveness of the survey was the extent and intensity of past development work. Ground surface exposure was consistently found to have been caused by mechanical disturbance rather than natural processes, though in all instances the exposures themselves offered full surface visibility. However, while the compacted and lightly eroded vehicle track exposures inspected beyond the study boundary were highly conducive to the detection of artefacts, exposures within the area itself, where surfaces tended to be more churned, friable and uneven, were only moderately conducive to artefact detection.

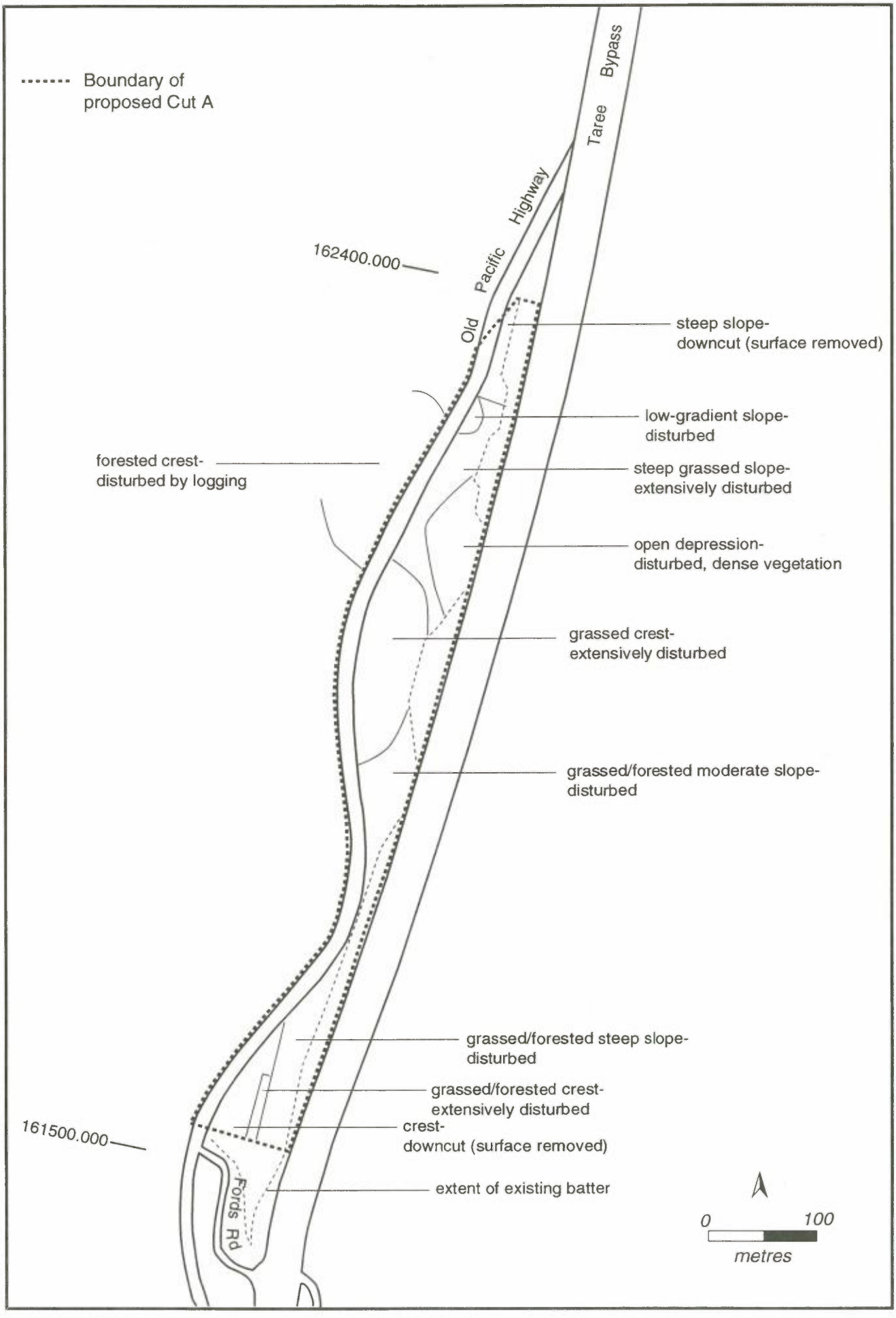


FIGURE 4: Location and disturbance context of Cut A landform elements

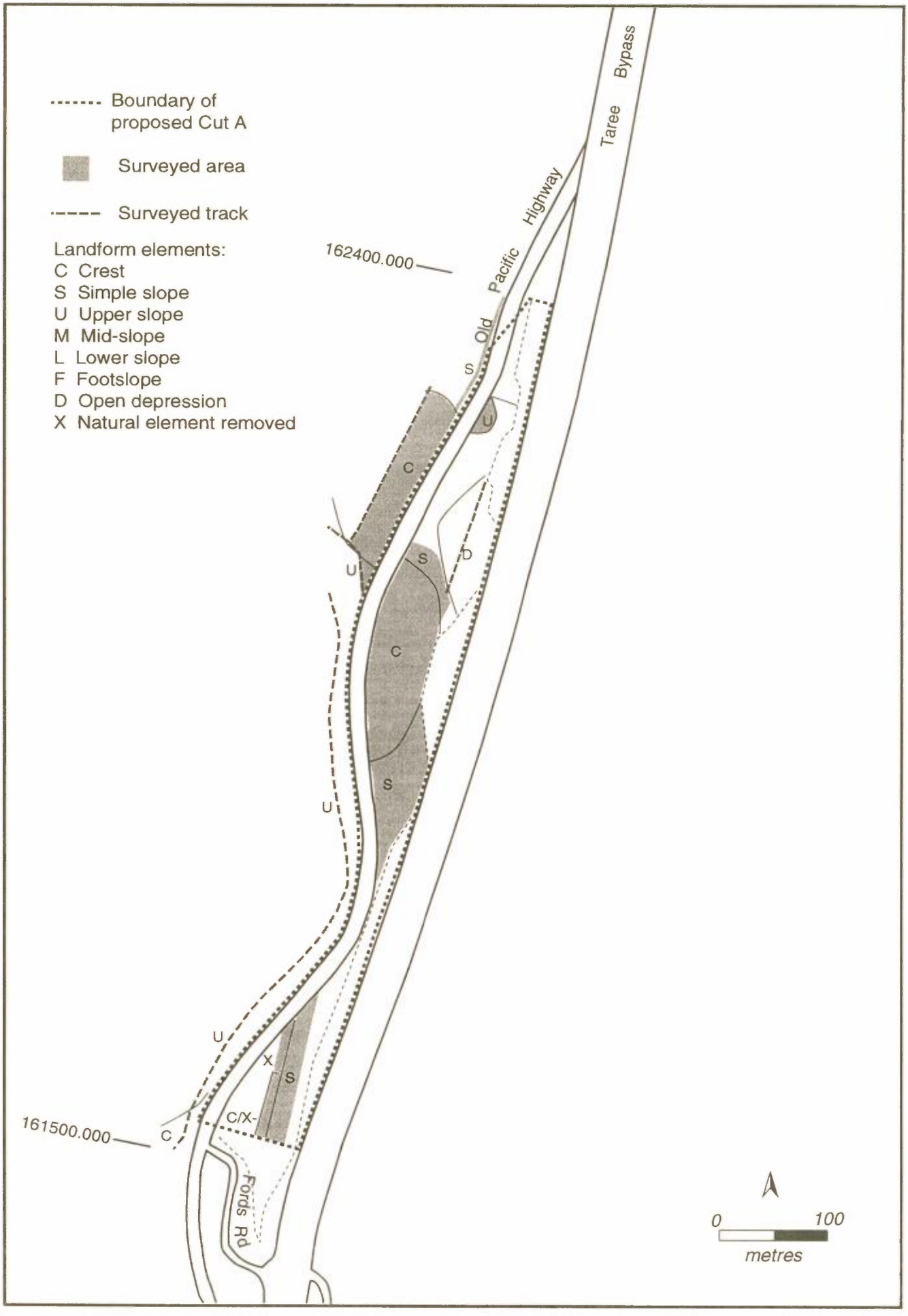


FIGURE 5: Location of areas surveyed within and in the vicinity of Cut A

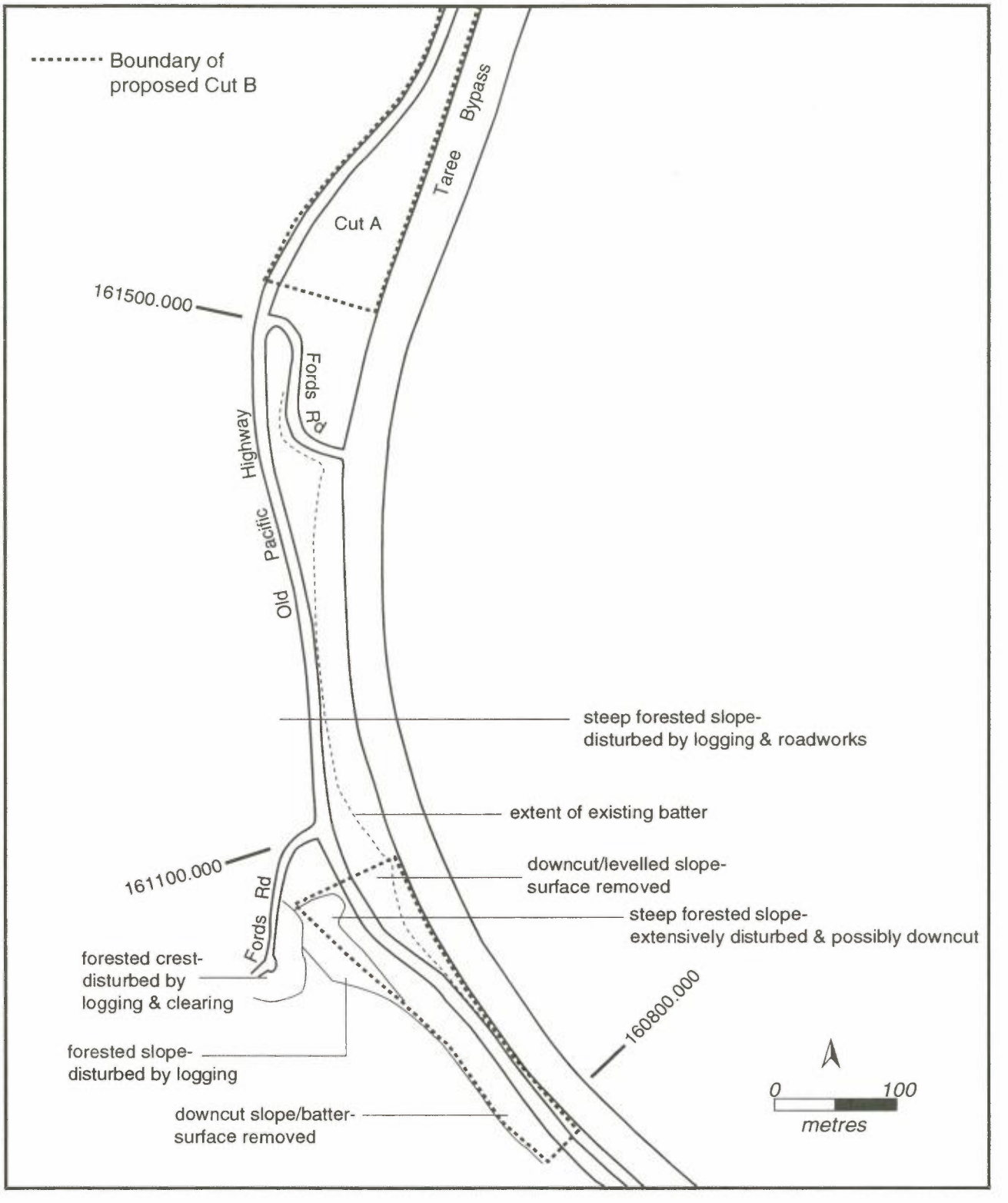


FIGURE 6: Location and disturbance context of Cut B landform elements

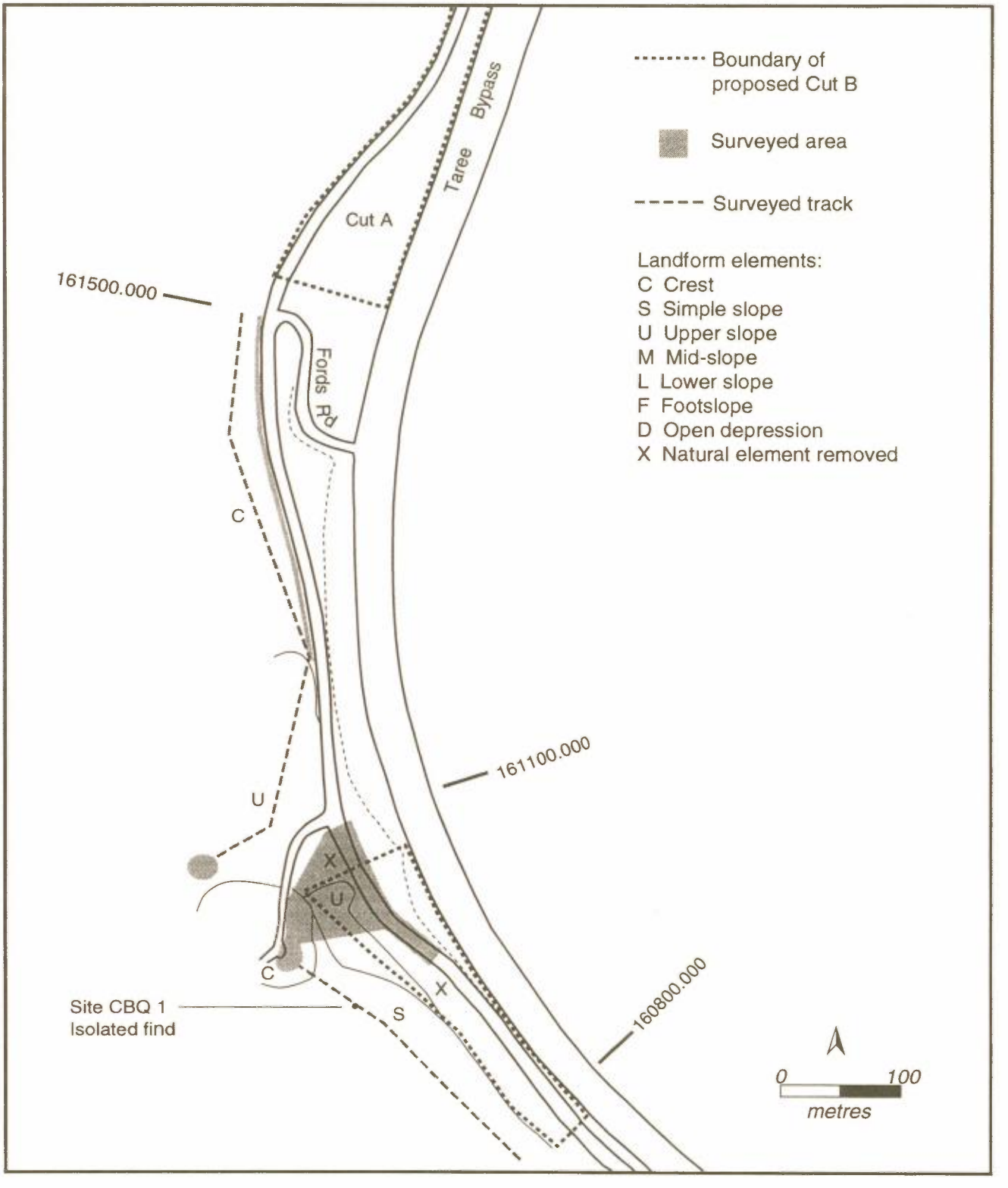


FIGURE 7: Location of areas surveyed within and in the vicinity of Cut B

PLATE 1: View north to proposed Cut A (arrow) from proposed Cut B

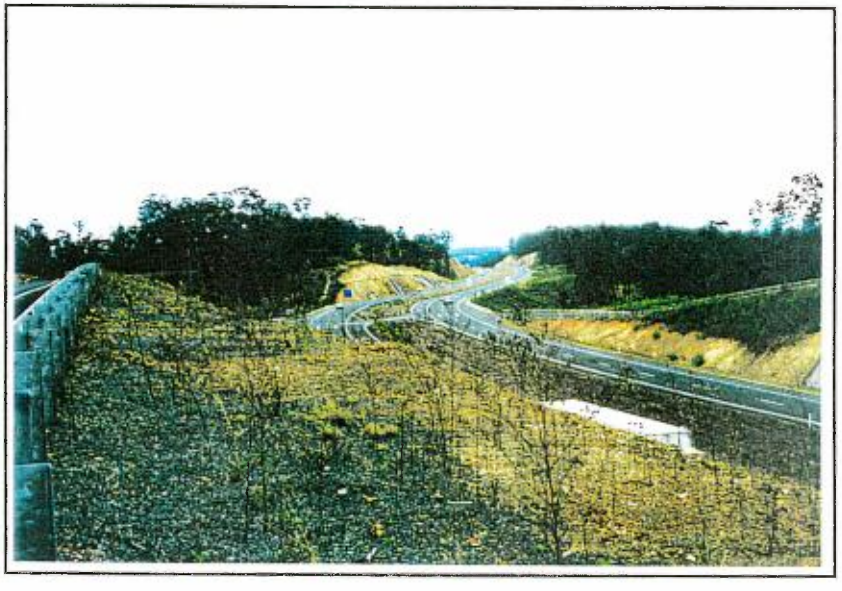


PLATE 2: Northern mid-lower slope of proposed Cut A

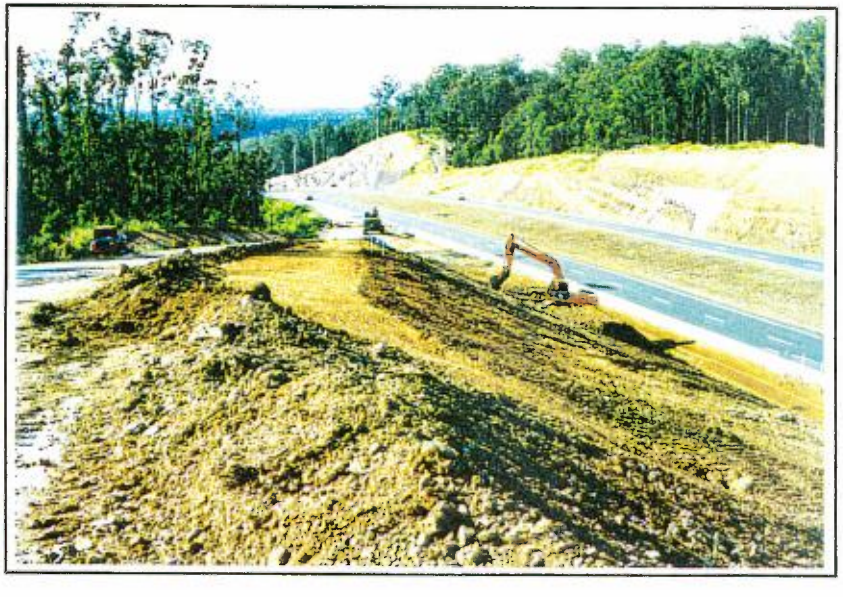


PLATE 3: Upper northern slope of proposed Cut A



PLATE 4: Central disturbed crest on proposed Cut A



PLATE 5: Central crest immediately west of proposed Cut A

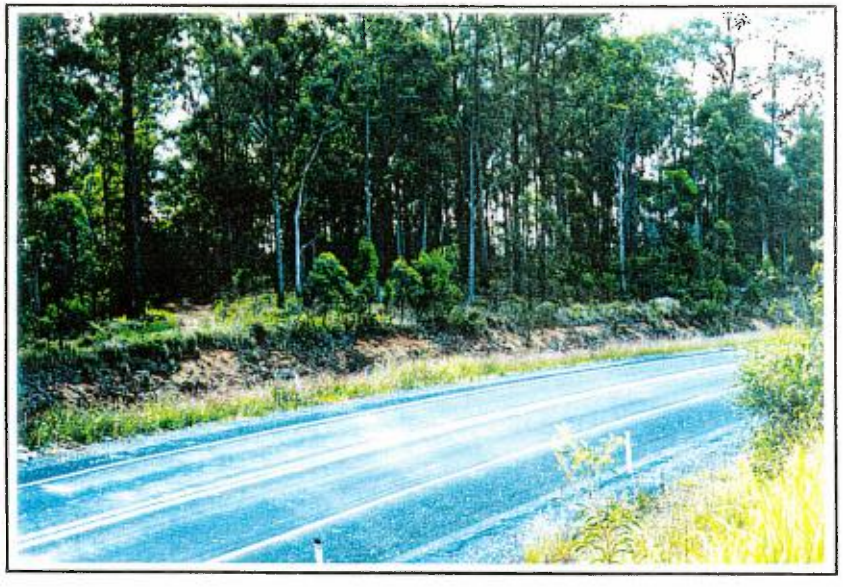


PLATE 6: Disturbed slope on southern end of proposed Cut A

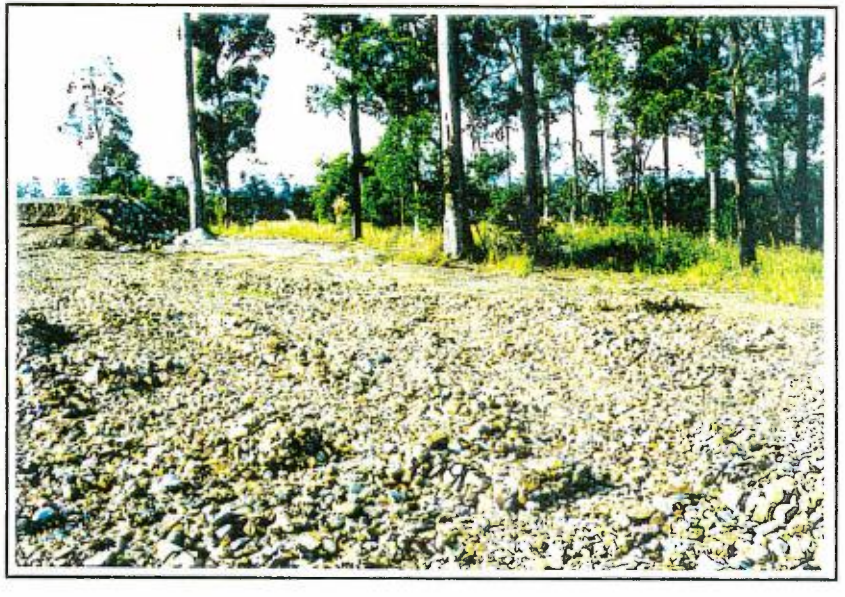


PLATE 7: View south along Old Highway, proposed Cut B



PLATE 8: Vegetated slope on northern end of proposed Cut B

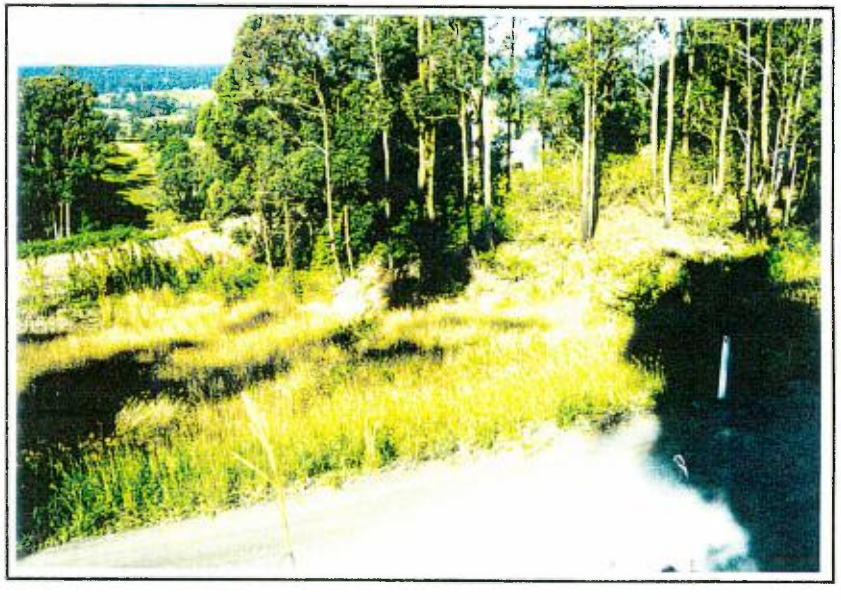


TABLE 2: Summary details of surveyed areas

Landform element	Disturbance type	Exposure type	Area ($m.^2$)	Mean % visibility	Effective coverage ($m.^2$)
Proposed Cut A					
C	3-4	M-X	8,900	5	445
S	2-4	L-M-X	7,312	10	731.2
U	4	M-X	125	10	12.5
D	4	T	200	80	160
X	4	X	500	100	500
Proposed Cut B					
U	4	L-M	1,125	50	562.5
X	4	X	2,000	100	2,000
Total			20,162(2.16ha)		4,411.2(0.44ha)
Beyond study boundary- area covered by Figure 5					
C	1-4	T-L	4,250	5	212.5
S	3-4	M	250	90	225
U	4	T	1,800	90	1,620
Beyond study boundary- area covered by Figure 7					
C	1-4	T-L	1,600	80	1,280
S	3-4	T	350	100	350
U	3-4	T-M	1,100	80	880
Total			9,350(0.94ha)		4,567.5(0.46ha)
TOTAL			29,512(2.95ha)		8,978.7(0.90ha)

KEY:

Landform elements (Speight 1990:11-34)-

C Crest- element which stands above all, or almost all, points in the adjacent terrain; characteristically smoothly convex upwards.

S Simple slope- a slope adjacent below a crest and adjacent above a flat or depression.

U Upper slope- a slope element adjacent below a crest but not adjacent above a flat or depression.

D Open depression- element with a lower outlet which stands below all, or almost all, points in the adjacent terrain.

X Excavated or dug out by human activity.

Site disturbance (McDonald, Isbell & Speight 1990:88)

0 No effective disturbance

1 Limited clearing

2 Extensive clearing

3 Complete clearing

4 Highly disturbed by human activity

Exposure type-

N Natural erosion scour

T Vehicle track

L Logging- discontinuous disturbance of natural surface

M Mechanical clearing- natural surface churned

X Mechanical excavation- downcut

Effective coverage = Surveyed area x Mean % visibility [% of visible ground surface]

TABLE 3: Survey coverage of landform elements

Landform element	Area surveyed	Total effective coverage	Total area of landform element	% effectively surveyed
Study area (proposed Cut A & Cut B)				
Crest	8,900m^2	445m^2	8,900m^2	5.0
Simple slope	7,312m^2	731.2m^2	11,965m^2	6.1
Upper slope	1,250m^2	575m^2	1,512m^2	38.0
Open depression	200m^2	160m^2	3,750m^2	4.3
Excavated	2,500m^2	2,500m^2	28,500m^2	8.8
Total	20,162m^2	4,411.2m^2	54,627m^2(5.5ha)	8.1%
Beyond study boundary				
Crest	5,850m^2	1,492.5m^2	n/a	25.5
Simple slope	600m^2	575m^2	n/a	95.8
Upper slope	2,900m^2	2,500m^2	n/a	86.2
Total	9,350m^2	4,567.5m^2	n/a	48.9%

8. SURVEY RESULTS

8.1. Sites within the study area

No Aboriginal cultural material or other evidence of Aboriginal activity was discovered within the area to be affected by the proposed Cut Batters Quarry.

8.2. Sites beyond the study boundary

One isolated stone artefact (Site CBQ 1) was recorded during the survey in the location plotted on Figures 2 and 7.

Site CBQ 1: Isolated find

AMG Reference: 4/49160.64/62025 Taree 9334-2-S, Edition 2, 1:25,000

Multi-platform mudstone core, 63 x 47 x 25mm. (length x width x thickness)
5% pebble cortex, 14 negative flake scars.

This artefact was found within the Kiwarrak State Forest on the fully-exposed surface of a 2m. wide unformed track which branches south-east from a crest on Fords Road west of proposed Cut B. A subsurface Telstra optic fibre cable has been installed along the eastern edge of the track, and the dry sclerophyll forest to either side has a dense ground cover of lantana, long grass, logging debris and leaf litter. This forest had clearly been extensively disturbed and no off-

track inspection was attempted in the site vicinity. While it is acknowledged that the presence of fractured surface shale may have adversely influenced the result, the 250m. long section of track spanning the artefact location was carefully inspected without discovering any additional cultural material and the artefact is thus considered unlikely to be part of a larger scatter (open campsite).

Situated on the upper slope (5° gradient) at an elevation of approximately 100m. AHD and at least 250m. from the nearest potential water source (three seasonal creeks), the Site CBQ 1 artefact lies 45m. south-west of proposed Cut B and should not be affected by the proposed fill extraction.

9. DISCUSSION OF SURVEY RESULTS

Given the small size of the proposed quarry and the relatively intensive coverage gained through the inspection of exposures across all reasonably intact and potentially sensitive surfaces within the study area, supplemented by the survey of any potentially sensitive landform elements offering improved conditions immediately beyond the study boundary, I consider the results to reliably reflect both a low level of further archaeological potential for the study area itself, and the low-density character of the localised archaeological resource.

During her survey of the 400m. wide Taree Bypass corridor, Rich inspected both forested and eroded areas within the Kiwarrak State Forest, including a number of unformed tracks in the study vicinity. These tracks "followed the ridge tops and spurs and ... provided some visibility on flatter areas where open sites were more likely to be present" (Rich 1990:7). Despite this, only a single stone artefact, situated on a ridge crest exposure, was found. The current survey has similarly succeeded in identifying an isolated artefact on the higher part of the toposequence, which together with Rich's result, is suggestive of a low and probably itinerant level of past Aboriginal use of the ridge system on which the study area is based. Given that no cultural material was discovered on the unformed tracks which traverse the upper slope and crest west of proposed Cut A (beyond the study boundary) despite the presence of an outcropping source of suitable knapping stone and lightly eroded surfaces which were highly conducive to artefact detection, the archaeological record of the general area appears to be of an intermittent nature only.

While the study locality has undoubtedly been subject to past Aboriginal use and while this use may well have resulted in the discard of further undiscovered artefacts, past road construction has had such a major impact on the landscape that any sites which may have been located within the study area are extremely unlikely to have survived intact. Even so, presuming that

the isolated finds recorded during this and Rich's (1990) survey can be taken as representative of the archaeological resource as a whole, a low-density distribution of further isolated artefacts may be destroyed if the Cut Batters Quarry development proceeds. However, these artefacts can be expected to have already been dispersed/displaced through mechanical activities and are likely to currently lay concealed within the churned topsoil.

10. SIGNIFICANCE ASSESSMENT

10.1. Management principles and the concept of significance

Aboriginal sites and places of significance to Aboriginal people are protected in NSW under the National Parks & Wildlife Act (1974). This legislation is designed to ensure that the cultural resource is carefully managed, and that unmitigated destruction of archaeological material does not occur. The issue for resource managers is to permanently preserve a body of sites which is representative of the resource at the regional level, and this principle has been adopted by the NSW National Parks & Wildlife Service (NPWS). A representative sample of sites from a region should include examples of all site types, within the full range of environmental contexts (Clemens 1984). Under such a program, sites which are good representative examples of their type would be conserved, along with unique and rare site types.

The concept of significance has been developed in order to assess sites and to identify those which should be retained as part of a regional sample. These sites may be significant to Aboriginal communities, archaeologists or to the general public, or they may be significant to all or any combination of these groups. Given that the ultimate objective is to preserve a regionally-representative sample, site significance is usually assessed within a regional framework.

10.1.1. Cultural/social significance to Aboriginal people

Archaeological sites, including those which may not have been known to Aboriginal people prior to survey, may take on *general heritage value* by virtue of their ability to demonstrate past occupation of an area, and due to the sense of community which they can provide with previous generations (Bowdler 1983). This is the most common kind of cultural/social significance and the NPWS has respect for such significance when considering applications for consent to investigate, damage or destroy sites. It is NPWS policy to consult with the relevant LALC or Aboriginal community on all aspects of site management, and when consents to salvage/destroy or permits for archaeological excavation are sought, the Director-General seeks and considers the advice of the relevant Aboriginal group/s (NPWS n.d.).

The cultural/social significance of Aboriginal sites and places can only be assessed by the Aboriginal community itself. To enable the Purfleet-Taree LALC to make an informed assessment of the cultural value of the study area as a whole, a draft copy of this report was provided for discussion at a full Land Council meeting held on 10 August 1998. As a result of its consideration of the draft report the Land Council has advised that it has no objections to the Cut Batters Quarry proposal proceeding, providing the recommendations made in Section 11 are implemented (Appendix 2).

10.1.2. Scientific/archaeological significance

This type of significance is essentially an assessment of a site's potential to elucidate past behaviour. Such assessment is made not only with regard to currently available knowledge, theories and data retrieval methods, but with consideration of likely future scientific developments. Sites have particular potential, and thus greater archaeological significance, if there are few other sites which can contribute similar types of information, if they are in a good state of preservation, if they can provide a chronology extending back into the past, and if they display a connectedness with other local sites (NPWS 1997:26-28).

Although the research potential of sites is obviously dependent upon the questions being addressed, large and structured concentrations of cultural materials which have retained their stratigraphic and/or horizontal integrity are generally regarded as being archaeologically/ scientifically significant. Because the level to which a site can maintain its spatial integrity declines in proportion to the level of disturbance it has suffered, the most significant sites are usually found in undisturbed environments.

10.2. Potential undiscovered sites within the study area

On the basis of the results of this and past surveys in the study locality, and as discussed in Section 9, there is the potential for a dispersed, low-density distribution of undiscovered stone artefacts to occur within the proposed Cut Batters Quarry area. Given the disturbance history of the proposed extraction area, however, there is virtually no chance that any of these artefacts will be *in situ* or that they could offer anything more than a minimal level of research potential. It is therefore considered likely that any undiscovered sites within the study area will have a low level of both cultural and archaeological/scientific significance.

11. RECOMMENDATIONS

The recommendations presented here were developed in liaison with Purfleet-Taree LALC sites officers Vienna Maslin and Ralph Saunders, Co-ordinator Gillian Donovan and Elder Willie Bungie and have been endorsed by Aboriginal community members following discussion at a full meeting of the Land Council (Appendix 2).

The following recommendations are based on:

- The provisions of the National Parks & Wildlife Act 1974 (as amended), which states that it is an offence to knowingly disturb, destroy, deface or damage a 'relic*' or Aboriginal place without the prior written consent of the NPWS Director-General;
- Advice received through the Aboriginal involvement outlined in Section 2;
- The results of the literature review presented in Sections 4 and 5;
- The results of the archaeological survey as detailed in Sections 7 and 8.

* A 'relic' is defined under the Act (Section 5[1]) as:

> "any deposit, object or material evidence (not being a handicraft made for sale) relating to the indigenous and non-European habitation of the area that comprises NSW, being habitation both prior to and concurrent with the occupation of that area by persons of European extraction"

11.1. Sites within the study area

As there were no archaeological sites found within the study area, site-specific recommendations are not necessary. However, while the potential is not considered substantial enough to warrant further survey work or subsurface investigation, isolated stone artefacts may occur in areas where the topsoil is still present, particularly on the crest and upper slopes in the central section of proposed Cut A. It is therefore recommended that fill extraction be allowed to proceed from the proposed Taree Bypass Cut Batters Quarry *providing the following recommendations are implemented:*

- If/when the proposed extraction work proceeds, all relevant contractors and their employees engaged for the work are to be advised of their legal obligations with regard to Aboriginal cultural materials:

Under the terms of the National Parks & Wildlife Act (1974), it is illegal for any person to knowingly disturb, destroy, deface or damage, or to permit the disturbance, destruction, defacement or damage to a 'relic' or Aboriginal place without first obtaining written consent to do so from the Director-General of the NPWS.

- Should any materials thought to be of potential Aboriginal origin be uncovered or unearthed during the course of vegetation clearing, fill extraction, or at any other time, all activities should immediately cease in their vicinity. Management advice should then be sought from both the NPWS (Port Macquarie District office) and the Purfleet-Taree LALC. Work should not resume in the subject area until clearance to do so has been given by both of these organisations.

11.2. Sites beyond the study boundary

The Site CBQ 1 isolated stone artefact lies 45m. south-west of the boundary of proposed Cut B and will not be directly affected by the extraction proposal. This artefact is legally protected under the terms of the National Parks & Wildlife Act, and may not be further disturbed, defaced or damaged without the prior written consent of the NPWS Director-General.

- In order to prevent any indirect disturbance it is recommended that the artefact location be clearly marked onto all quarry/cut batters project development maps and the area strictly avoided during the course of all extraction and subsequent rehabilitation works.

- Prior to the commencement of extraction on Cut B it is recommended that all relevant contractors and their employees engaged for the work be advised of the archaeological sensitivity of the track on which the artefact was found, and of the necessity to at all times confine their work to land coastward (east) of the Telstra optic fibre cable.

In an effort to ensure that Site CBQ 1 is not inadvertently affected by forestry activities, State Forests (through the Taree District's Aboriginal liaison officer) has been advised of the artefact location and furnished with a copy of the NPWS site recording form submitted for it.

REFERENCES

BELSHAW, J. 1966 *The economic basis of Aboriginal life in northern NSW in the nineteenth century*. B.A.(Hons) Thesis, University of New England, Armidale.

BIRRELL, W.K. 1987 The Manning Valley: Landscape and Settlement 1824-1900. Jacaranda Press, Sydney.

BOWDLER, S. 1983 The Aboriginal Sites of the Crown Timber Lands of New South Wales. NSW Forestry Commission.

BRAYSHAW, H. 1977 *Report of an archaeological survey of the route of a proposed transmission line between Taree and Kempsey*. Report to the NSW Electricity Commission.

1983 *Archaeological survey at Harrington near Taree, NSW*. Report to GHD Pty Ltd.

1990 *Saltwater Beach EIS, archaeological survey for Aboriginal sites*. Report to Lewis Environmental Consultants.

1994 *Harrington Waters Estate Manning River, NSW. Archaeological survey for Aboriginal sites*. Report to Peakhurst Properties Pty Ltd.

BYRNE, D. 1989 Aboriginal Heritage of the North Coast. A Discussion Paper. Department of Planning, Grafton.

CHEVALLY, L. 1946 *Letter to R.C. Law*. Manuscript, Clarence River Historical Society archives, Grafton.

CLEMENS, H. 1984 *The Aboriginal site reservation program*. Discussion Paper, Cultural Resources Section, NSW National Parks & Wildlife Service.

COLEMAN, J. 1978 *The analysis of vertebrate faunal remains from four shell middens in the lower Macleay River district*. B.A.(Hons) Thesis, University of New England, Armidale.

COLLINS, J.P. 1993 *Archaeological assessment of the Saltwater Beach sandmining lease*. Report to Mineral Deposits Ltd.

1994 *Report on the archaeological salvage of open campsites #30-5-22 and #30-5-43 on the Taree Traffic Relief Route*. Report to the NSW Roads & Traffic Authority.

1995 *Aboriginal archaeology. Area 13 (Thrumster), Port Macquarie, NSW*. Report to Hastings Council.

COLLINS, J.P. & M.J. MORWOOD 1991 *An archaeological assessment of the forests of the Wingham Management Area*. Report to Truyard Pty Ltd.

CONNELL WAGNER 1998 *Fill material quarry on the cut batters of the Taree Bypass. Review of environmental factors*. Report to the NSW Roads & Traffic Authority.

CONNORS, F.W. 1985 Pioneering Days Around Taree: A Factual History of Exploration and Earliest Settlement of the Manning River. Classic Printers, Taree.

CREW, D. 1989 *Archaeological survey at Harrington, near Taree, NSW: proposed subdivision of Portions 142 & 143, Closed Road and Lot 150 DP771675*. Report to GHD Pty Ltd.

DEAN-JONES, P. 1989 *Report on an archaeological survey at Middle Brother Mountain, Hastings Shire*. Report to Planning Workshop.

EADES, D. 1979 *Gumbaynggir*. In R.M.W. Dixon & B.J. Blake (eds), Handbook of Australian Languages. Australian Institute of Aboriginal Studies, Canberra. pp.244-385.

FITZPATRICK, F.A. 1914 Peeps into the Past. Cumberland Argus Ltd., Parramatta.

HALL, R. & K. LOMAX 1993 *An archaeological assessment of the Grafton Management Area.* Report to the NSW Forestry Commission.

HOLMER, N.M. 1966 *An attempt towards a comparative grammar of two Australian languages.* Occasional Papers in Aboriginal Studies , No. 5, Linguistics Paper No. 3. Australian Institute of Aboriginal Studies, Canberra.

KLAVER, J. & K.J. HEFFERNAN 1991 *Greater Taree Aboriginal heritage study.* Report to the Greater Taree City Council.

McDONALD, R.C., R.F. ISBELL & J.G. SPEIGHT 1990 *Land surface.* In R.C. McDonald, R.F. Isbell, J.G. Speight, J. Walker & M.S. Hopkins (eds), Australian Soil and Land Survey: Field Handbook. Second Edition. Inkata Press, Sydney. pp. 87-102.

(NSW) NATIONAL PARKS & WILDLIFE SERVICE (NPWS) 1997 *Guidelines for archaeological survey reporting. Working draft.* NSW National Parks & Wildlife Service.

1988 Aboriginal Sites of New South Wales. NSW National Parks & Wildlife Service.

n.d. *Guidelines for the preparation of archaeological reports:requirements by NPWS.* NSW National Parks & Wildlife Service.

NAVIN, K. 1992 *Archaeological survey for Aboriginal sites: Middle Brother Mountain, north of Taree NSW.* Report to Sinclair Knight & Partners Pty Ltd.

PACKARD, P. 1992 *An archaeological assessment of State Forests in the Kempsey and Wauchope Forestry Management Areas.* Report to the NSW Forestry Commission.

PIERCE, R.G. 1971 *The effects of aquatic foods on the diet and economy of the Aborigines of the north coast of NSW at the time of first settlement.* B.A.(Hons) Thesis, University of New England, Armidale.

PALMER, G. 1986 *An Aboriginal site survey of the Manning District water supply proposed headworks augmentation.* Report to the NSW Public Works Department.

RADCLIFFE-BROWN, A.R. 1931 *Social organisation of Australian tribes.* Oceania Monograph.

RAMSLAND, J. 1987 The Struggle Against Isolation: A History of the Manning Valley. Library of Australian History, North Sydney.

RICH, E. 1990 *Pacific Highway S.H. No.10- Taree Traffic Relief Route: archaeological survey for Aboriginal sites.* Report to GHD Pty Ltd.

SIMON, E. 1987 Through My Eyes. Collins Dove, Victoria.

SPEIGHT, J.G. 1990 *Landform.* In R.C. McDonald, R.F. Isbell, J.G. Speight, J. Walker & M.S. Hopkins (eds), Australian Soil and Land Survey: Field Handbook. Second Edition. Inkata Press, Sydney. pp. 9-57.

SULLIVAN, A. 1996 *Archaeological assessment for continued operation of 'Lansdowne Forest' clay pit.* Report to John Baker.

TINDALE, N. 1940 *Results of the Harvard-Adelaide Universities anthropological expedition, 1938-1939.* Transactions of the Royal Society of South Australia, 64(1):140-231.

WILLIAMS, E. 1980 *Aboriginal relics survey of the proposed sewerage treatment works at Taree, NSW.* Report to Sinclair Knight & Partners Pty Ltd.

WITTER, D.C. 1992 *Regions and resources.* Unpublished Ph.D. Thesis, Australian National University, Canberra.

GLOSSARY

ARTEFACT
Any object having attributes as a consequence of human activity (Dunnell 1971).

BORA/CEREMONIAL GROUND
While there are a number of different types of Bora ground, most common on the north coast is that composed of one or a pair of raised earth circles ranging in size from two to 40m. in diameter. The Bora ground functioned as a stage for various initiation rites (Byrne 1989:18).

CARVED TREE
Carved trees carry figures or patterns carved into the bark or wood and are generally found in direct association with either Aboriginal burial or ceremonial grounds. The designs which were carved into the trees were symbolic of totemic groups (Byrne 1989:15).

CORE
A piece of stone which has been used as a source for flake production. Cores are thus generally characterised by negative flake scars (Morwood & L'Oste-Brown 1995:162).

CORTEX
The natural weathered surface of rock, not the result of human activity (McCarthy 1976:101).

CREST
Landform element standing above all or most points in the adjacent terrain. Usually smoothly convex (Speight 1990:13).

FLAKE
A piece of stone detached from a larger mass by the application of force and having a feather, hinge or step termination and a bulb of percussion. A platform may be present if the proximal end is unbroken (Crabtree 1972:64).

GREYWACKE
Sedimentary rock. A very hard, dark grey or greenish-grey, coarse-grained sandstone characterised by angular particles and rock fragments embedded in a clayey matrix (Lapidus 1990:265).

LANDFORM ELEMENT
A topographic feature of 40m. or more in maximum dimension which forms part of a larger unit, the landform pattern (Speight 1990:9).

LENGTH
Maximum dimension of a core or flaked piece in any direction; maximum distance along the percussion axis of a flake from the platform to the distal margin (Witter 1986:2).

MUDSTONE
A commonly-used synonym for Mudrock. A fine-grained sedimentary rock composed chiefly of particles in the silt-clay size range. Mudrock/mudstone is a general term used to distinguish the finer-grained sedimentary rocks from sandstones or limestones (Lapidus 1987:362).

MULTI-PLATFORM CORE
A core with at least one negative scar running in a different direction to the remainder. Multi-directional scars indicate that the core has been rotated to get the most economical use of the raw material (Hiscock 1986:49).

NEGATIVE FLAKE SCAR
Concave surface resulting from the removal of a flake (Phagan 1976:39).

OPEN DEPRESSION
A landform element with a lower outlet which stands below all, or almost all, points in the adjacent terrain (Speight 1990:15).

PEBBLE
Stone worn and rounded by water and other natural forces (McCarthy 1976:101).

PLATFORM/STRIKING PLATFORM
The plane or surface against which force is applied in order to detach a flake from a core. The platform may be the natural surface of the stone, or cortex, it may be a surface produced by the prior removal of one or more flakes, or a surface produced by grinding or abrading (Phagan 1976:11).

RETOUCH
The alteration to the primary termination of a flake caused by deliberate secondary flaking in order to resharpen or modify the edge (Crabtree 1972:89).

SCARRED TREE
Aboriginal scarred trees carry scars caused through the removal of bark or wood for making artefacts such as canoes, shields and containers, or which have been marked for other reasons (e.g.toe-holds to aid climbing). As such, scarred trees are generally associated with domestic resource-extraction activities (Byrne 1989:13).

SIMPLE SLOPE
Landform element comprising a slope adjacent below a crest, spur or ridge, and above a flat or depression (Speight 1990:15).

STONE ARRANGEMENT
Aboriginal stone arrangements usually comprise a group of stone heaps or cairns, varying in size up to about half a metre in height and 10m. in diameter. These cairns may be oval, rectangular or square as well as circular. While little is known about the significance of stone arrangements, they are thought to have played a role in higher levels of initiation ceremonies (Byrne 1989:16).

STONE ARTEFACT
Fragment of stone which generally possesses one or more of the following characteristics:
- Positive or negative ring crack
- Distinct positive or negative bulb of force
- Definite eraillure scar in position beneath a platform
- Definite remnants of flake scars (i.e.dorsal scars and ridges)

These traits indicate the application of an external force to a core, and are characteristic of the spalls removed by humans using direct percussion. Stone artefacts which have none of the above may be identified as such if they possess ground facet/s characteristic of human industry (Hiscock 1984:128).

THICKNESS
The greatest dimension perpendicular to both the length and width of an artefact (Witter 1986:2).

WIDTH
The maximum distance between the lateral margins, measured at right angles to the length (Witter 1986:2).

Glossary References

BYRNE, D. 1989 Aboriginal Heritage of the North Coast. A Discussion Paper. Department of Planning, Grafton.

CRABTREE, D. 1972 *An introduction to the technology of stone tools. Part II*. Occasional Papers of the Idaho State Museum, No.28.

DUNNELL, R.C. 1971 Systematics in Prehistory. Free Press, New York.

HISCOCK, P. 1986 *Raw material rationing as an explanation of assemblage differences: a case study of Lawn Hill, northwest Queensland*. In G.K. Ward (ed.), Archaeology at ANZAAS Canberra. Canberra Archaeological Society, Canberra. pp.178-190.

1984 *A preliminary report on the stone artefacts from Colless Creek Cave, northwest Queensland*. Queensland Archaeological Research, 1:120-151.

LAPIDUS, D.F. 1990 Dictionary of Geology. Collins, London.

McCARTHY, F.D. 1976 Australian Aboriginal Stone Implements. The Australian Museum, Sydney.

MORWOOD, M.J. & S. L'OSTE-BROWN 1995 *Chronological changes in stone artefact technology*. In M.J. Morwood & D.R. Hobbs (eds.), Quinkan Prehistory: The Archaeology of Aboriginal Art in S.E. Cape York Peninsula, Australia. Tempus 3. University of Queensland, St. Lucia.

PHAGAN, C.J. 1976 *A method for the analysis of flakes in archaeological assemblages: a Peruvian example*. Unpublished Ph.D. Thesis, Ohio State University, Ohio.

SPEIGHT, J.G. 1990 *Landform*. In R.C. McDonald, R.F. Isbell, J.G. Speight, J. Walker & M.S. Hopkins (eds), Australian Soil and Land Survey: Field Handbook. Second Edition. Inkata Press, Sydney. pp.9-57.

WITTER, D.C. 1986 *Detailed stone artefact recording*. Report to the NSW National Parks & Wildlife Service.

APPENDIX 1: Purfleet-Taree LALC sites officer's survey report

PURFLEET-TAREE LOCAL ABORIGINAL LAND COUNCIL

P.O. Box 346, Taree N.S.W. 2430
Phone (02) 6552 4106 — Fax (02) 6551 0847

(THE SHARK IS THE TRIBAL TOTEM FOR THE BIRIPI PEOPLE)

SURVEY REPORT
FORDS ROAD
TAREE BYPASS (OLD PACIFIC HIGHWAY)
12th June 98

Jacki Collins Archaeologist Consultant for the RTA,Ralph Saunders and myself Vienna Maslin Site Officers from the Purfleet/Taree L.A.L.C.
On the 2nd June 1998
We went along the Old Pacific Highway (Fords Road) about 900m from were the Old Lions Club rest area use to be then we walk to the southern side of the old highway to look for Aboriginal Camp Sites.We walk along a bush track about a quarter of a mile we found one artefact embeded in the ground.

Ralph surveyed the area where it was bulldozed but there were no signs of Aboriginal Significance to be found in that area.

Jacki,Ralph and myself walked along the telecom poles but we could not find any Aboriginal Artefacts either side of the track.

Yours Faithfully

Vienna Maslin

Vienna Maslin
(Site Officer)

APPENDIX 2: Correspondence from the Purfleet-Taree LALC

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(THE SHARK IS THE TRIBAL TOTEM FOR THE BIRIPI PEOPLE)

Jacki Collins
Archaeologist Consultant
9 Unique Close
Dunbogan NSW 2443
24th August 1998

SURVEY REPORT

RE:FORDS ROAD

To per conversation last week your draft for recommendation was passed at the Purfleet/Taree LALC meeting held on the 10th August 1998,For the Survey that we did at Fords Road.

If you need any further information do nt hesitate to give me a call.

Yours Faithfully

Vienna Maslin

Vienna Maslin
Site Officer

APPENDIX F
NOISE AND VIBRATION STUDY

ATKINS
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Atkins Acoustics and Associates Pty Ltd.
Consulting Acoustical & Vibration Engineers

NOISE and VIBRATION ASSESSMENT FILL MATERIAL QUARRY ON THE CUT BATTERS OF THE TAREE BYPASS KOORAINGHAT

28.4772.R1:GA103

Rev 02

Prepared for: Connell Wagner Pty Limited
116 Military Road
NEUTRAL BAY NSW 2089

Prepared by: Atkins Acoustics and Associates Pty Ltd.
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September 1998

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1.0 INTRODUCTION

Atkins Acoustics and Associates was commissioned by Connell Wagner Pty Ltd on behalf of the Roads and Traffic Authority to investigate the noise and vibration impacts of the works required to stabilise batters and extract material from a section of the Taree Bypass (Appendix 1).

The results and findings of the noise and vibration assessment together with recommendations to minimise noise impacts are presented in this report. The assessment was based on;

- site inspections,
- ambient background noise level measurements,
- noise assessment procedures and goals recommended in the EPA, Environmental Noise Control Manual (EPA,ENCM),
- sound pressure and vibration levels obtained from audit measurements at similar developments,
- the prediction and assessment of noise and vibration emissions and impacts from the proposed works, and
- an assessment of the likely additional road traffic noise generated by the proposal.

This report has been prepared for the investigation described, and no part should be used in any other context or for any other purpose.

2.0 THE PROPOSAL

The location and layout of the site and the proposed works are shown on Appendices 1 and 2.

2.1 Site Location and Description

The subject site is located on the Taree Bypass south of Purfleet (chainages 160700 to 162500). In essence, the batters of the existing bypass would be stabilised and quarried, with the quarried material being road transported to Coopernook, Cundletown and Moorland for fill.

Two areas (Cut B and Fords Road Realignment Batter) have been identified as requiring stabilisation and a source of fill material. Cut B is located adjacent to the northbound carriageway between chainages 161400 to 162500. The width of the proposed Cut B is approximately 80 metres at chainage 162100. The total volume of material identified in Cut B is approximately 578,500m^3.

The Fords Road Realignment Batter is located adjacent to the northbound carriageway between chainages 161100 to 161400. The width of the proposed cut is approximately 30m at chainage 161300. The total volume of material identified at this location is approximately 52,500m^3.

The proposed work involve the progressive removal of the existing material to suit the earthworks construction for the Coopernook Bypass, Cundletown and Moorland projects. Further moving of material within the site may then occur should preloading be required.

Total truck movements to complete the works would total approximately 37,860. It has been estimated that approximately 19,830 truck movements would be required for the fill needs of the Coopernook Bypass alone, and a further 18,030 truck movements

for the Taree to Coopernook section. The hourly truck movements from the site during the daytime hours would peak at around twenty five (25) per hour.

2.2 Site Activities

In general, the following site establishment and quarry activities would be conducted at the subject site;

- Site compound and access tracks would be established utilising existing bypassed sections of the Pacific Highway.

- The quarry site would be cleared, topsoil would be stripped and stockpiled.

- The majority of quarrying activities would be done by ripping using bulldozers, rock breakers, excavators and trucks. It is anticipated that the quarry would be worked from above the cutting utilising the former Pacific Highway for access.

- Drilling and pre-splitting may be required for any hard rock.

- Blasting may also be required for the very hard rock, however it is unlikely that a large proportion (if any) of the material would require blasting.

2.3 Site Access/Egress

While detailed access/egress arrangements would be developed as part of the contractors quarry plan, it is expected that trucks would access the site at the Fords Road intersection, load above the cutting and rejoin the northbound carriageway using the disused former highway pavement at northern end of Cut B.

The Fords Road Realignment Cut Batter would be worked following completion of quarrying of Cut B. Trucks would both enter and exit the site via the Fords Road intersection.

2.4 Site Development

2.4.1 Cut B

The likely method of operation is to commence quarrying from the western edge of the proposed additional cutting. A single workforce or two smaller workforces would be managed to enable the correct quantities of better or poorer quality material to be maintained.

Some work may be required on the shorter batters adjacent to the road to increase their stability.

To reduce potential noise impacts from the site activities, it has been recommended that the site works commence at the northern end of the cutting and progress in a southerly direction. Where practical the works should be conducted behind a working face.

2.4.2 Fords Road Realignment Cut Batter

The likely method of operation at Fords Road is also to commence quarrying from the western edge of the proposed cutting.

Similar to the above recommendation the site works should commence at the northern end and progress in a southerly direction behind a working face.

2.5 Nearby Land Uses

A land use survey has shown that the land surrounding the site would be described as generally undeveloped natural state with some isolated residential development that is exposed to the Pacific Highway. A residential development in the vicinity of the site includes a small number of dwellings located to the south and south-east. The nearest dwellings by several hundred metres are the Thrift and Henderson residences which are located on the southern side of a ridge line some three hundred (300) metres from the Fords Road Realignment site. The ridge provides a degree acoustic shielding from the

proposed site activities. The Kiwarrak State Forest is located to the west of the site (Appendix 1).

2.6 Traffic

Assuming a continuous working fleet of fifteen (15) semi trailers travelling between the site and the Pacific Highway at Coopernook, then it would be expected that during the daytime hours the proposal could generate up to twenty-five (25) loaded truck trips per hour. The existing highway carries some four hundred and fifty (450) daytime vehicle movements per hour with approximately 15% heavy vehicles.

2.7 Operating Hours

To minimise impacts from the proposal, excavating activities would generally be restricted to between 7.00am and 6.00pm, Monday to Friday, and 8.00am to 1.00pm on Saturday. With prior approval from the EPA and Council and notification to residents, activities outside these hours especially loading and truck haulage to the north, could be undertaken provided the site noise emissions did not give rise to an unreasonable nuisance or disturbance to the occupiers of any residential dwelling.

3.0 EXISTING AMBIENT NOISE LEVELS

For the purpose of the assessment, ambient background noise levels were measured at a location to represent the two (2) closest residential properties, three (300) hundred metres along Fords Road. The measurements were conducted during the period from Monday 1 June '98 to Saturday 13 June '98.

The location selected to acquire the ambient noise data was on the northern boundary of the residential property identified as 35 Fords Road. The location is indicated on Appendix 1.

The instrumentation selected for the measurements consisted of one (1) RTA Technology Environmental Noise Logger. The reference level of the instrument was checked prior to and after the measurements with a Bruel & Kjaer Sound Level Calibrator Type 4230, and remained within the range ±0.5dB(A).

The ambient noise levels were measured and assessed as percentile A-weighted sound levels. The parameters regarded as being the most important amongst these, are the "L_{A1}", or the A-weighted sound level exceeded for 1% of the sample period and referenced as the "maximum noise level", the "L_{A10}", or the level exceeded for 10% of the sample period (the "average maximum noise level"), the "L_{A90}", the level exceeded for 90% of the sample period and referenced as the "background or average minimum noise level", and the "L_{Aeq}", which is the A-weighted energy equivalent continuous (constant) sound level.

A graphic representation of the noise measurements is shown in Appendix 3.

3.1 Measurement Results

The site investigations and ambient noise measurements confirmed that the noise in the area is controlled by road traffic on the Pacific Highway, and other subtle noise sources

associated with a rural environment, such as birds, insects, wind in the trees and grass etc.

The noise measurement results confirmed that the daytime (7.00am-6.00pm) background (L_{A90}) noise levels ranged between 33-45dB(A) with an average minimum level of 40dB(A). During the night-time hours the average minimum background (L_{A90}) level was 32dB(A). During both the daytime and night-time hours the average maximum (L_{A10}) noise levels were generally 8-10dB(A) higher than the background (L_{A90}) levels.

4.0 NOISE ASSESSMENT CRITERIA

4.1 Site Noise

For assessment of noise emanating from new developments, the Environment Protection Authority (EPA) normally recommend that the source (L_{A10}) noise level from the proposal should not exceed the existing background (L_{A90}) by more than 5dB(A) when assessed at or on the nearest residential property, and that the level derived by this method should comply with the recommended outdoor background noise levels (EPA.ENCM,[Chapter 21]).

In regards to the subject site, the EPA,ENCM would describe the nearby areas as "Rural" and accordingly recommends a daytime background noise level for assessment purposes of 45-50dB(A), and night-time level of 35-40dB(A).

Having regard to both the measured background (L_{A90}) levels and the EPA planning goals, the following criteria is recommended for assessing the site noise emissions;

> *"Noise from the site activities should not result in a noise contribution during the daytime hours exceeding $L_{A10,\ 15\ min}$ 45dB(A) and a night-time level of $L_{A10,\ 15\ min}$ 37dB(A), when assessed at any residential property".*

4.2 Ground Vibration from Site Plant and Equipment

For the assessment of ground vibration impacts from the proposal the following goals have been considered;

4.2.1 EPA Human Comfort and Disturbance

The EPA's Noise Control Manual (Chapter 174) recommends criteria for assessing vibration in buildings from construction sites. The EPA have based their criteria on weighted curves developed in the British Standard BS6472, and recommend that the vibration levels measured on the floor of a residence should

not exceed the base Curve 60; where the levels are less than Curve 60 and exceed Curve 2 it is recommended that the construction activities be restricted to between 7.00am and 6.00pm Monday to Friday, 7.00am and 1.00pm Saturday.

4.2.2 British Standard Effects on Building Occupants

British Standard BS6472[1992] provides guidelines for assessing potential disturbance to persons exposed to continuous and intermittent vibration in buildings. The levels of vibration referenced in the Standard that may give rise to "adverse comment" are shown in Table 1. For comparison purposes continuous vibration is normally felt at about 0.15mm/sec and becomes "noticeable" at approximately 1mm/sec.

Table 1: Vibration Levels for Assessing Human Comfort
(Reference: British Standard BS6472)

Type of Space Occupancy	Time of Day	Vibration Levels mm/sec			
		Continuous Vibration		Intermittent Vibration and Impulsive Vibration Excitation with Several Occurrences per day	
		Vert.	*Hor.*	*Vert.*	*Hor.*
Residential	Day Night	0.3 to 0.66 0.2	0.8 to 1.6 0.6	8.4 to 12.6 2.8	24 to 36 8

4.2.3 Effects on Structures - DIN 4150

German Standard DIN 4150 - [Part 3:1986] provides guidelines for evaluating the affects of vibration on structures. The values recommended in the Standard (maximum levels measured in any direction at the building foundation) are summarised in Table 2.

Table 2: Structural Damage - Safe Limits for Building Vibration
(Reference: German Standard DIN4150)

Type of Structure	Vibration Velocity mm/sec		
	Frequency		
	Less than 10Hz	*10Hz to 50Hz*	*50Hz to 100Hz*
Buildings used for commercial purposes, industrial buildings and buildings of similar design	20	20 to 40	40 to 50
Dwellings and buildings of similar design and/or use	5	5 to 15	5 to 20

As the buildings in the vicinity of the proposed works would be classified as residential structures, a vibration level of 5mm/sec has been recommended for assessing the potential for structural damage from construction activities. It should be noted that this level is a "safe limit", up to which no damage due to vibration effects has been observed for the particular class of building. "Damage is defined by DIN 4150 to include minor non-structural superficial cracking in cement render, the enlargement of cracks already present, and the separation of partitions or intermediate walls from load bearing walls.

4.2.4 Effects on Building Contents

The threshold for visible movement of susceptible building contents (eg. plants, hanging pictures, etc) is approximately 0.5mm/sec, the audible rattling of loose objects (eg. crockery) generally does not occur until levels of about 0.9mm/sec.

4.3 Transport Noise / Truck Movements

It is generally acknowledged (Ref: RTA, Interim Traffic Noise Policy) that an appreciable change to road traffic noise is represented by an increase of 3dB(A) or greater. Therefore, the assessment of the likely change to traffic noise from the Pacific Highway resulting from the proposal has been considered in terms of there being no appreciable increase to the existing noise.

4.4 Blasting

Ground vibration and airblast impacts from blasting is assessed in terms of criteria referenced to human annoyance and structural damage. The criteria set to limit discomfort and disturbance to occupants of residences are more stringent than those required to limit structural damage to buildings, and therefore become the limiting criteria.

4.4.1 Human Comfort and Disturbance

The EPA's Noise Control Manual (Chapter 154) criteria for blasting in NSW is based on human comfort and is summarised in Table 3.

Table 3: Limiting Criteria for the Control of Blasting Impact at Residences

Time of blasting	Airblast (dB(linear))	Ground Vibration (PVS) (mm/sec)
Monday - Saturday 9.00am - 3.00pm	115	5
Monday - Saturday 6.00am-9.00am and 3.00pm-8.00pm	105	2
Sunday, Public Holiday, 6.00am-8.00pm Any day, 8.00pm-6.00am	95	1

In the application of the EPA criteria, it is generally recognised that ground vibration may exceed 5mm/sec on infrequent occasions. This should be limited to no more than 5% of the total number of blasts and should not exceed 10mm/sec at any time.

4.4.2 Structural Damage from Ground Vibration

The structural damage criteria recommended in the Australian Standard Explosives Code, AS2187.2-1993, is dependent on the building type and are defined in terms of peak vector sum (PVS) or peak particle velocity (PPV). Table 4 presents a summary of the criteria recommended in AS2187.

Table 4: Recommended Peak Vector Sum Ground Vibration
(Reference: AS2187.2)

Type of Building or Structure	Peak Particle Velocity mm/sec
Houses and low-rise residential buildings; commercial buildings not included below	10
Commercial and industrial buildings or structures of reinforced concrete or steel construction	25

5.0 SITE PLANT AND ACTIVITIES

5.1 Mobile Plant

For the evaluation of noise emissions from the site, the assessment has considered the level varying noise from the envisaged fleet of mobile plant. The envisaged mobile plant that has been identified as of acoustic significance, consists of two (2) dozers, four (4) excavators, two (2) hydraulic rock breakers and trucks.

To assess the range of noise levels for the site activities, the sound power levels summarised in Table 5 have been established from data presented in Australian Standard AS2436-1981 and previous studies conducted by Atkins Acoustics have been adopted..

Table 5: Construction Plant and Equipment Sound Power Levels
L_{A10} re: 10^{-12} Watts

Plant Description	Plant Type	Sound Power Level
Dozer	Caterpillar D7, D9	113
Excavator	Kato 750	107
Rock breaker (hydraulic)		115
Truck		106
Hydraulic Drill Rig		120

5.2 Ground Vibration from Construction Activities

As part of the site activities it will be necessary to use plant and equipment that will generate ground vibration. To evaluate the possible effects of ground vibration from the site activities, the following vibration levels established from similar assessments have been adopted.

Table 6: Construction Plant Vibration Levels

Plant Description	Vibration Levels mm/sec	
	5 metres	20 metres
Rock-breaker (large)	4	0.4
Dozer	2	0.2

5.3 Controlled Blasting

During the quarrying activities blasting may be required for very hard rock outcrops. A provisional blast design that has been considered in this assessment for these areas, consisted of 50mm diameter blastholes, a 3m x 3m drill pattern, one blasthole per delay, and a charge mass per delay of 10kg.

6.0 ASSESSMENT

6.1 Site Noise Emissions

Noise emissions from the site have been computed taking into account attenuation factors such as distance, ground coverage, atmospheric absorption, topographical features and the cumulative effects of multiple noise sources.

Considering the envisaged construction scenarios, the range of site noise emissions has been calculated to the closest referenced residential properties on Fords Road (three hundred (300) metres from the nearest work site). It is noted that the predicted noise levels represent the range of noise levels that could be experienced during the proposed works, that is when the activities are in closest proximity to the subject property on the top of batter, and at the furthest distance and at the bottom of the batter. Table 7 presents a summary of the range of noise levels predicted from the site activities.

Table 7: Predicted Noise Levels from Site Activities
L_{A10} re: 20×10^{-6} Pa

Location of Activities	Sound Pressure Level dB(A) re 20×10^{-6} Pa			
	Fords Road Realignment Batter		Cut B	
	Top of Batter	Bottom of Batter	Top of Batter	Bottom of Batter
Excavation South	58	48	51	45
Excavation North	51	46	38	28
Rock Breakers - South	57	47	50	44
Rock Breakers - North	50	45	37	27
Drilling - South	59	49	52	46
Drilling - North	52	47	39	29
Loading Trucks - South	-	37	-	34
Loading Trucks - North	-	35	-	17

6.1.1 Assessment of Site Noise Activities

The assessment has shown that noise emissions from the site activities on the southern end of the Fords Road Realignment Batter and on the top of the batter B, could exceed the recommended assessment goal of 45dB(A). It is understood that the Thrift and Henderson residences were exposed to similar noise levels during the construction of the Taree Bypass, and that no negative comments were received by the RTA.

From our experience, we confirm that as a result of the type of plant and equipment required for the proposed works, other than plant selection, there is little opportunity to reduce the noise levels. To minimise potential noise impacts during these exposed activities, it is recommended that the plant and equipment be selected and operated with appropriate mufflers and noise controls, and where practical work practices be considered so as to minimise potential noise.

6.2 Predicted Ground Vibration from Site Plant

Plant and equipment used during the site excavations will give rise to ground vibration. Table 9, presents a summary of the predicted vibration levels that could be generated by that plant.

Table 8: Typical Plant Vibration Levels
velocity (mm/sec)

Plant Description	Vibration Levels mm/sec	
	20 metres	40 metres
Rock-breaker (heavy)	0.4	0.15
Dozer	0.2	0.02

6.2.1 Assessment of Ground Vibration from Site Activities

The main source of ground vibration from the construction plant will be associated with rock breakers. Typical ground vibration levels from breakers

range up to 0.4mm/sec at a distance of twenty (20) metres, at distances greater than forty (40) metres the levels will generally be below 0.2mm/sec.

As a result of the distance between the site activities and the residential buildings, the assessment has shown that the mobile plant will not give rise to vibration levels that are perceived at the Fords Road residential buildings.

6.3 Additional Road Traffic Movements Generated

It is understood that the proposal at full capacity could generate fifty (50) hourly truck movements on the Pacific Highway.

Considering the existing daytime hourly traffic flow of 450 vehicles on the Taree Bypass with 15% heavy vehicles and the worst case scenario for truck movements involving fifty (50), our calculations would indicate that an increase in traffic noise from the Pacific Highway would be in the order of $L_{A10,1hr}$ 1dB(A).

Acknowledging that an appreciable noise increase is greater than 3dB(A), the assessment has shown that traffic noise along the Pacific Highway resulting from the proposal would be considered as insignificant.

6.4 Controlled Blasting

The relationship between the peak vector sum (PVS) ground vibration and peak airblast from blasting are presented below;

Peak Vector Sum (PVS) = 1143 $(R/Q^{0.5})^{-1.6}$

Airblast(dB) = 165 - 24($\log_{10}$ R - 0.33$\log_{10}$ Q)

where,	PVS	= Peak Vector Sum (mm/sec)
	Airblast dB	= Airblast level (dB Lin)
	R	= Distance from blast centre (m)
	Q	= Charge Mass per Delay (kg)

Considering the provisional blast design, the levels of ground vibration and airblast have been predicted for a charge mass per delay of 10kg. Table 10 presents a summary of the vibration and airblast predictions.

Table 9: Predicted Vibration and Airblast Emission

Distance from Blasting (approx)	PVS Ground Vibration (mm/s)	Peak Airblast (dBLinear)
50m	14	132
100m	4.5	125
150m	2.4	120
200m	1.5	117
250m	1.0	115
500m	0.3	108

6.4.1 Assessment of Vibration and Airblast

Based on the predicted ground vibration and airblast results for a charge mass per delay of 10kg, the predicted airblast level at two hundred and fifty (250) metres is less than the EPA comfort criteria of 5mm/sec and 115dB (linear), and is less than the US Bureau of Mines airblast criterion for building damage of 132dB (linear).

To ensure the ground vibration and airblast levels are within acceptable limits and comply with the limits set by the EPA, it is recommended that if blasting is required the initial blasts be monitored for vibration and airblast, and where required blast patterns be modified and charge weights per delay reduced.

6.5 Recommendations

Although the noise levels are expected to marginally exceed the EPA assessment goals when the activities are located on the tops of the batters, the impacts are expected to be minor to minimise the degree of noise generated from the site, it is recommended that as part of the contractors undertaking that an "Construction Noise Management Plan" (CNMP), be prepared to address the issue of construction noise. The CNMP

should include but not be necessarily limited to the following measures.

- the selection and operation of plant and equipment where practicable on acoustical performance,
- the use of plant and equipment to minimise potential noise impacts,
- the implementation of a noise monitoring program to ensure that 'best practice' is being implemented, and
- the initiation of a program to inform the nearby residents of any changes to the envisaged site works or time when impacts may be experienced.

7.0 CONCLUSION

This report presents the results, findings and recommendations of a noise and vibration assessment of the works required to stabilise batters and extract material from a section of the batters adjacent to the Taree Bypass (Appendix 1).

The assessment has been based on an inspection of the site and nearby areas, the measurement of the existing ambient noise, and the prediction and assessment of the level of noise and vibration that could be potentially emitted by the proposal.

The investigations have confirmed that the existing background (L_{A90}) noise in the area is controlled by road traffic on the Pacific Highway and sources associated with a rural area; viz, wind in trees, birds, insects, animals, etc.

The assessment has shown that during periods when earthworks activities are located on the top of the batters, noise emissions from some activities may be audible and exceed the recommended assessment goals. However, any potential noise impacts from these activities will be generally less than the noise levels presently experienced from road traffic on the Pacific Highway.

In regard to additional road traffic noise, the assessment has shown that the vehicle movements generated by the proposal when operating at full capacity will not result in an appreciable increase in traffic noise on the Pacific Highway.

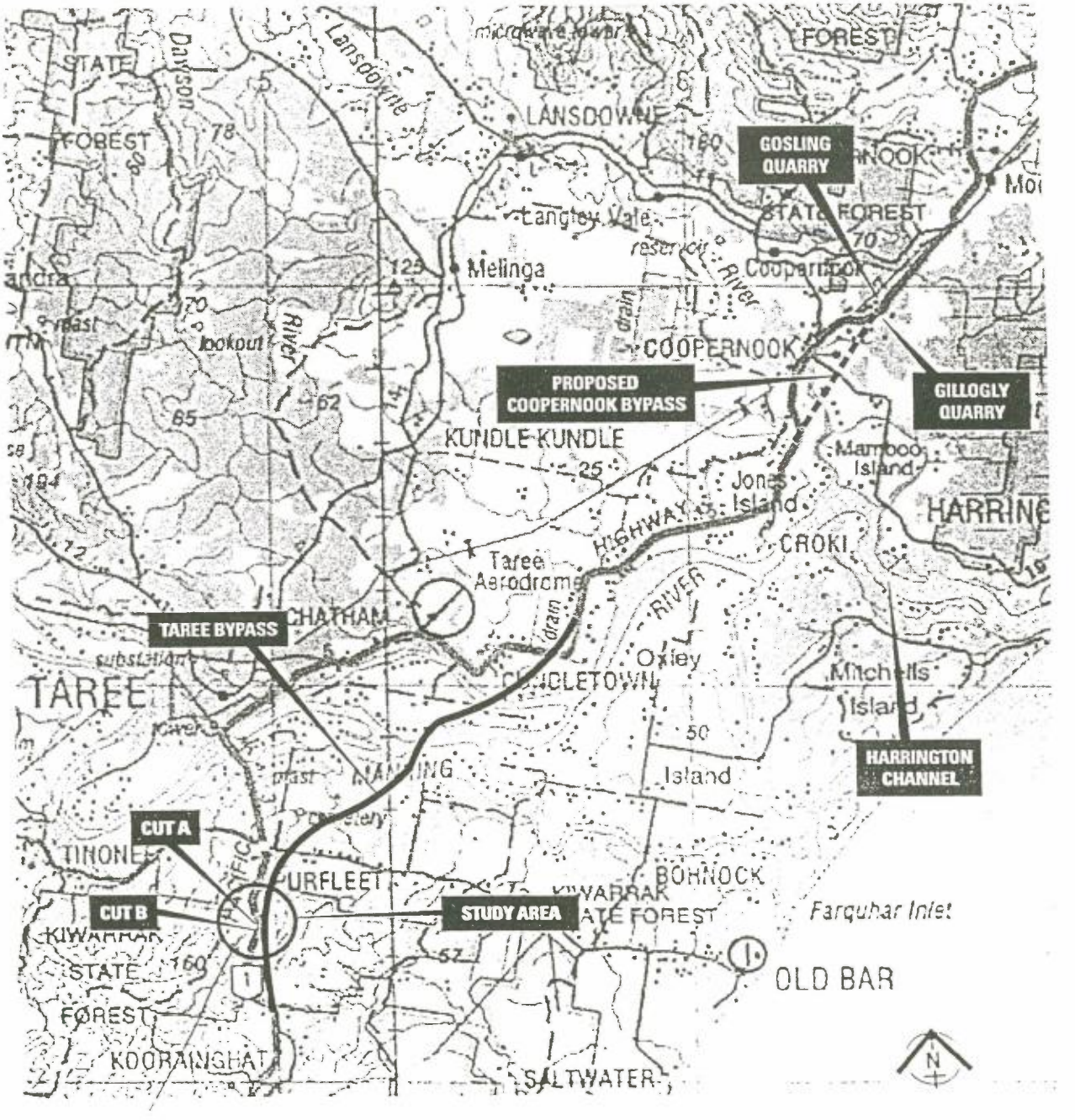
Resulting from the distance separation between the site activities and the Fords Road residential properties, the assessment has shown that the site mobile plant will not give rise to vibration levels that are perceived at the residential buildings.

It is not envisaged that blasting will be employed by the Contractor to remove material

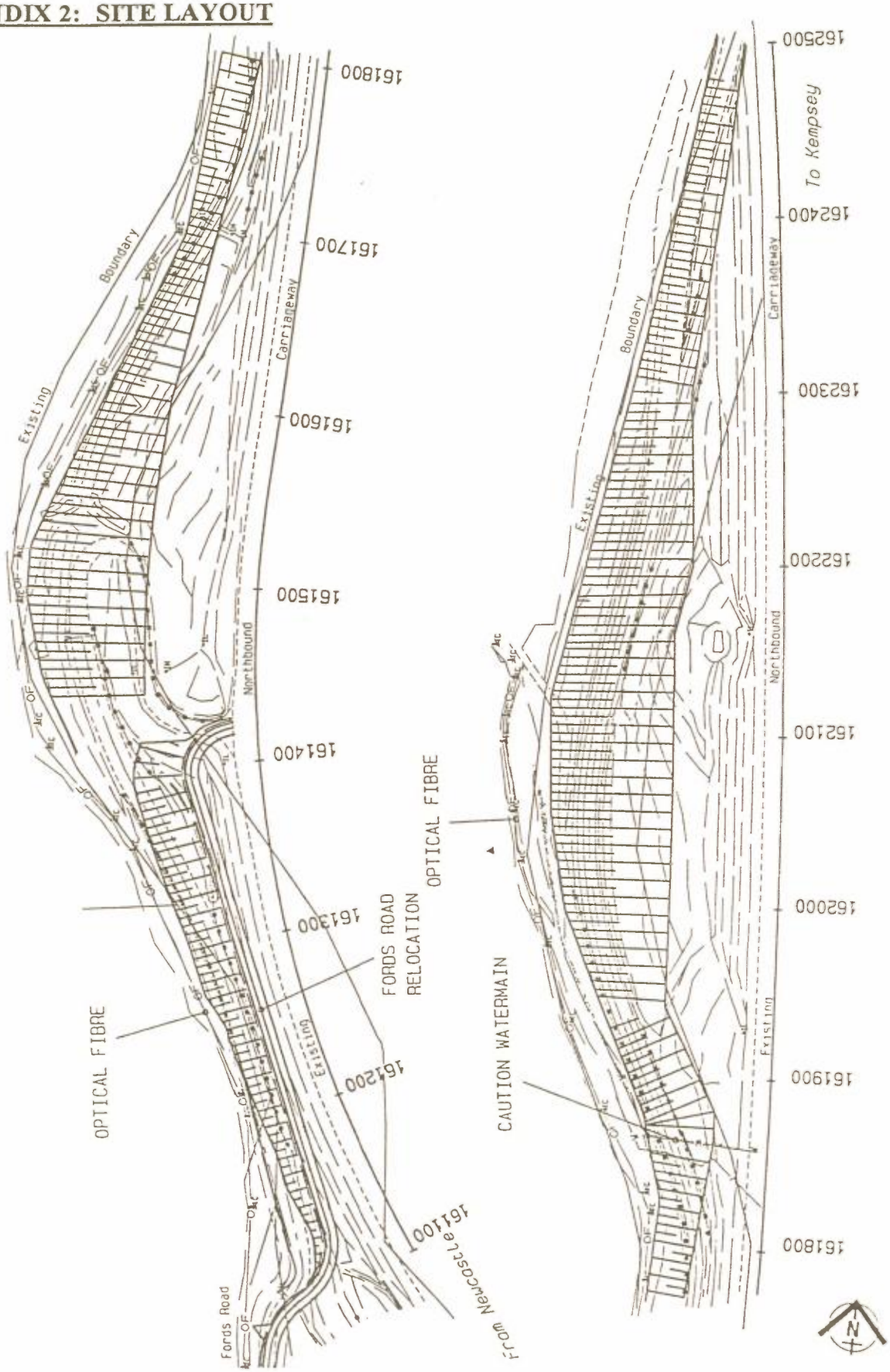
from the site, however, if during the works it is established that blasting is required, the assessment has shown that with a charge mass per delay of 10kg, the predicted ground vibration and airblast levels at a distance of three hundred (300) metres (closest residential dwelling) are less than the EPA comfort criteria of 5mm/sec and 115dB (linear).

As part of the proposal to minimise noise and vibration impacts, it has been recommended that the Contractor responsible for the execution of the works prepare a Construction Noise Management Plan to ensure that best practice acoustic principles are employed and maintained during the project.

APPENDIX 1: SITE LOCATION

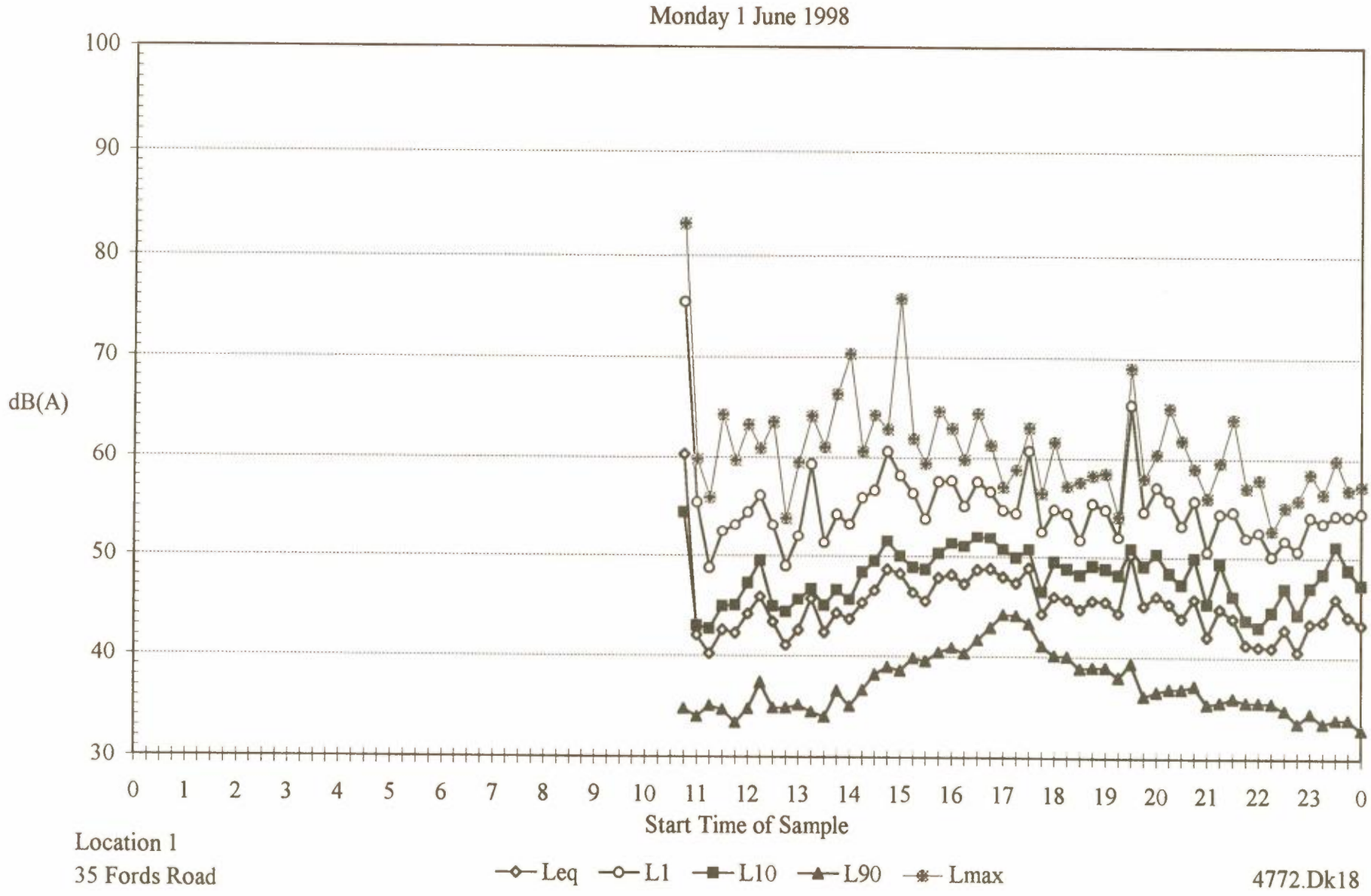


APPENDIX 2: SITE LAYOUT



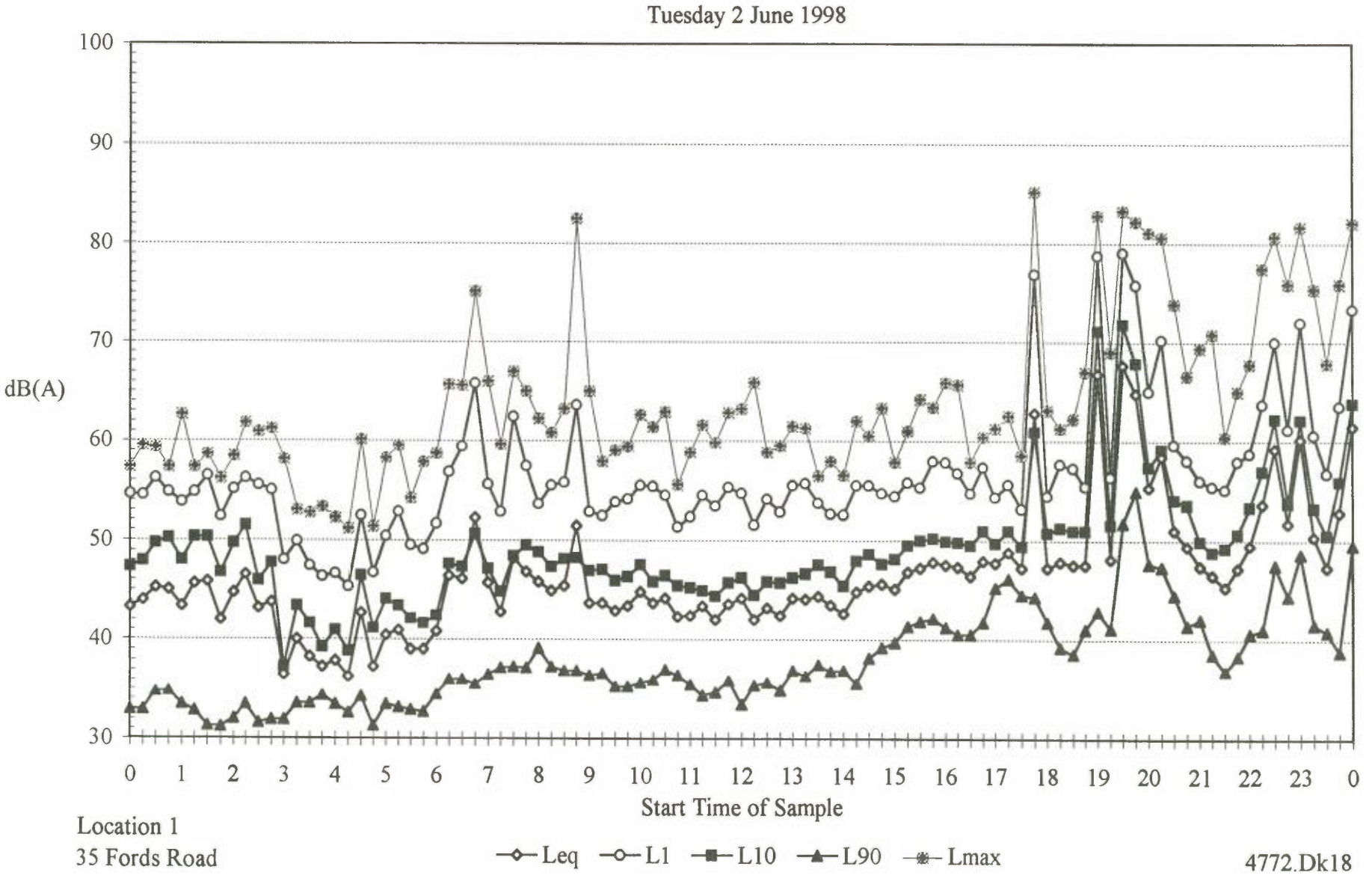
APPENDIX 3: AMBIENT SOUND PRESSURE LEVELS

Ambient Sound Pressure Levels



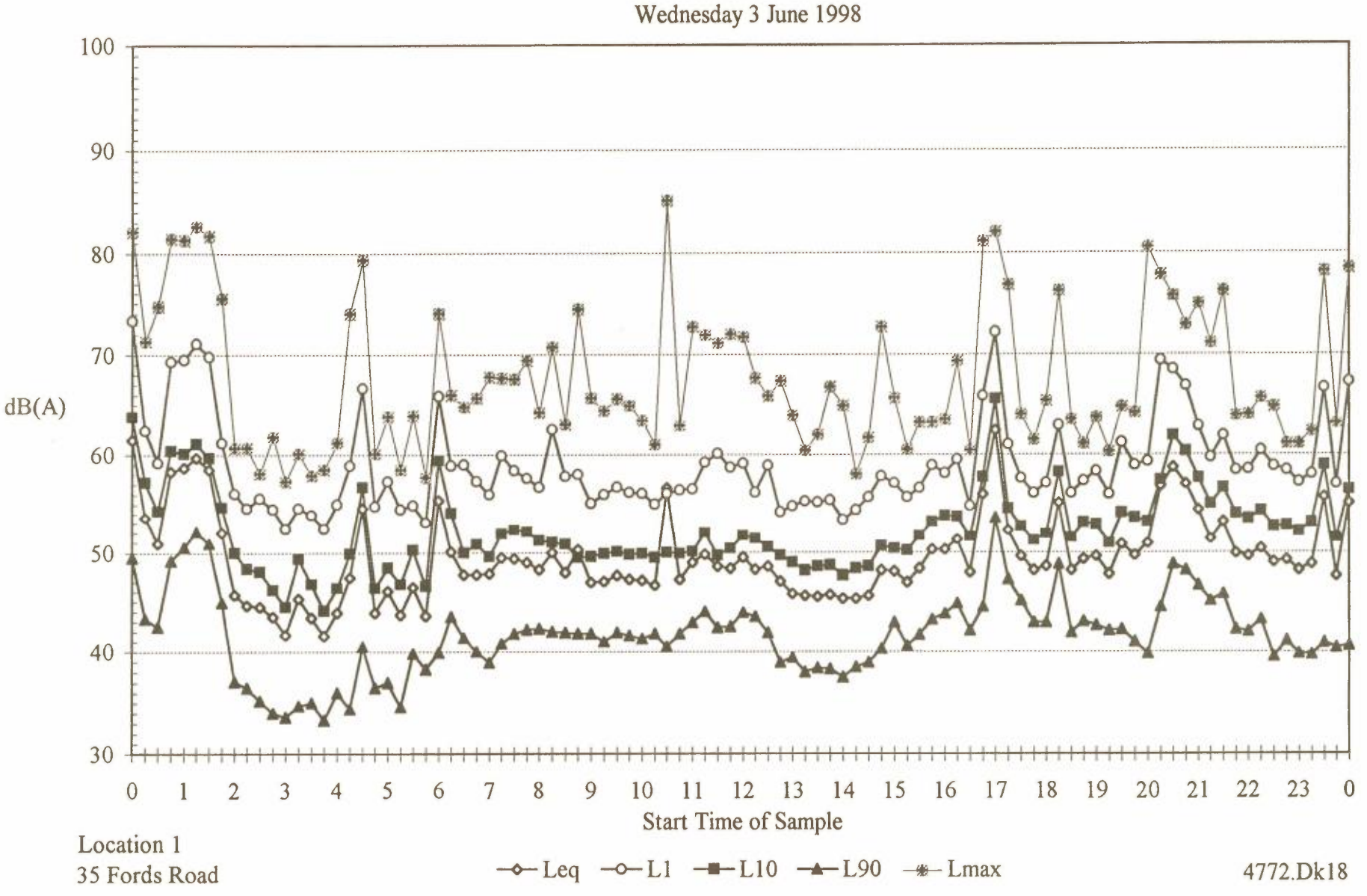
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Ambient Sound Pressue Levels



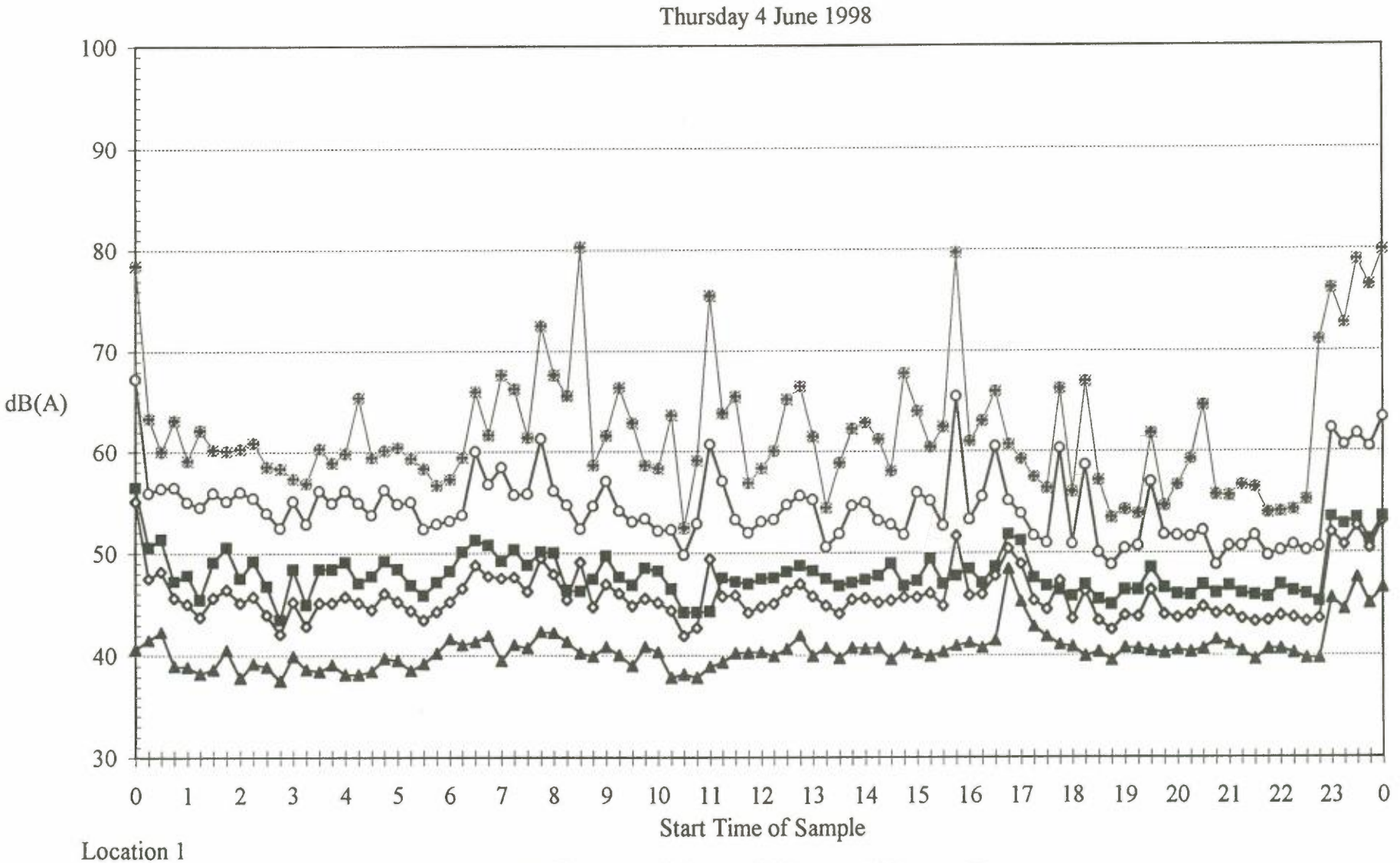
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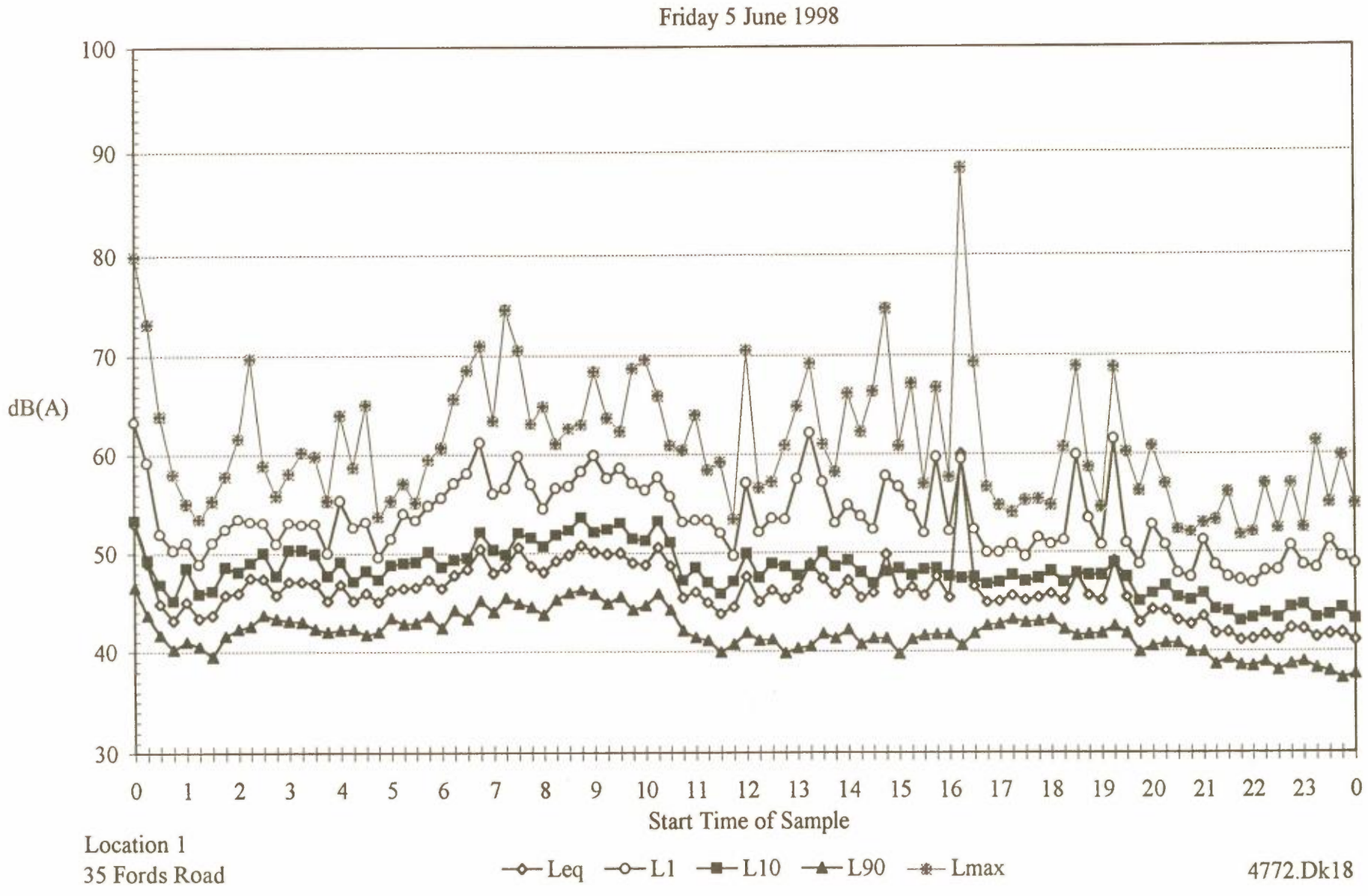
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Ambient Sound Pressure Levels



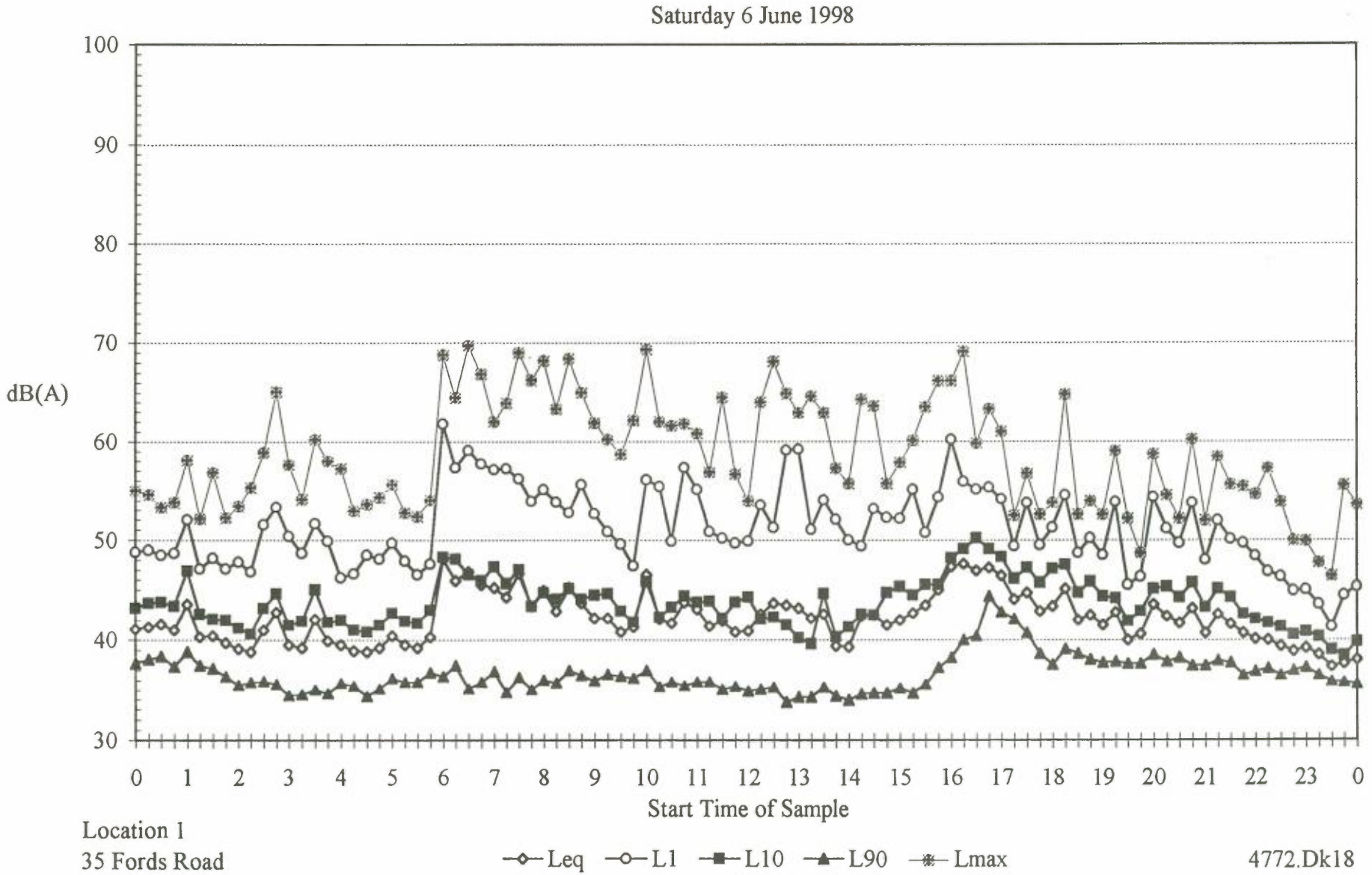
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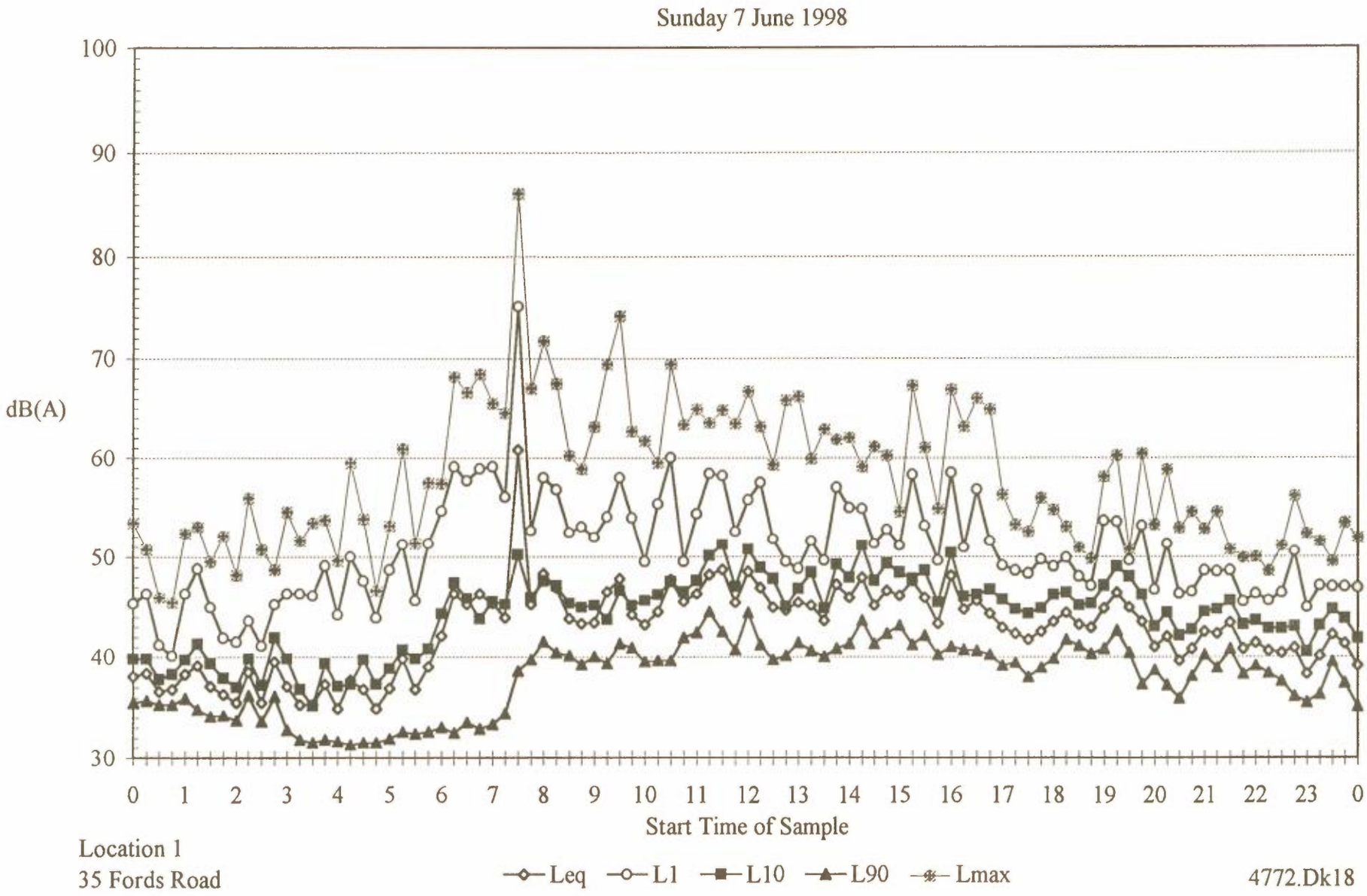
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Ambient Sound Pressure Levels



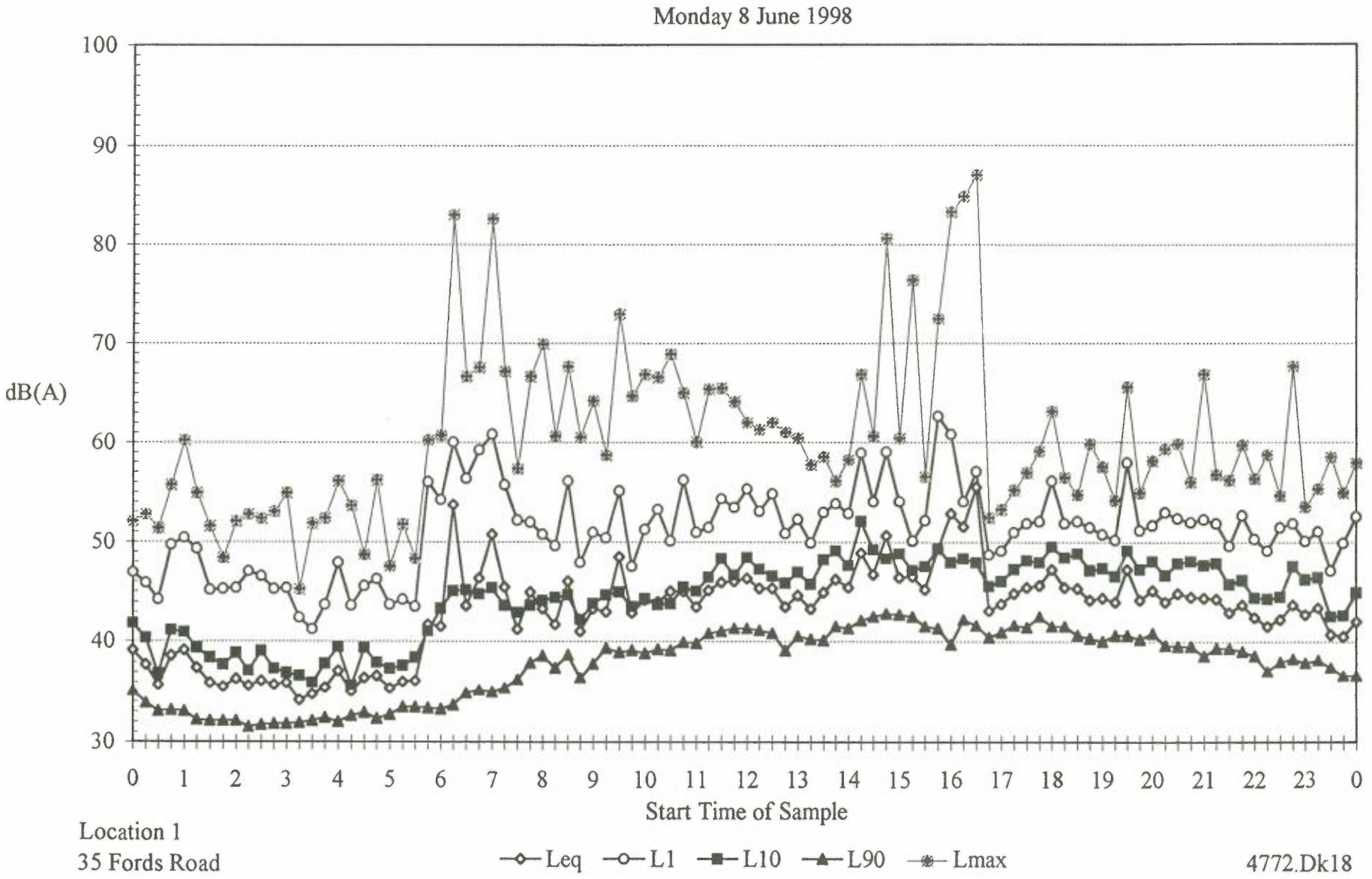
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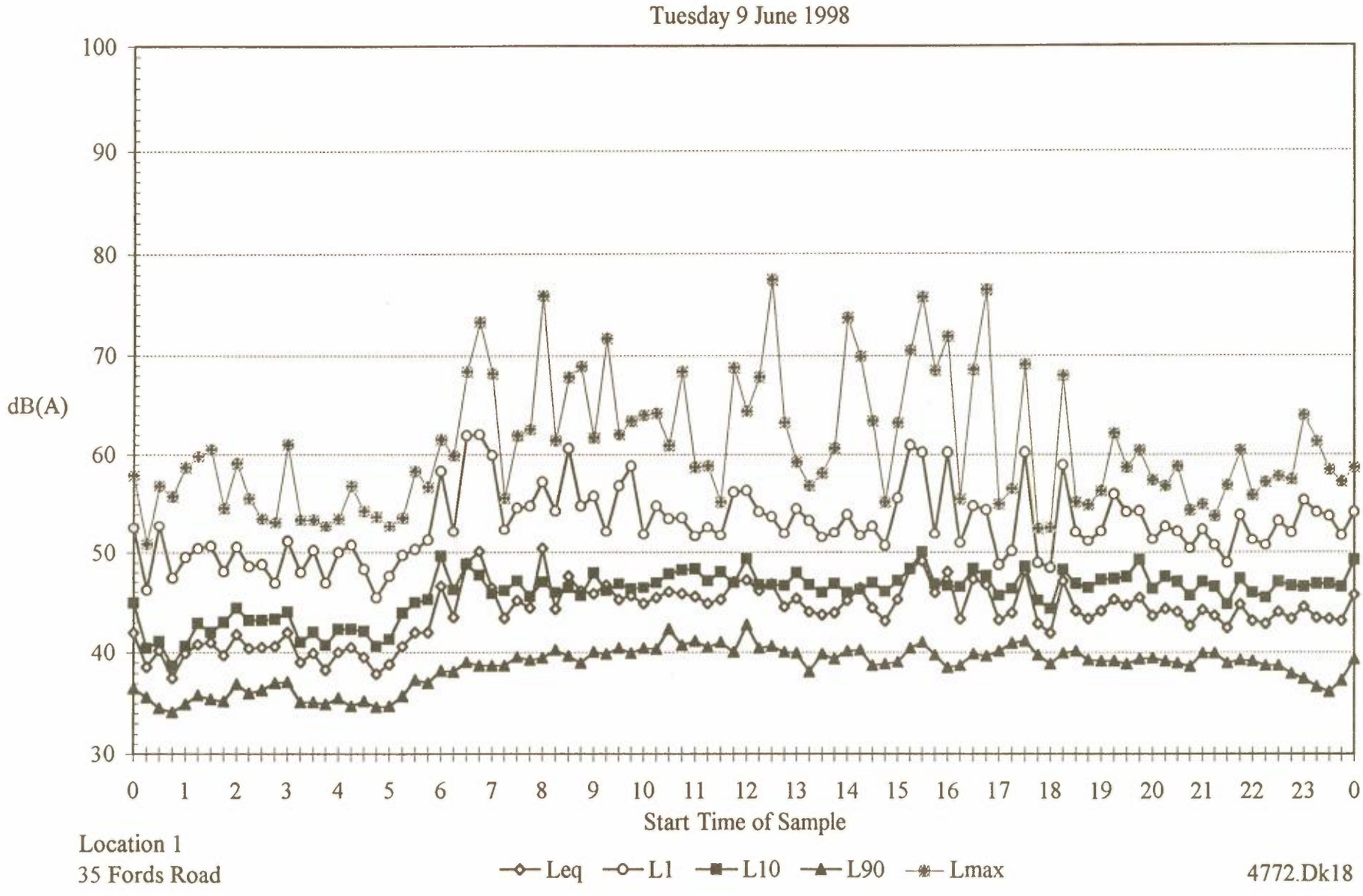
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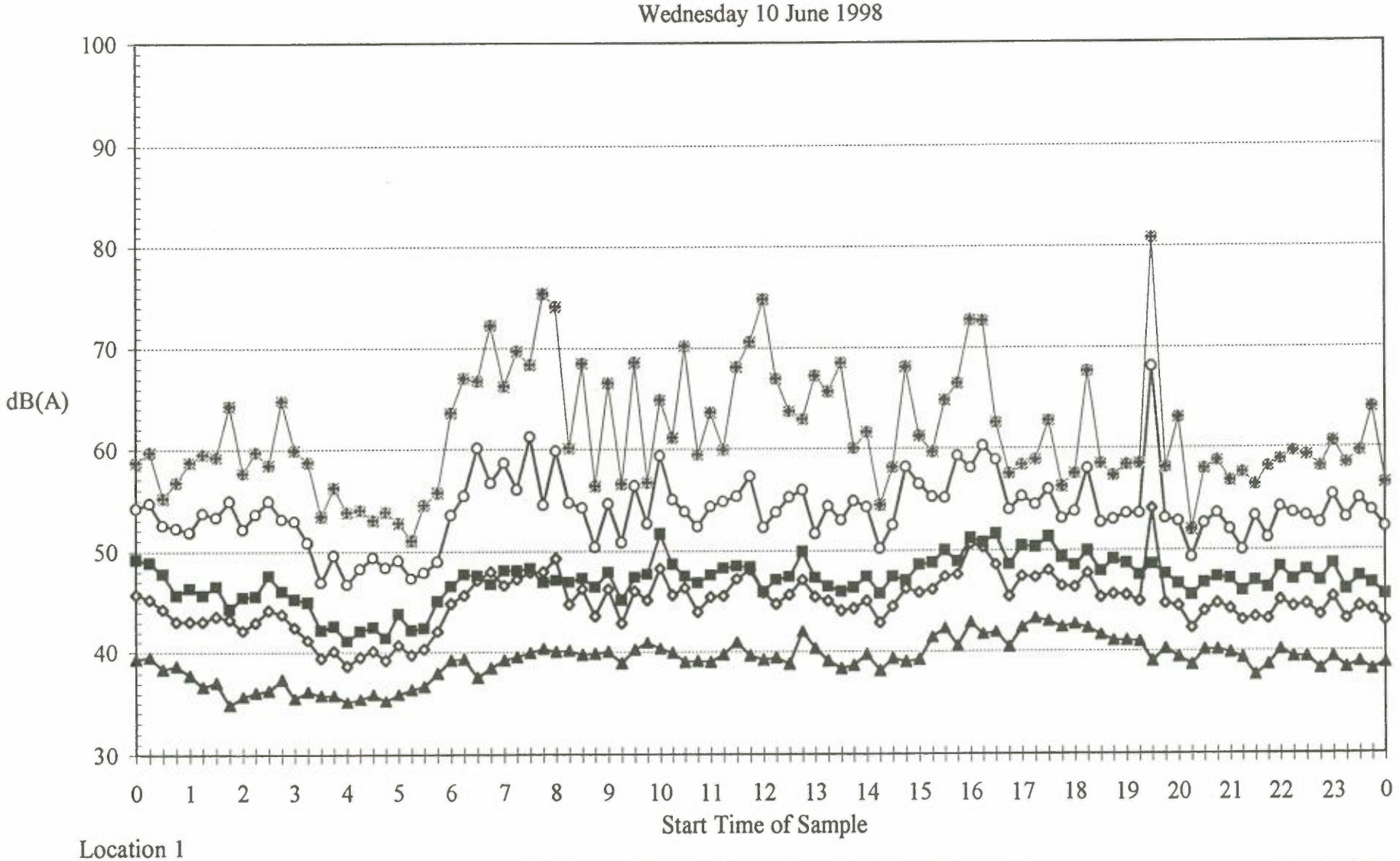
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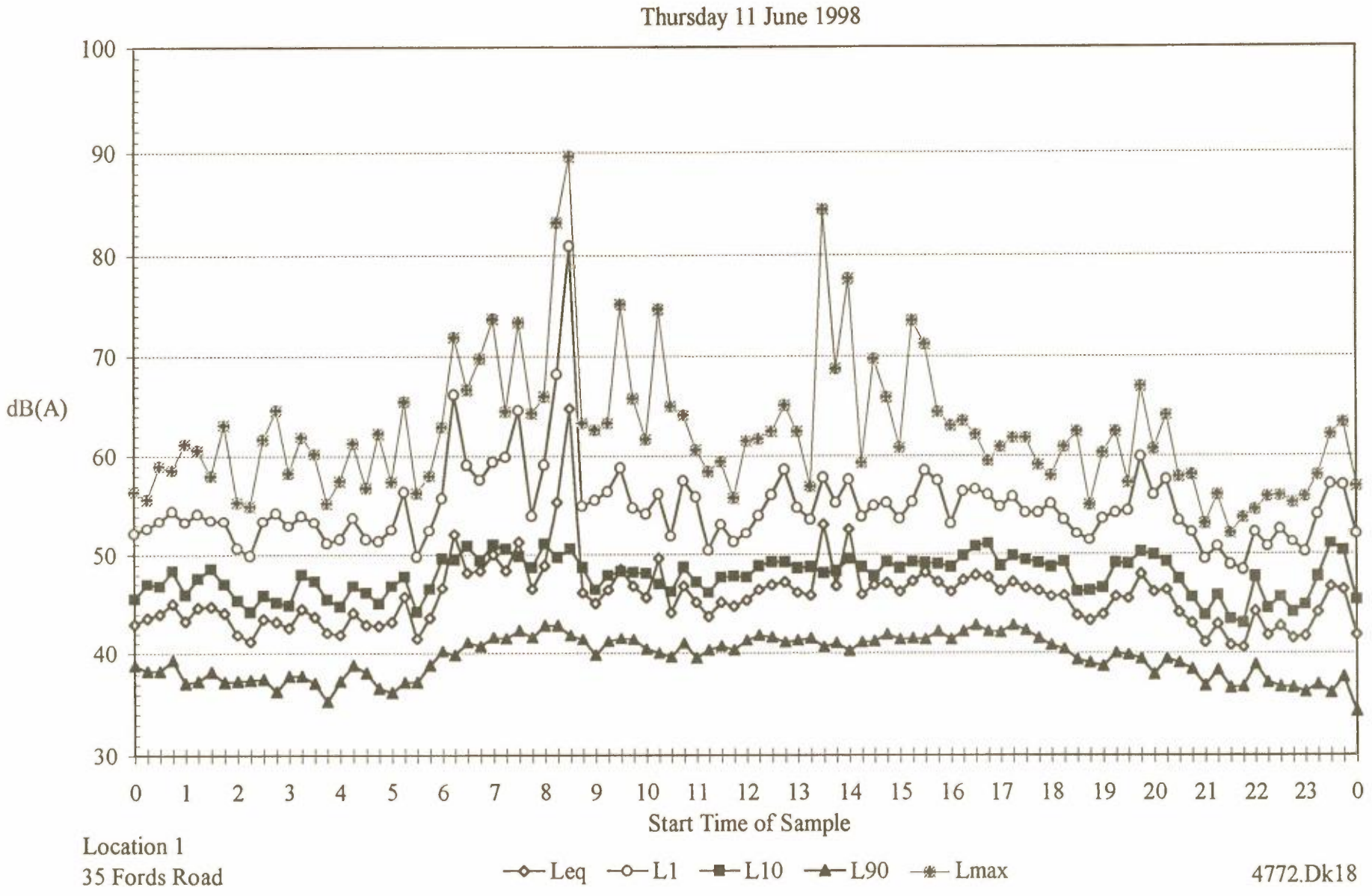
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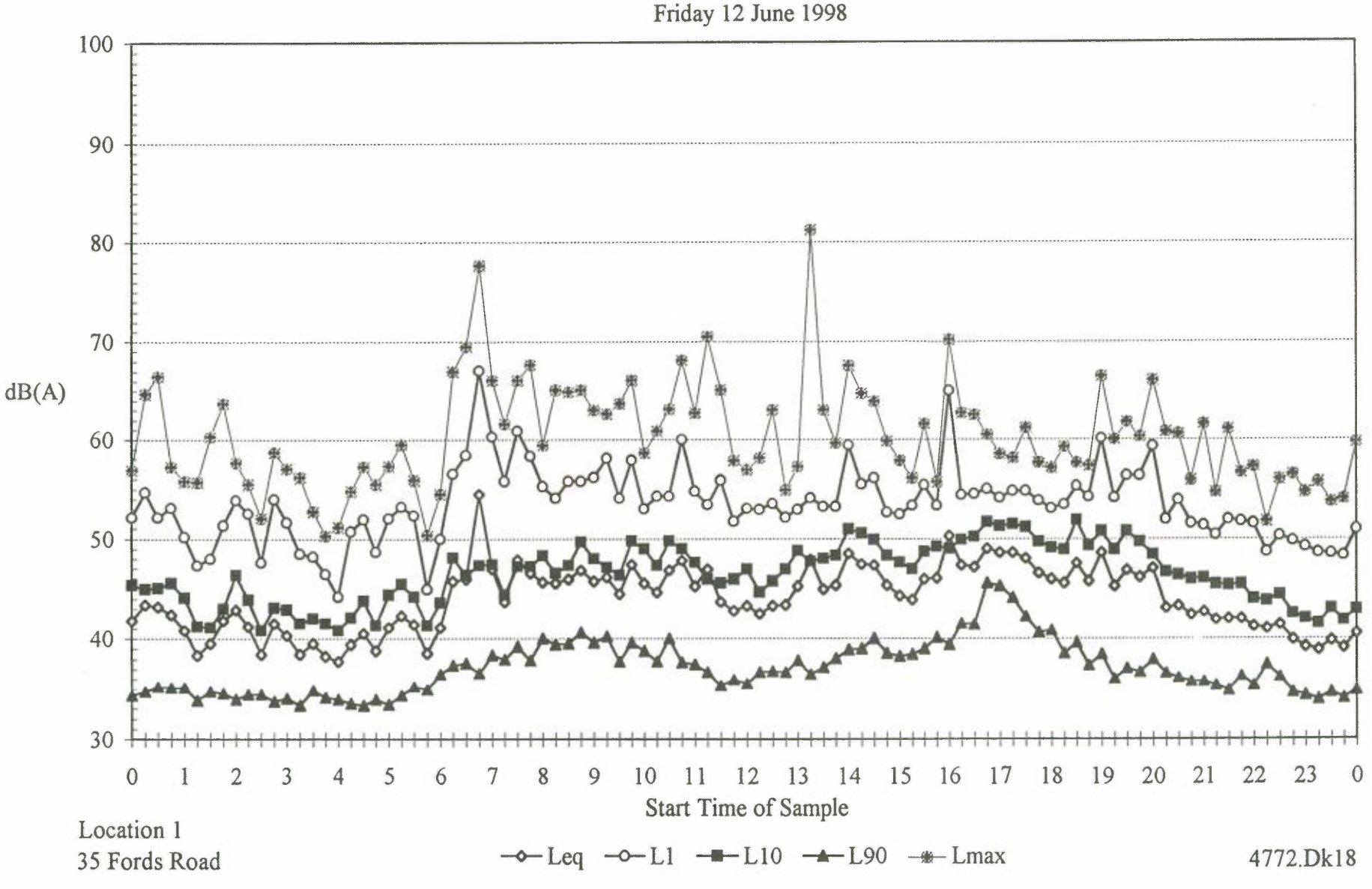
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Ambient Sound Pressue Levels



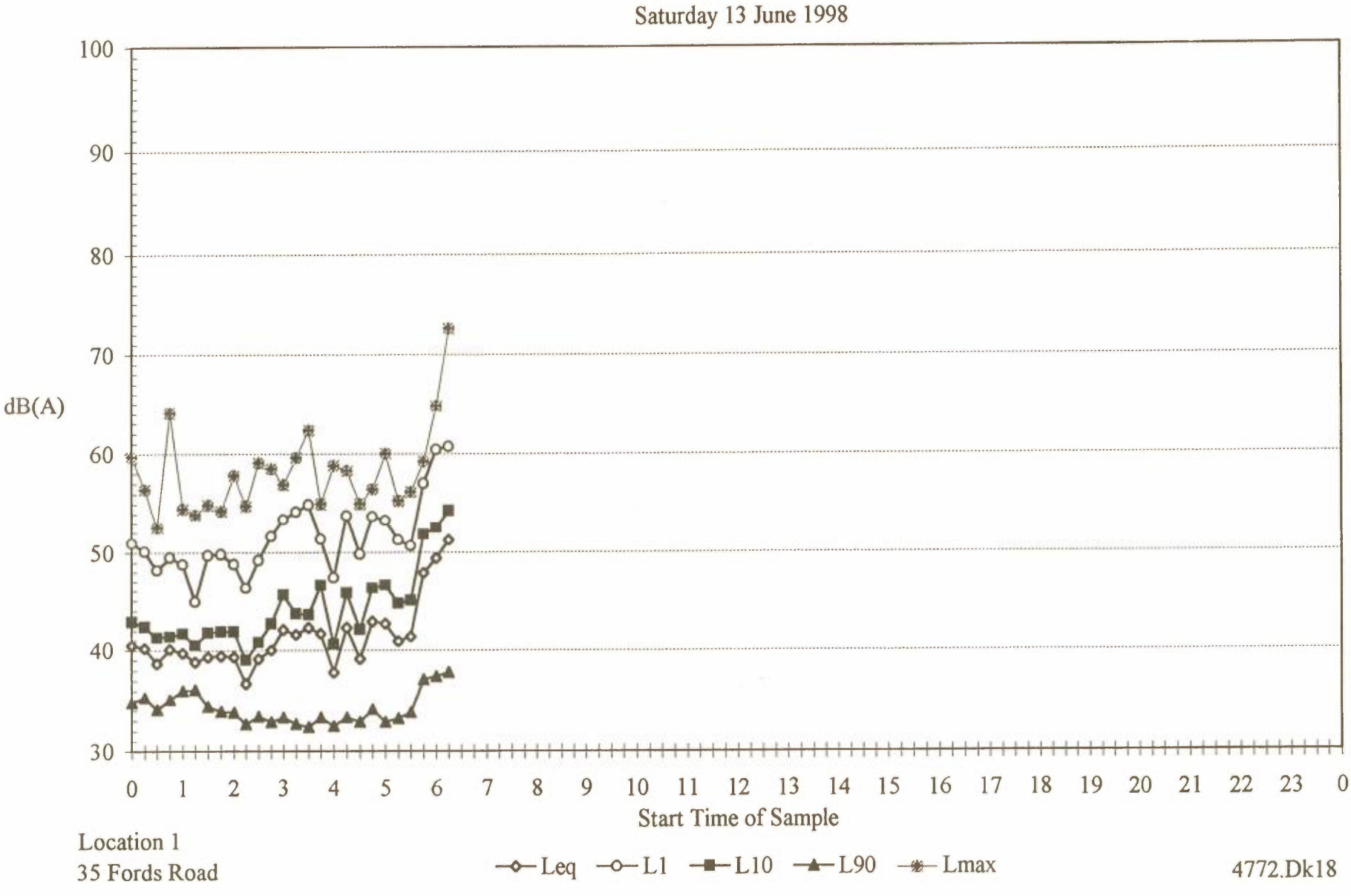
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Ambient Sound Pressure Levels



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Ambient Sound Pressure Levels



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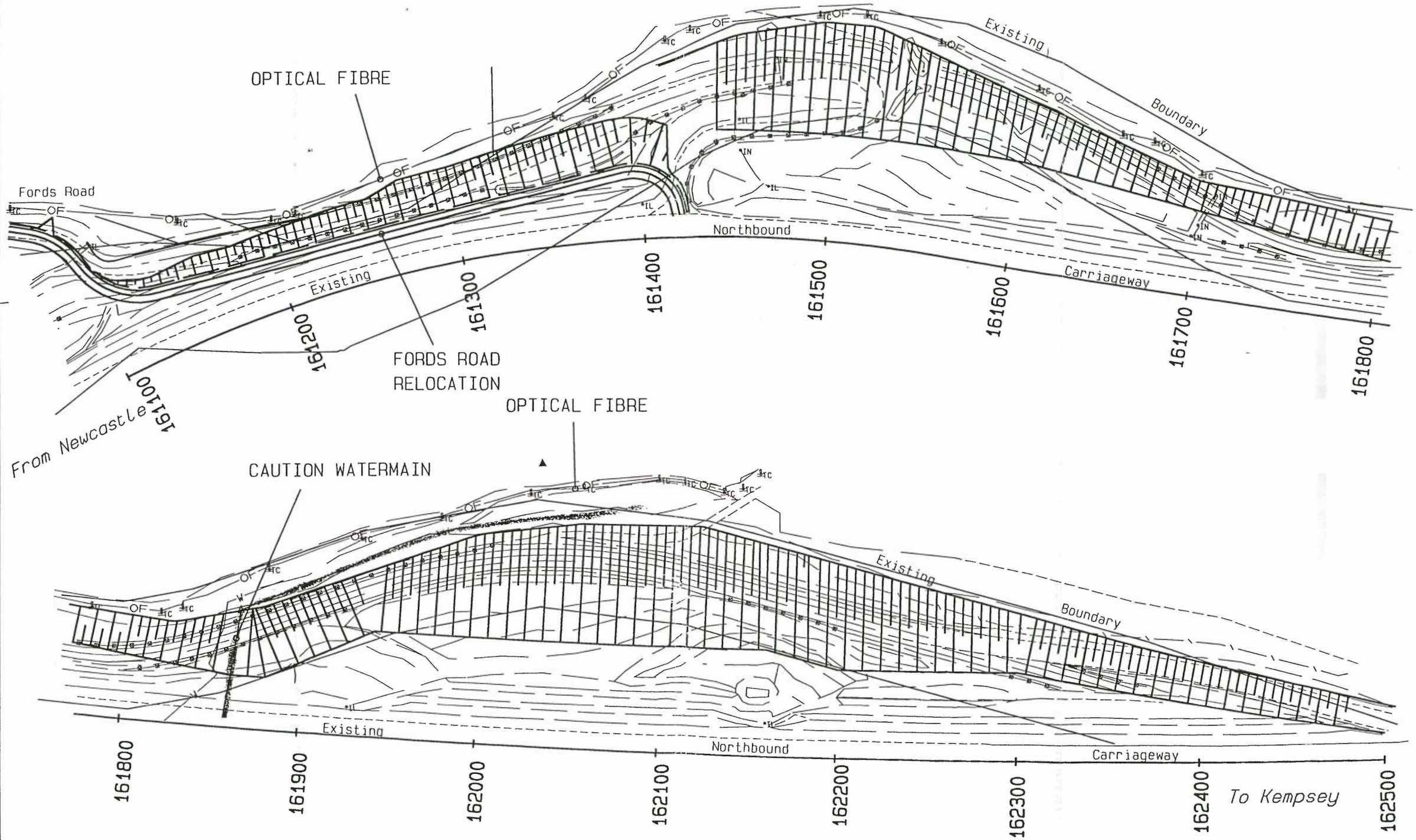
APPENDIX G
QUARRY CONCEPT DESIGN PLANS AND COST ESTIMATE

APPENDIX CONCEPT DESIGN COST ESTIMATE

PROJECT NAME: TAREE BYPASS CUT BATTERS QUARRY
DATE: 18/8/98

ITEM	DESCRIPTION	QUANTITY	UNIT	RATE	AMOUNT ($)
1.	INVESTIGATION / DESIGN				
	(2% of total construction costs)				
	With Haulage		Lump Sum		162,390
	Without Haulage				66,390
2.	PROPERTY ACQUISITION				
	Direct Land Take	2	Ha	10,000	20,000
	Other Effects		Lump Sum		50,000
3.	UTILITIES		Lump Sum		20,000
4.	CONSTRUCTION WORKS				
	a) PRELIMINARIES				
	Construction Compound		Lump Sum		5,000
	Quality Systems		Lump Sum		5,000
	b) SITE PREPARATION				
	Clearing and Grubbing	5	Ha	2,000	10,000
	Removal and Stockpile of Topsoil	3,000	cu m	4	12,000
	c) DRAINAGE				
	Erosion and Sedimentation Control		Lump Sum		30,000
	d) EARTHWORKS				
	Cut	600,000	cu m	5	3,000,000
	Haulage **	600,000	cu m	8	4,800,000
	e) PAVEMENT				
	Hot Bitumous Concrete (Fords Road)	2,400	sq m	25	60,000
	Extended Turning Bay Slip Lane	150	sq m	50	7,500
	f) MISCELLANEOUS WORKS				
	Fencing	2,500	m	20	50,000
	Landscaping		Lump Sum		50,000
			Total Construction Costs (with Haulage)		8,119,500
			Total Construction Costs (without Haulage)		3,319,500
			SUB TOTAL (with Haulage)		8,281,890
			SUB TOTAL (without Haulage)		3,385,890
5.	ENGINEERING SERVICES (7%)				
	With Haulage				579,732
	Without Haulage				237,012

6.	ALLOWANCES (18%)	
	With Haulage	1,490,740
	Without Haulage	609,460
	TOTAL CONCEPT ESTIMATE:	
	With Haulage	10,352,363
	Without Haulage	4,232,363



No.	Description	Init.	Date
	AMENDMENT BLOCK		

SCALES

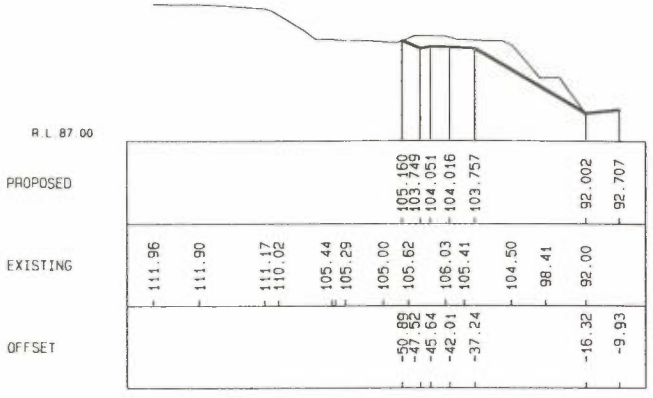
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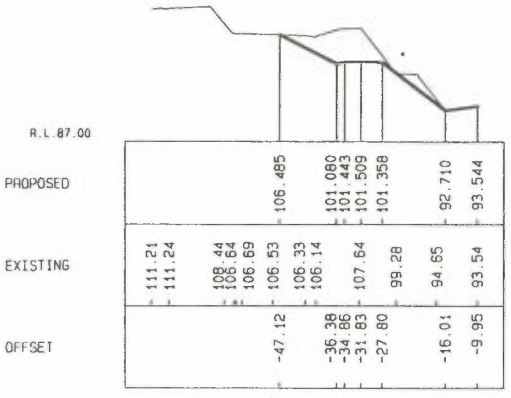
ROADS AND TRAFFIC AUTHORITY NSW

SH10 CITY OF GREATER TAREE
TAREE TO COOPERNOOK
4 MILE HILL BORROW AREA
161KM000 TO 162KM500

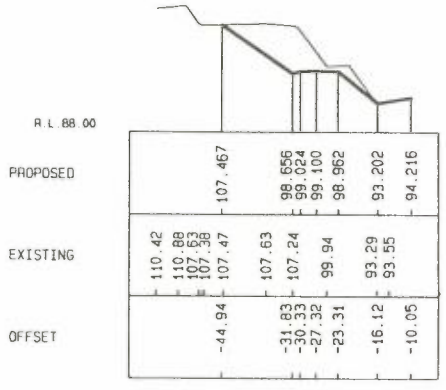
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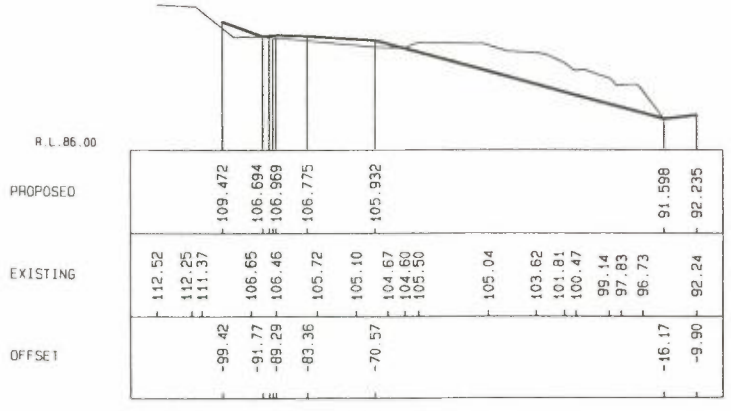
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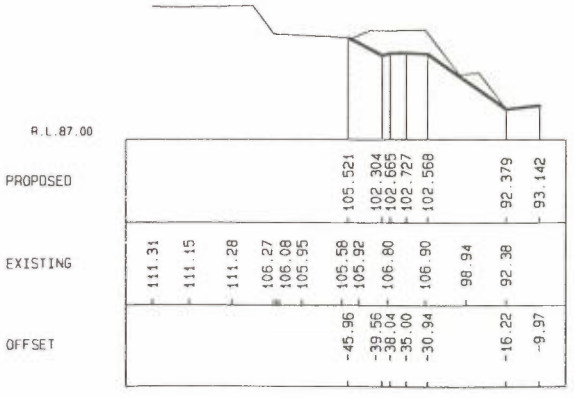
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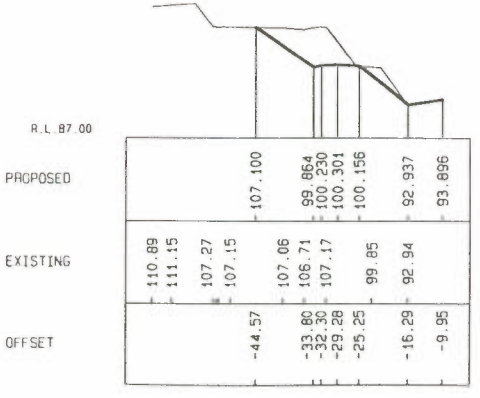
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	AMENDMENT BLOCK		

SCALES

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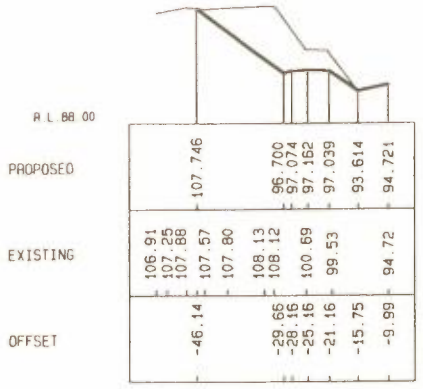
ROADS AND TRAFFIC AUTHORITY NSW

SH10 CITY OF GREATER TAREE
TAREE TRAFFIC RELIEF ROUTE
CROSS SECTIONS FOROS ROAD RELOCATION
161km100 to 161km400

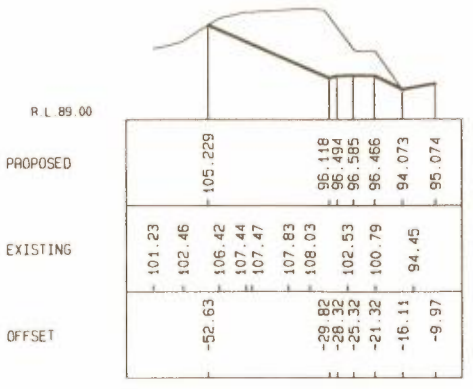
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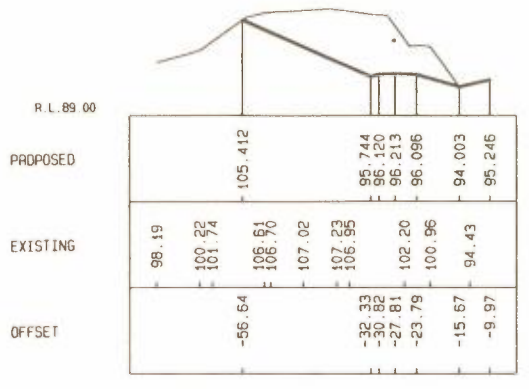
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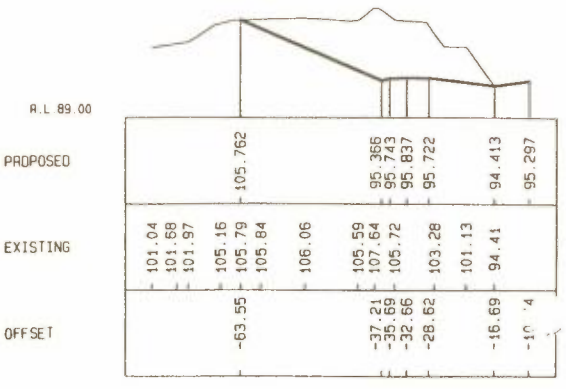
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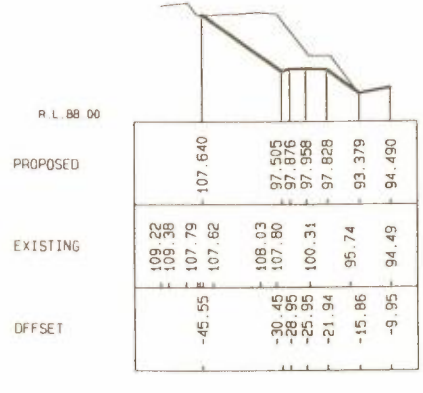
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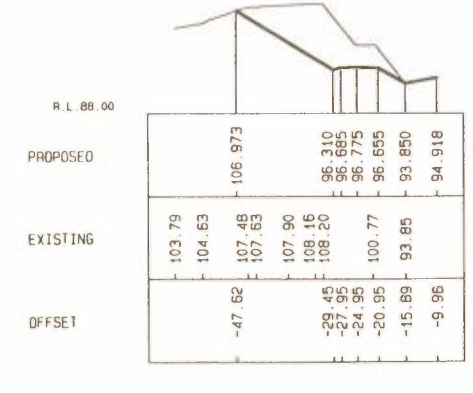
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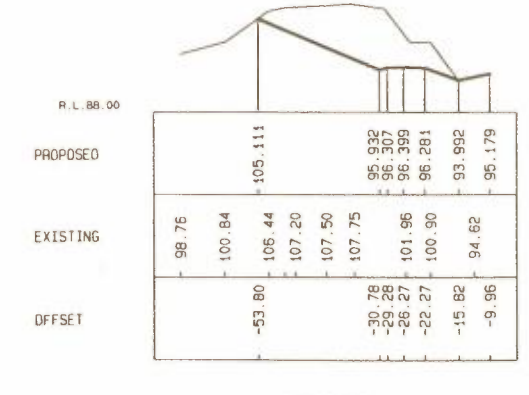
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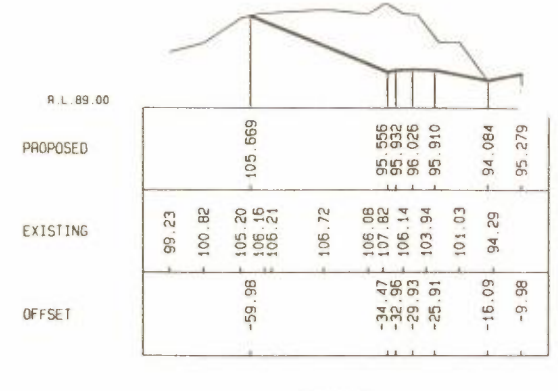
161220



161260



161300



161340

No.	Description	Init.	Date
	AMENDMENT BLOCK		

SCALES

CROSS SECTIONS

0 10 20 30 40

ROADS AND TRAFFIC AUTHORITY NSW

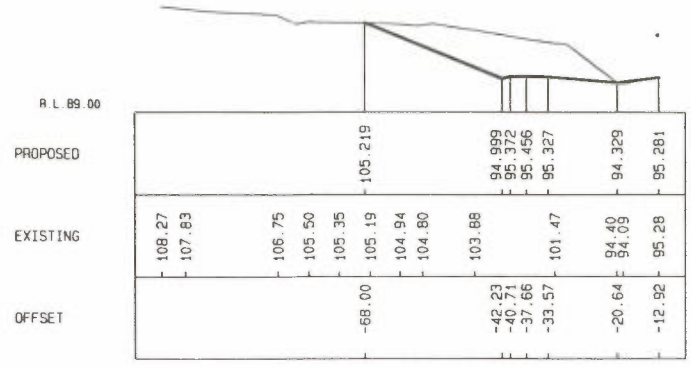
SH10 CITY OF GREATER TAREE
TAREE TRAFFIC RELIEF ROUTE
CROSS SECTIONS FORDS ROAD RELOCATION
161km100 to 161km400

FILE No. 10/426.1363

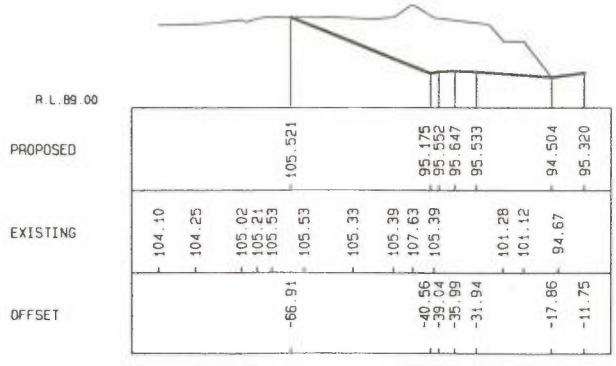
No. SHEETS

SHEET No.

REG. No. 0010 426 XXXX



161400



161380

No.	Description	Init.	Date
	AMENDMENT BLOCK		

SCALES

CROSS SECTIONS

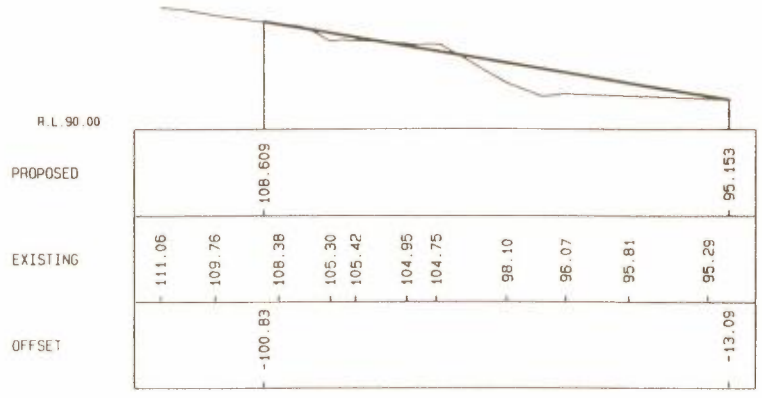
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ROADS AND TRAFFIC AUTHORITY NSW

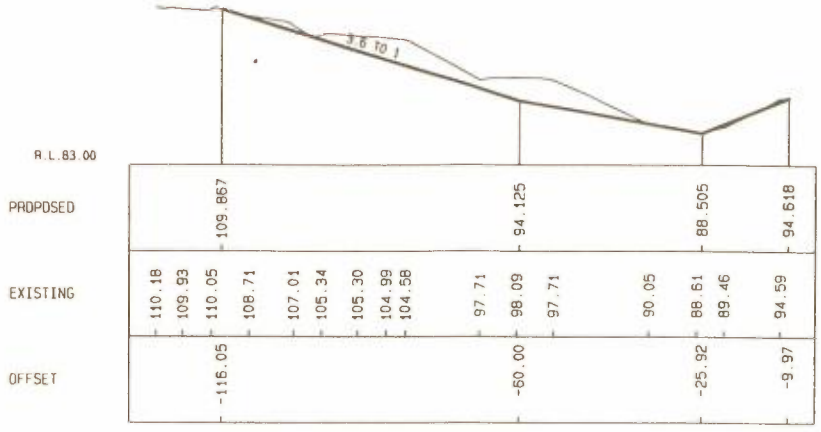
SH10 CITY OF GREATER TAREE
TAREE TRAFFIC RELIEF ROUTE
CROSS SECTIONS FORDS ROAD RELOCATION
161km100 to 161km400

FILE No.	No. SHEETS	SHEET No.
10/426.1363		

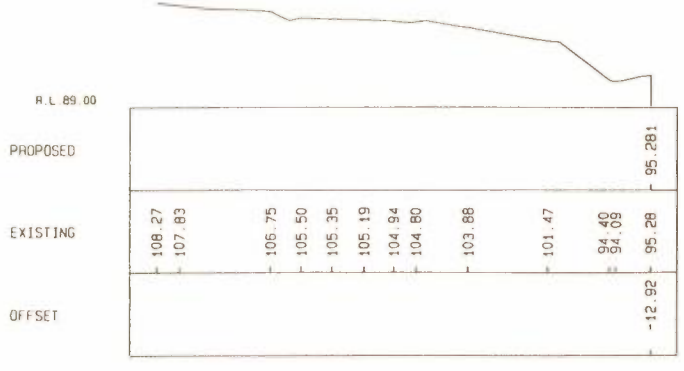
REG. No.
0010 426 XXXX



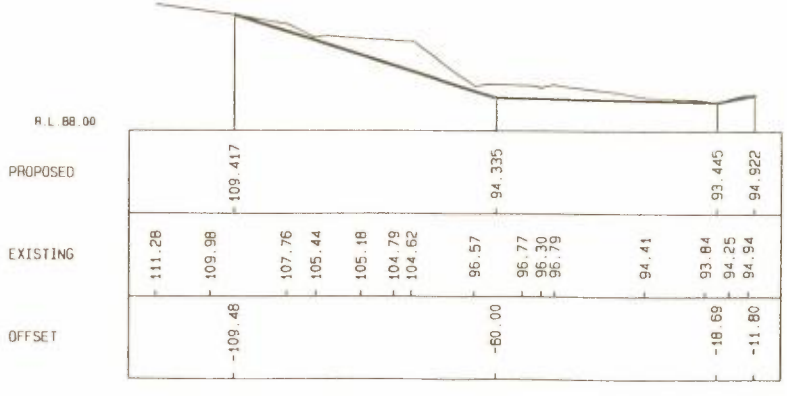
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161460



161400



161440

No.	Description	Init.	Date
	AMENDM[redacted]OCK		

SCALES

CROSS SECTIONS

0 10 20 30 40

ROADS AND TRAFFIC AUTHORITY NSW

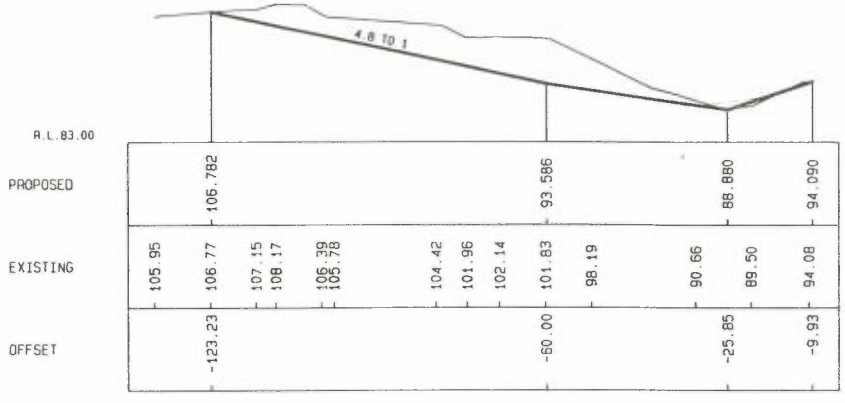
SH10 CITY OF GREATER TAREE
TAREE TRAFFIC RELIEF ROUTE
CROSS SECTIONS 4MILE BORROW AREA
161k[redacted]o 1[redacted]0

FILE No. 10/426.1363

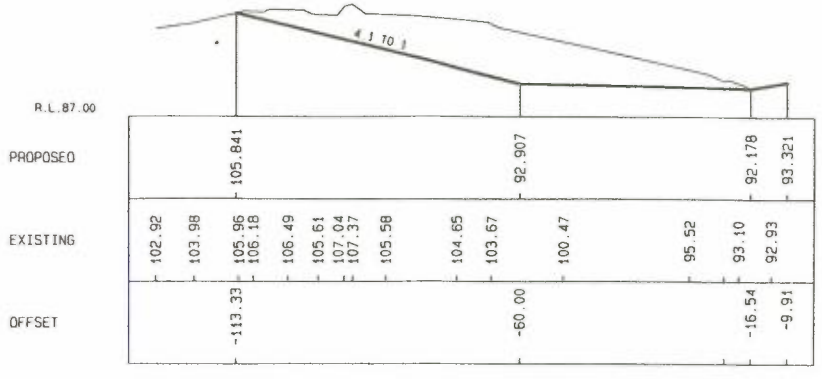
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SHEET No.

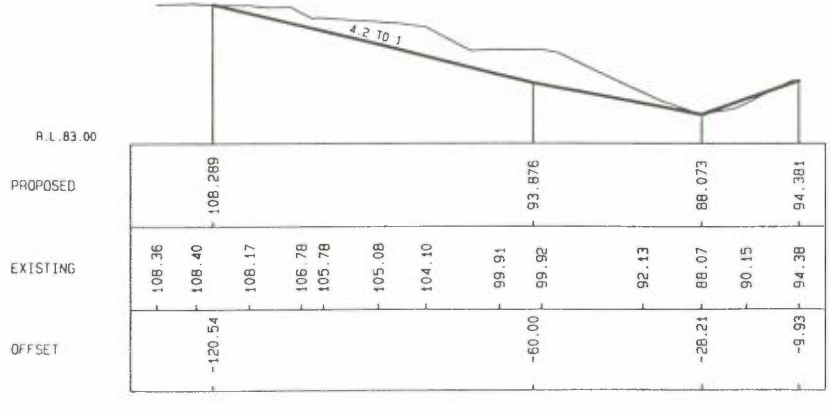
REG. No. 0010 426 XXXX



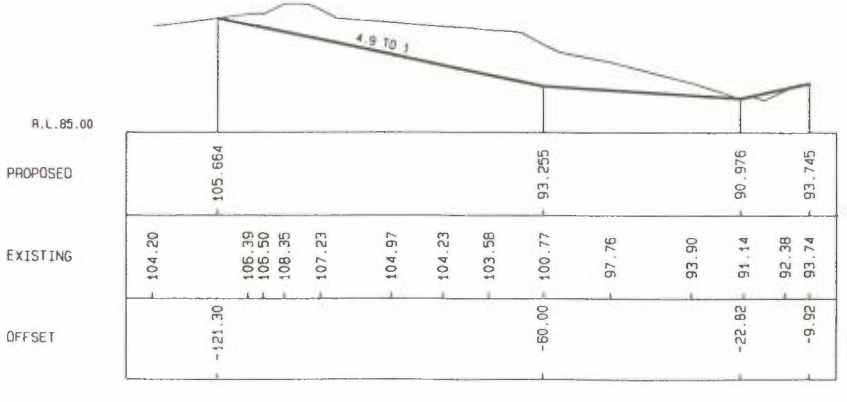
161500



161540



161480



161520

No.	Description	Init.	Date
	AMENDMENT BLOCK		

SCALES

CROSS SECTIONS

0 10 20 30 40

ROADS AND TRAFFIC AUTHORITY NSW

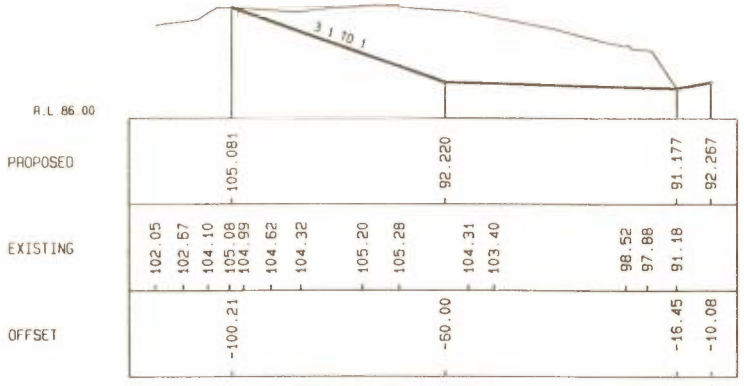
SH10 CITY OF GREATER TAREE
TAREE TRAFFIC RELIEF ROUTE
CROSS SECTIONS 4MILE BORROW AREA
161km400 to 162km500

FILE No. 10/426.1363

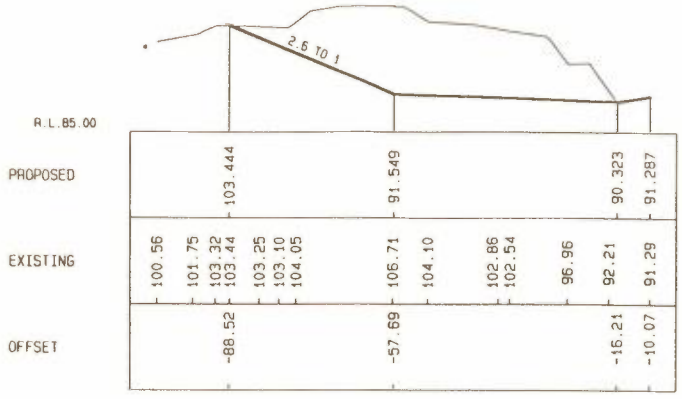
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SHEET No.

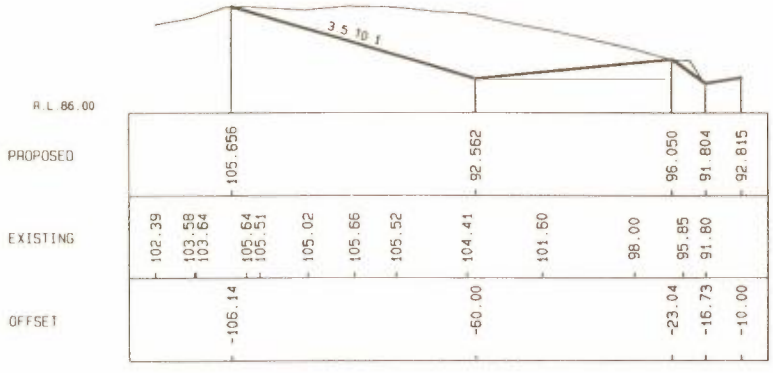
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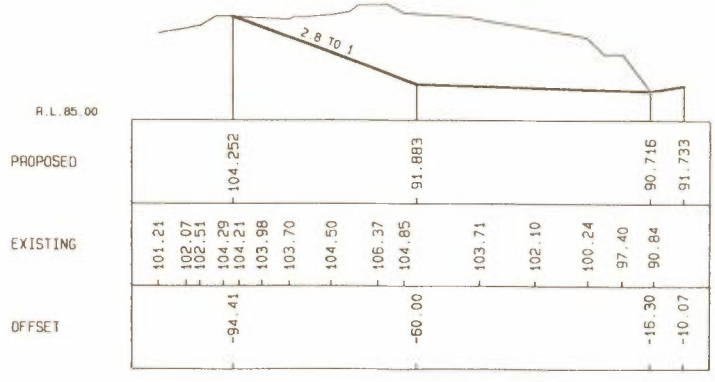
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161620



161560



161600

NO.	Description	Init	Date
	AMEND [redacted].DGN		

SCALES

CROSS SECTIONS

0 10 20 30 40

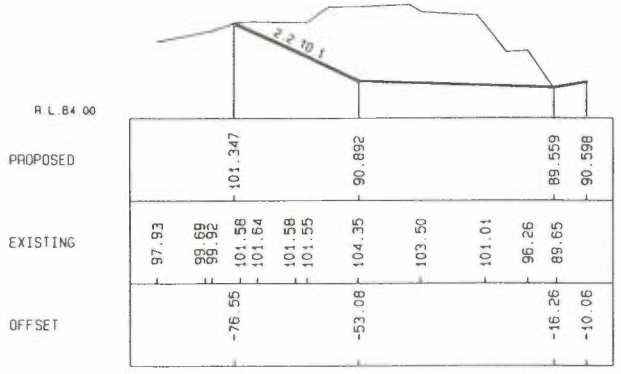
ROADS AND TRAFFIC AUTHORITY NSW

SH10 CITY OF GREATER TAREE
TAREE TRAFFIC RELIEF ROUTE
CROSS SECTIONS 4MILE BORROW AREA
161k[redacted] to 16[redacted]0

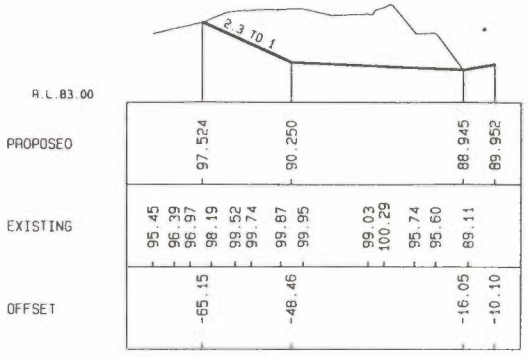
FILE No.	NO. SHEETS	SHEET NO.
10/426.1363		

REG. No.

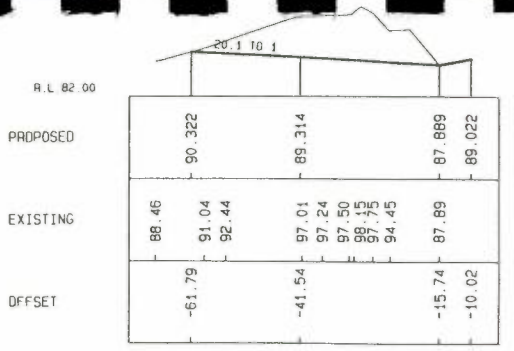
0010 426 XXXX



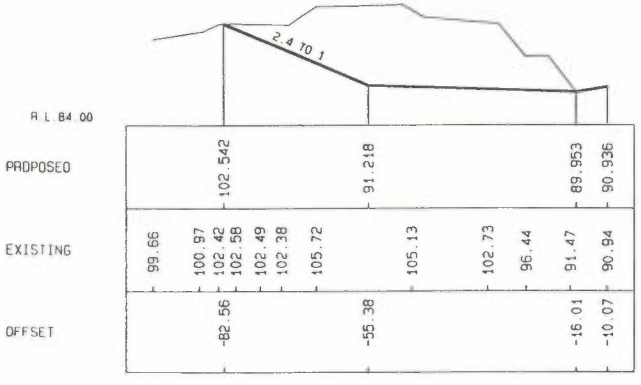
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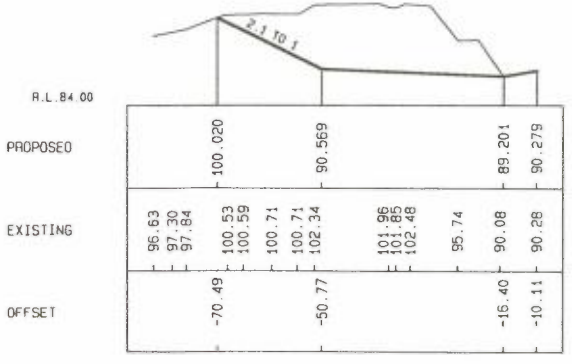
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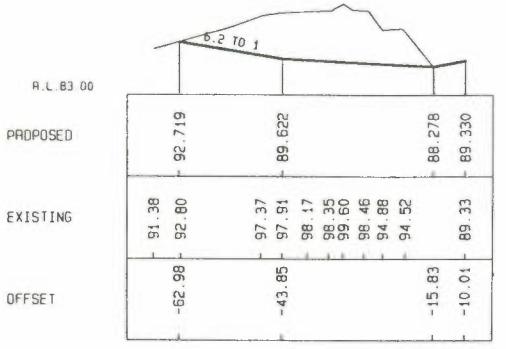
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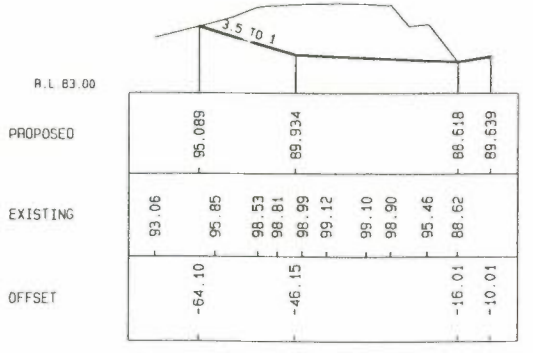
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161680



161740



161720

No.	Description	Init.	Date
	AMENDMENT BLOCK		

SCALES

CROSS SECTIONS

0 10 20 30 40

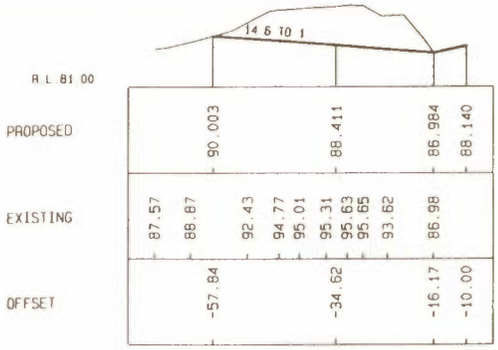
ROADS AND TRAFFIC AUTHORITY NSW

SH10 CITY OF GREATER TAREE
TAREE TRAFFIC RELIEF ROUTE
CROSS SECTIONS 4MILE BORROW AREA
161km400 to 162km500

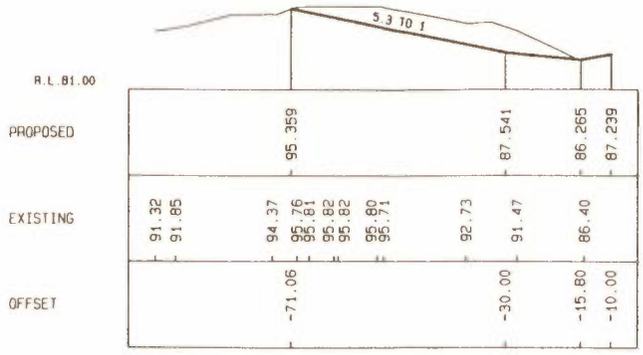
FILE No.	No. SHEETS	SHEET No.
10/426.1363		

REG. No.

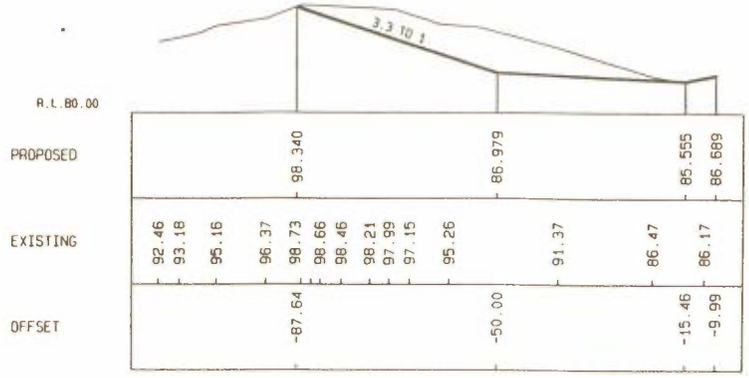
0010 426 XXXX



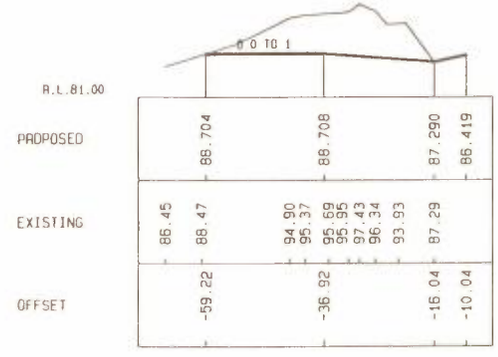
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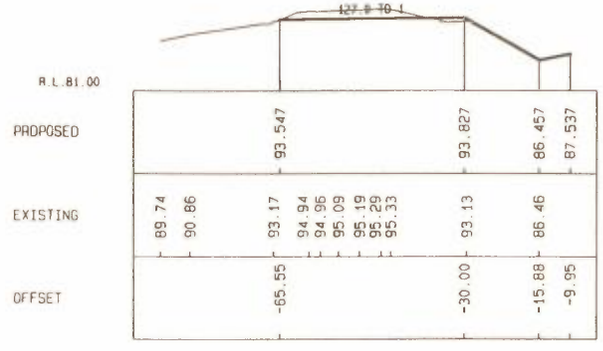
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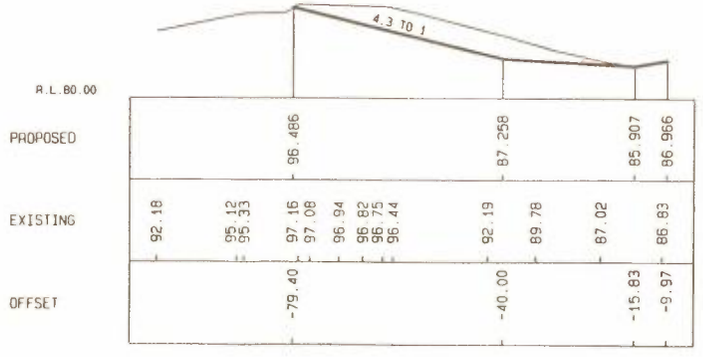
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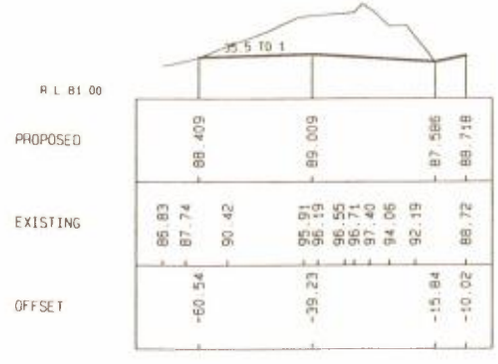
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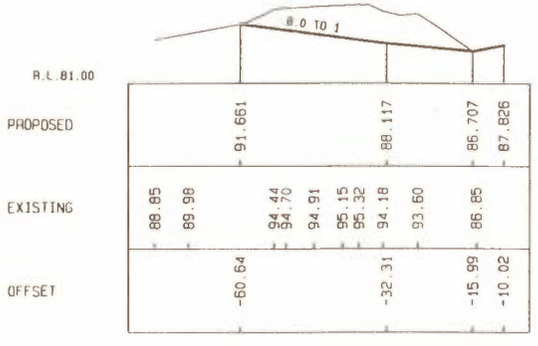
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161900



161780



161840

No.	Description	Init.	Date
	HENDERSON CROX		

SCALES

CROSS SECTIONS

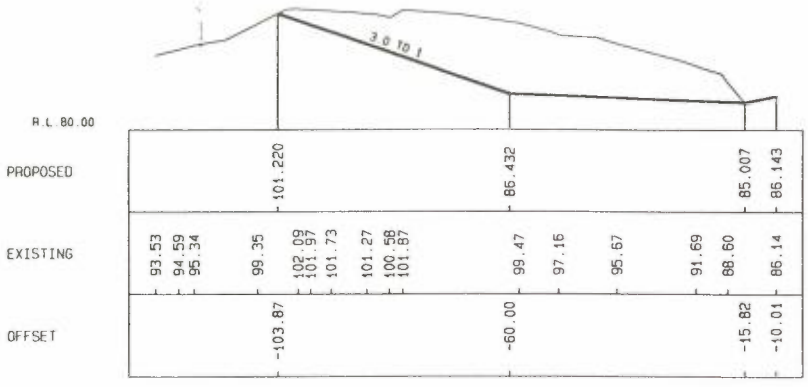
0 10 20 30 40

ROADS AND TRAFFIC AUTHORITY NSW

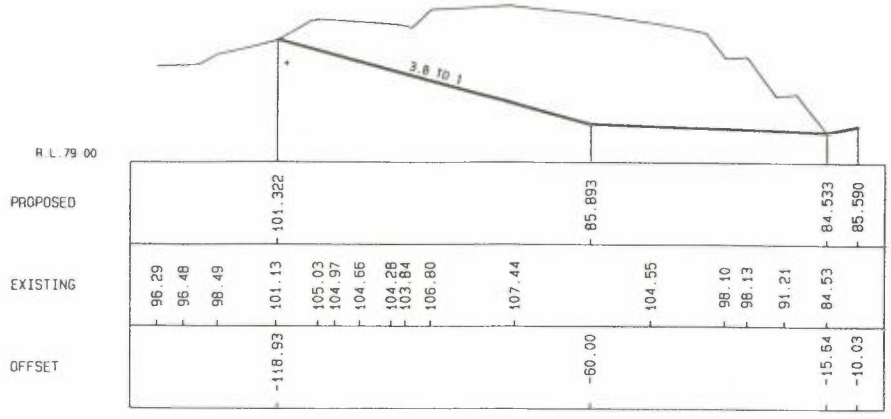
SH10 CITY OF GREATER TAREE
TAREE TRAFFIC RELIEF ROUTE
CROSS SECTIONS 4MILE BORROW AREA
161km490 to 162km560

FILE No.	No. SHEETS	SHEET No.
10/426.1363		

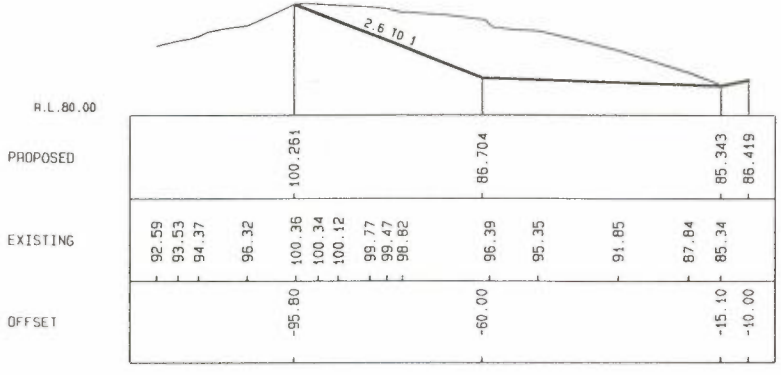
REG. No.
0010 426 XXXX



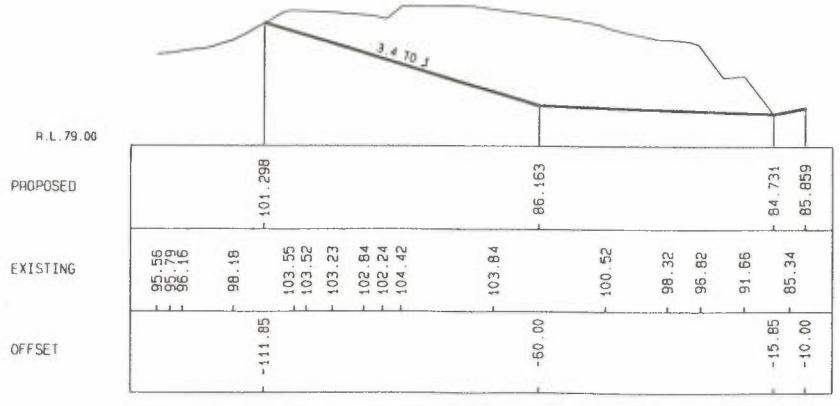
161960



162000



161940



161980

No.	Description	Init.	Date
	AMENDMENT BLOCK		

SCALES

CROSS SECTIONS

0 10 20 30 40

ROADS AND TRAFFIC AUTHORITY NSW

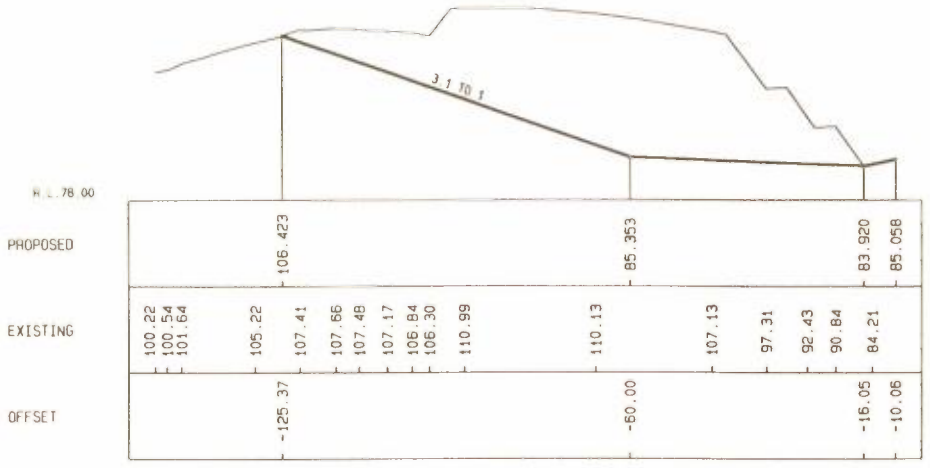
SH10 CITY OF GREATER TAREE
TAREE TRAFFIC RELIEF ROUTE
CROSS SECTIONS 4MILE BORROW AREA
161km400 to 162km500

FILE No. 10/426.1363

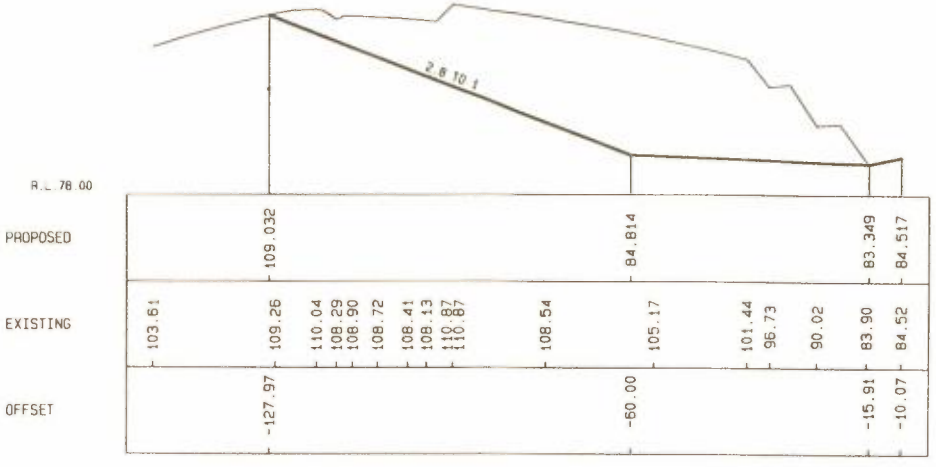
No. SHEETS

SHEET No.

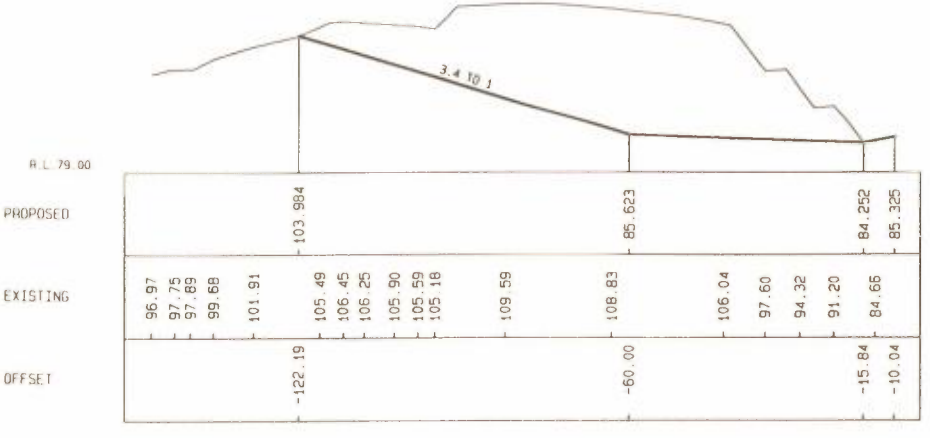
REG. No. 0010 426 XXXX



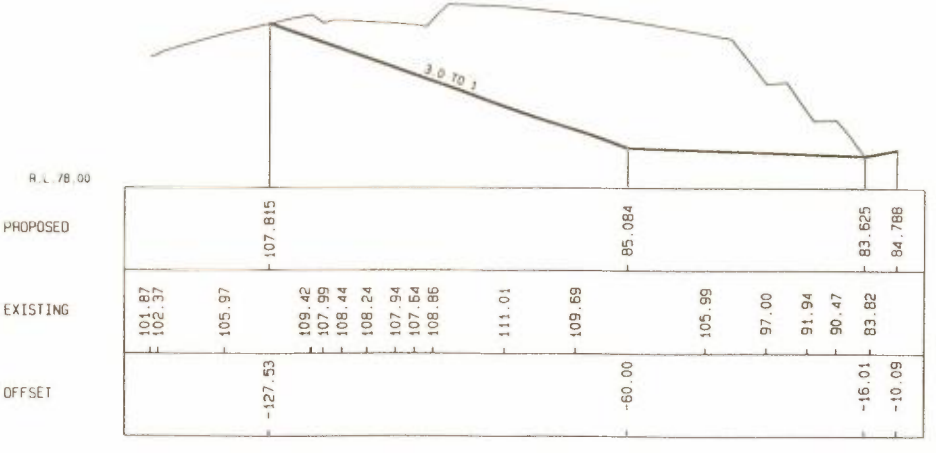
162040



162080



162020



162060

NO.	Description	Init.	Date
	AMEND[illegible]OCX		

SCALES

CROSS SECTIONS

0 10 20 30 40

ROADS AND TRAFFIC AUTHORITY NSW

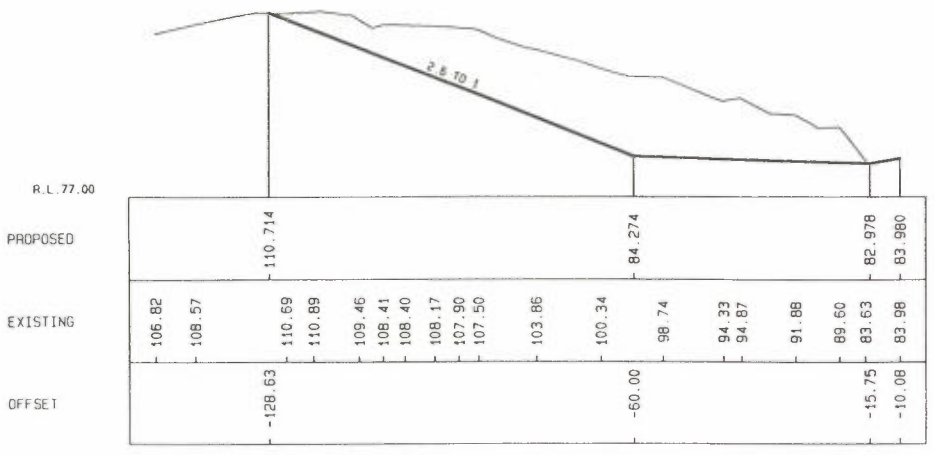
SH10 CITY OF GREATER TAREE
TAREE TRAFFIC RELIEF ROUTE
CROSS SECTIONS 4MILE BORROW AREA
161k[illegible] to 1[illegible]

FILE No. 10/426.1363

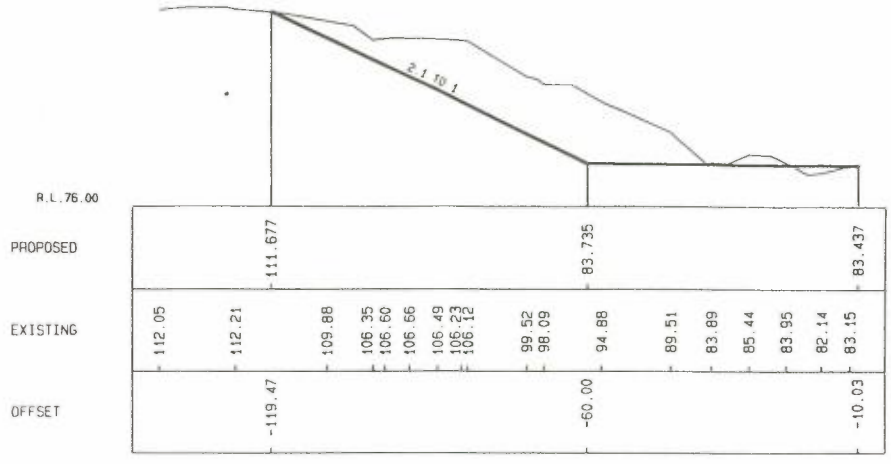
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SHEET No.

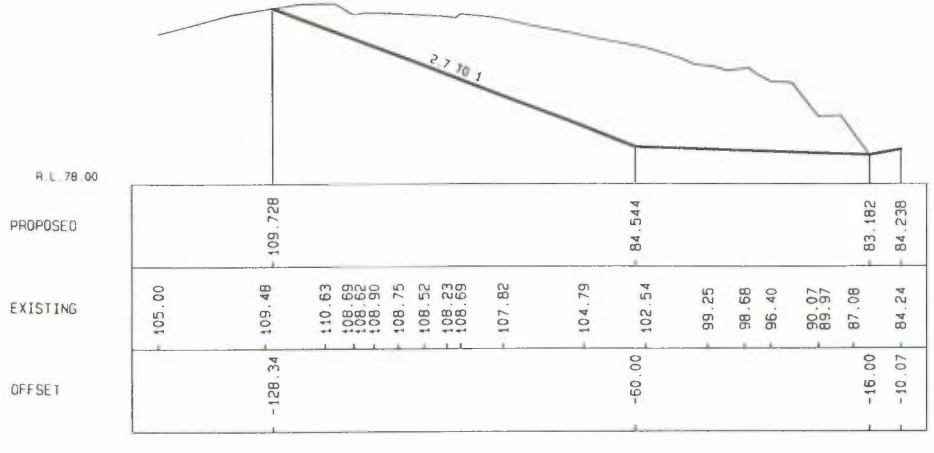
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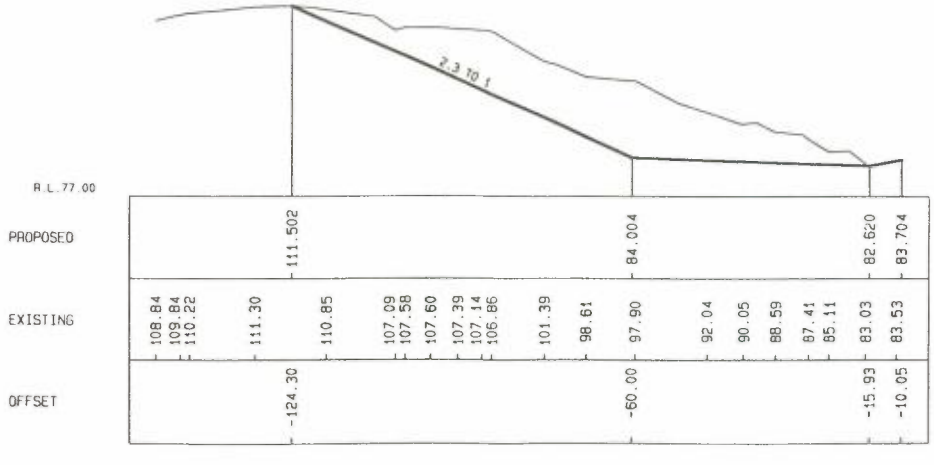
162120



162160



162100



162140

No.	Description	Init.	Date
	AMENDMENT BLOCK		

SCALES

CROSS SECTIONS

0 10 20 30 40

ROADS AND TRAFFIC AUTHORITY NSW

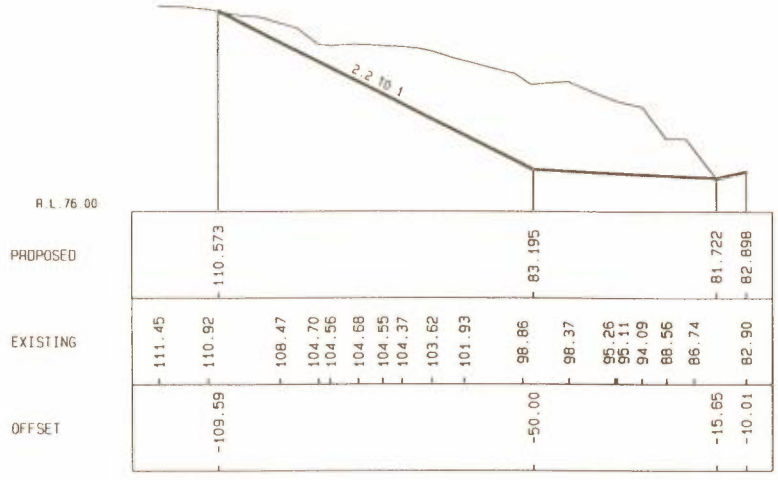
SH10 CITY OF GREATER TAREE
TAREE TRAFFIC RELIEF ROUTE
CROSS SECTIONS 4MILE BORROW AREA
161km400 to 162km500

FILE No. 10/426.1363

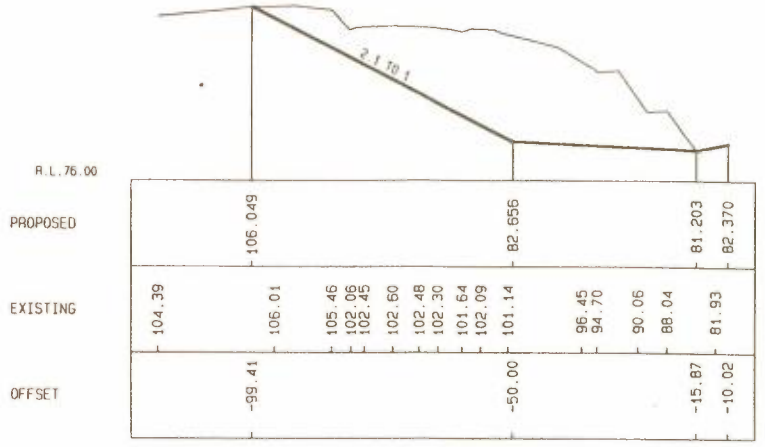
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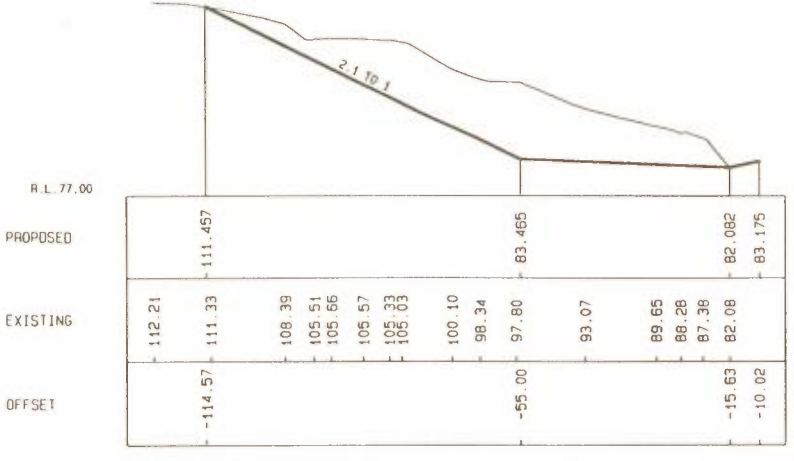
REG. NO. 0010 426 XXXX



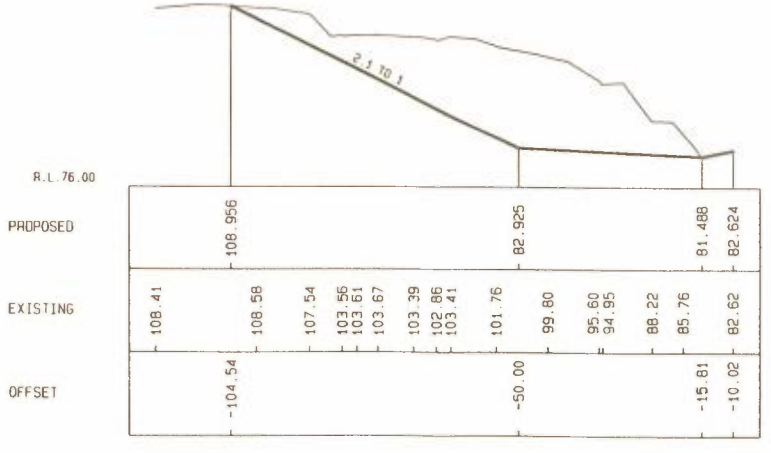
162200



162240



162180



162220

No.	Description	Init.	Date
	AMENDED [illegible] BLOCK		

SCALES

CROSS SECTIONS

0 10 20 30 40

ROADS AND TRAFFIC AUTHORITY NSW

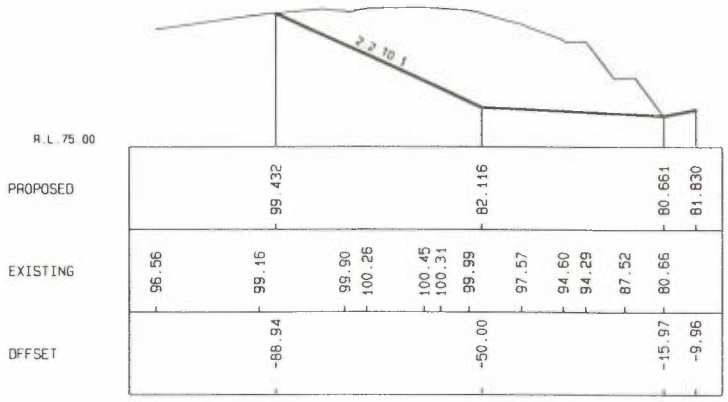
SH10 CITY OF GREATER TAREE
TAREE TRAFFIC RELIEF ROUTE
CROSS SECTIONS 4MILE BORROW AREA
161k[illegible] to 16[illegible]

FILE No. 10/426.1363

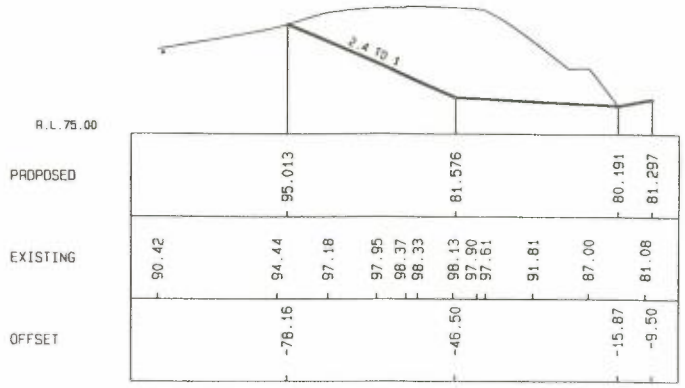
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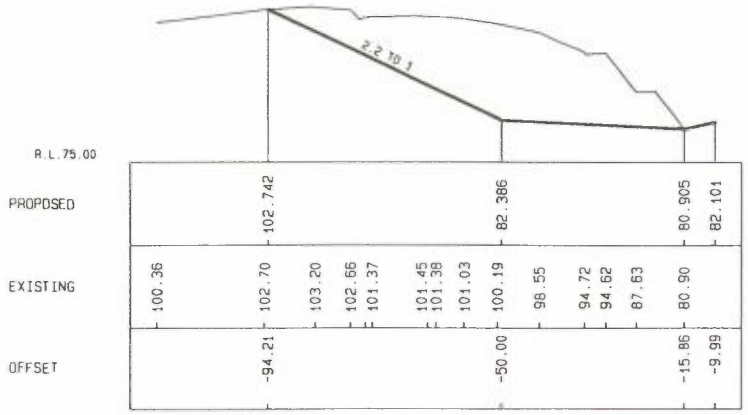
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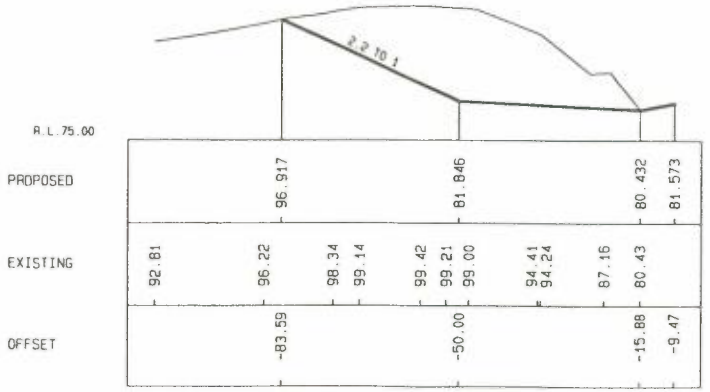
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162320



162260



162300

No.	Description	Init.	Date
	AMENDMENT BLOCK		

SCALES

CROSS SECTIONS

0 10 20 30 40

ROADS AND TRAFFIC AUTHORITY NSW

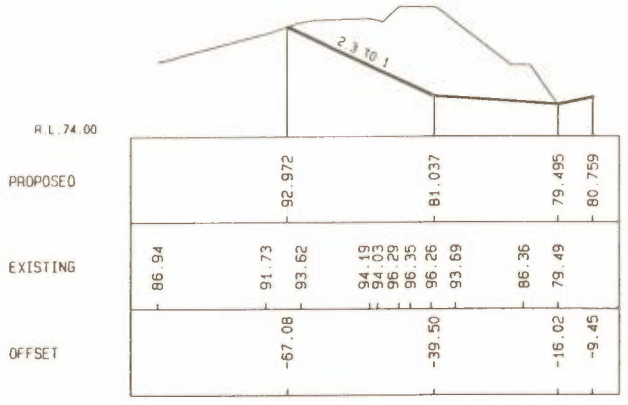
SH10 CITY OF GREATER TAREE
TAREE TRAFFIC RELIEF ROUTE
CROSS SECTIONS 4MILE BORROW AREA
161km400 to 162km500

FILE No. 10/426.1363

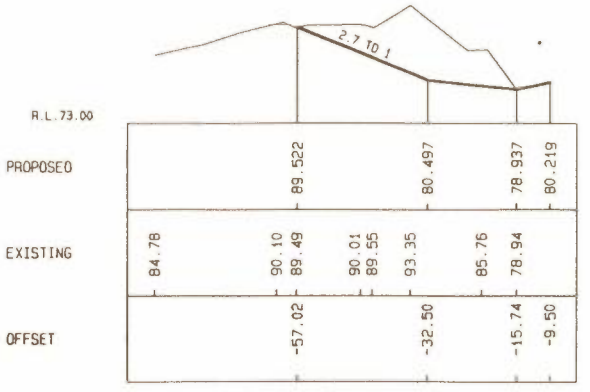
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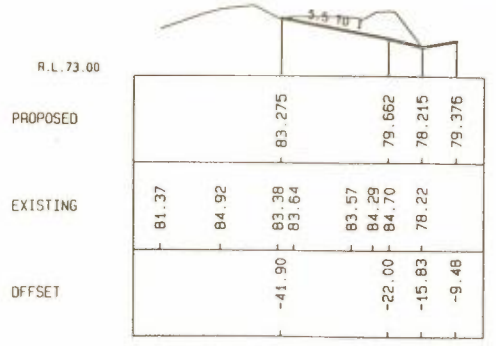
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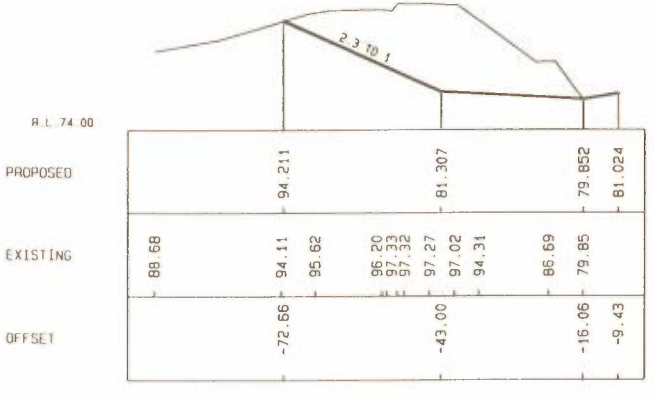
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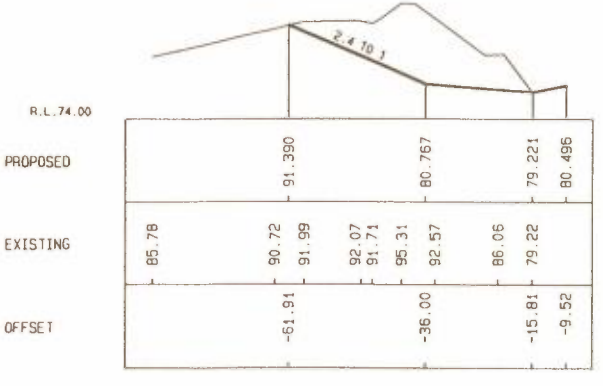
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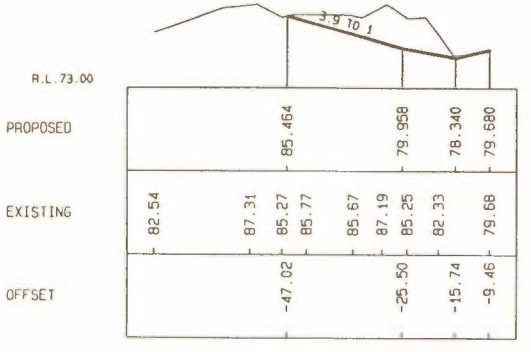
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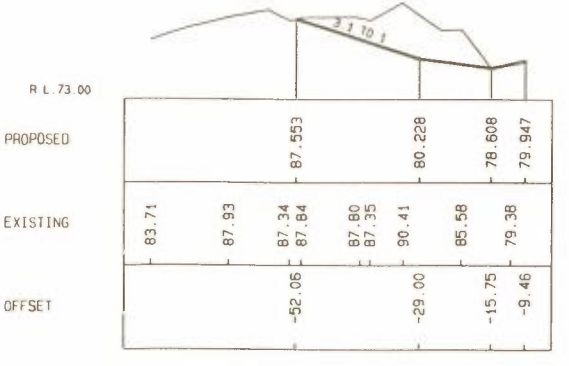
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162380



162440



162420

SCALES

CROSS SECTIONS

0 10 20 30 40

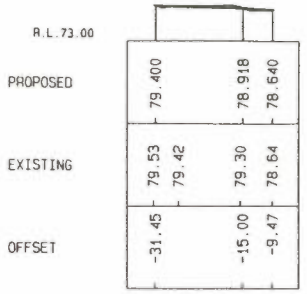
No.	Description	Init.	Date
	AMENDMENT BLOCK		

ROADS AND TRAFFIC AUTHORITY NSW

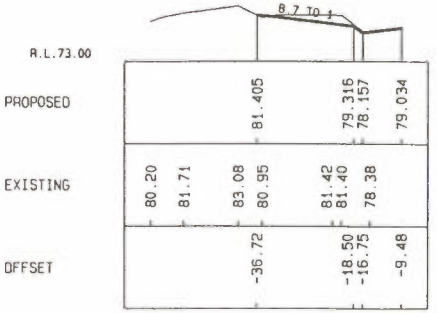
SH10 CITY OF GREATER TAREE
TAREE TRAFFIC RELIEF ROUTE
CROSS SECTIONS 4MILE BORROW AREA
161k [illegible] 1[illegible]0

FILE No.	No. SHEETS	SHEET No.
10/426.1363		

REG. No.
0010 426 XXXX



162500



162480

No.	Description	Init.	Date
	AMENDMENT BLOCK		

SCALES

CROSS SECTIONS

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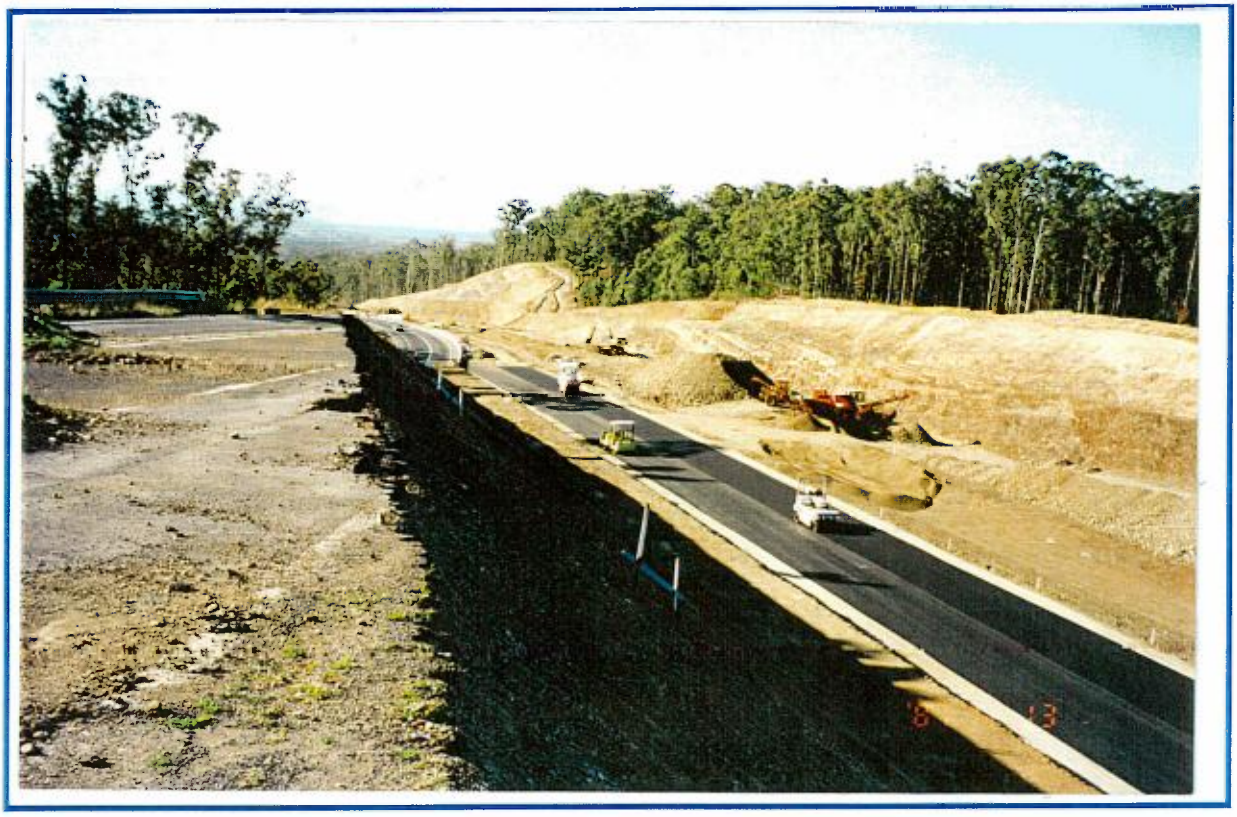
ROADS AND TRAFFIC AUTHORITY NSW

SH10 CITY OF GREATER TAREE
TAREE TRAFFIC RELIEF ROUTE
CROSS SECTIONS 4MILE BORROW AREA
161km400 to 162km500

FILE No.	No. SHEETS	SHEET No.
10/426.1363		

REG. No.
0010 426 XXXX

APPENDIX H
PHOTOGRAPHS OF THE STUDY AREA

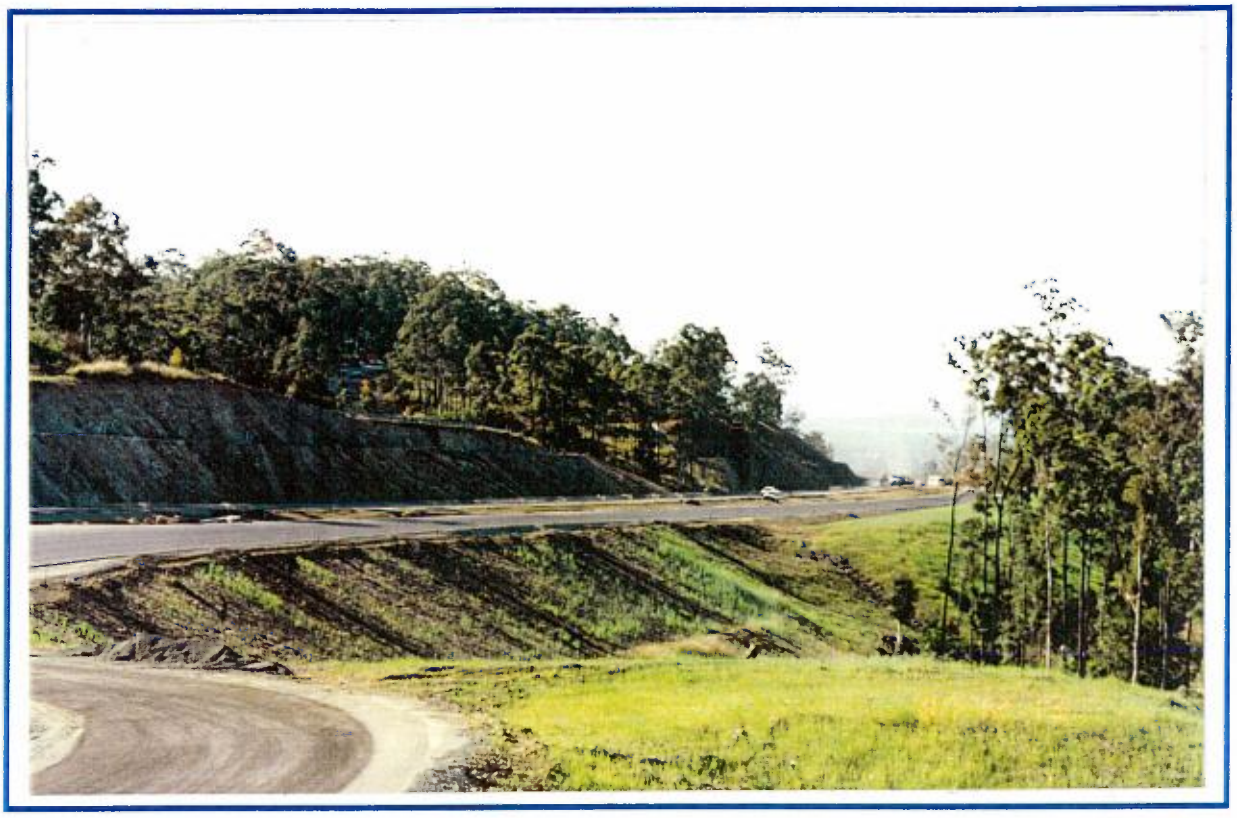


1.CUT A - VIEW TO NORTH (CH 162300)

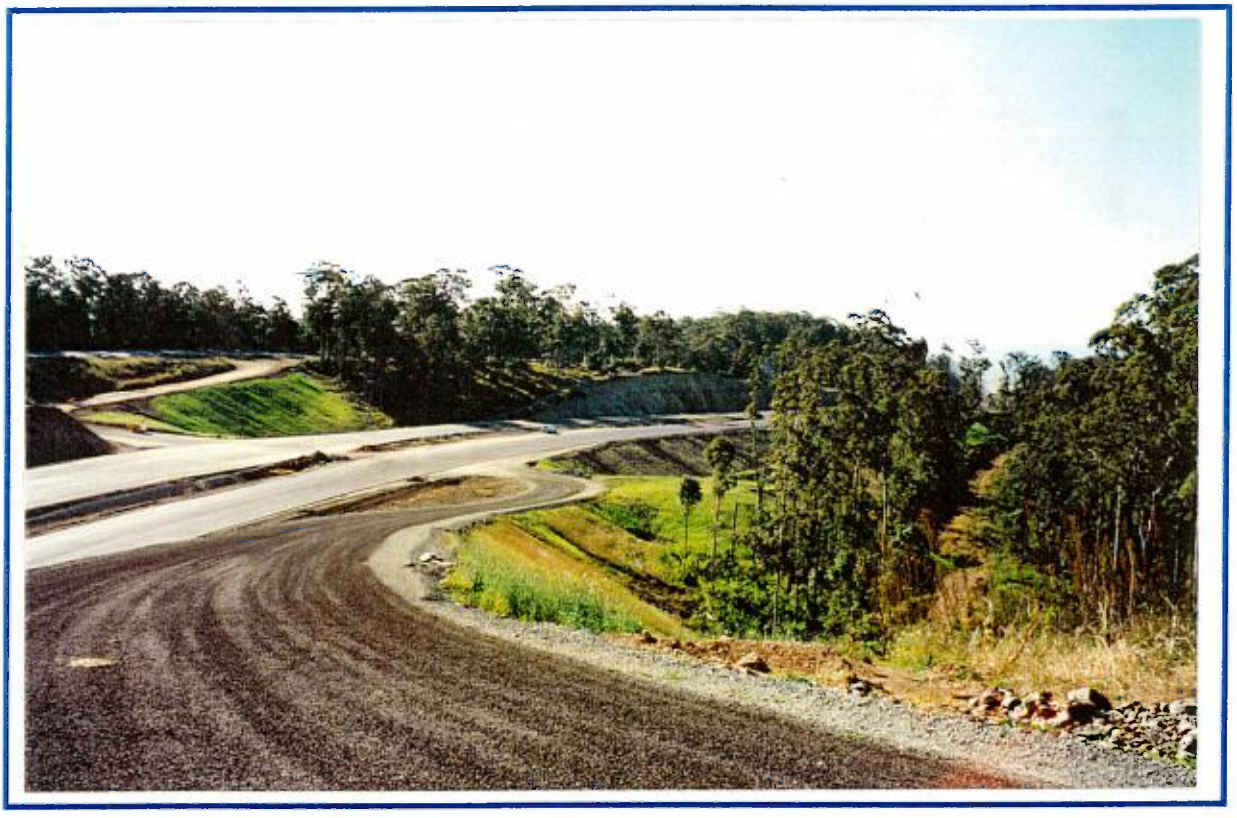


2. CUT A - VEGETATION BETWEEN TAREE BYPASS AND FORMER HIGHWAY (CH 162250)

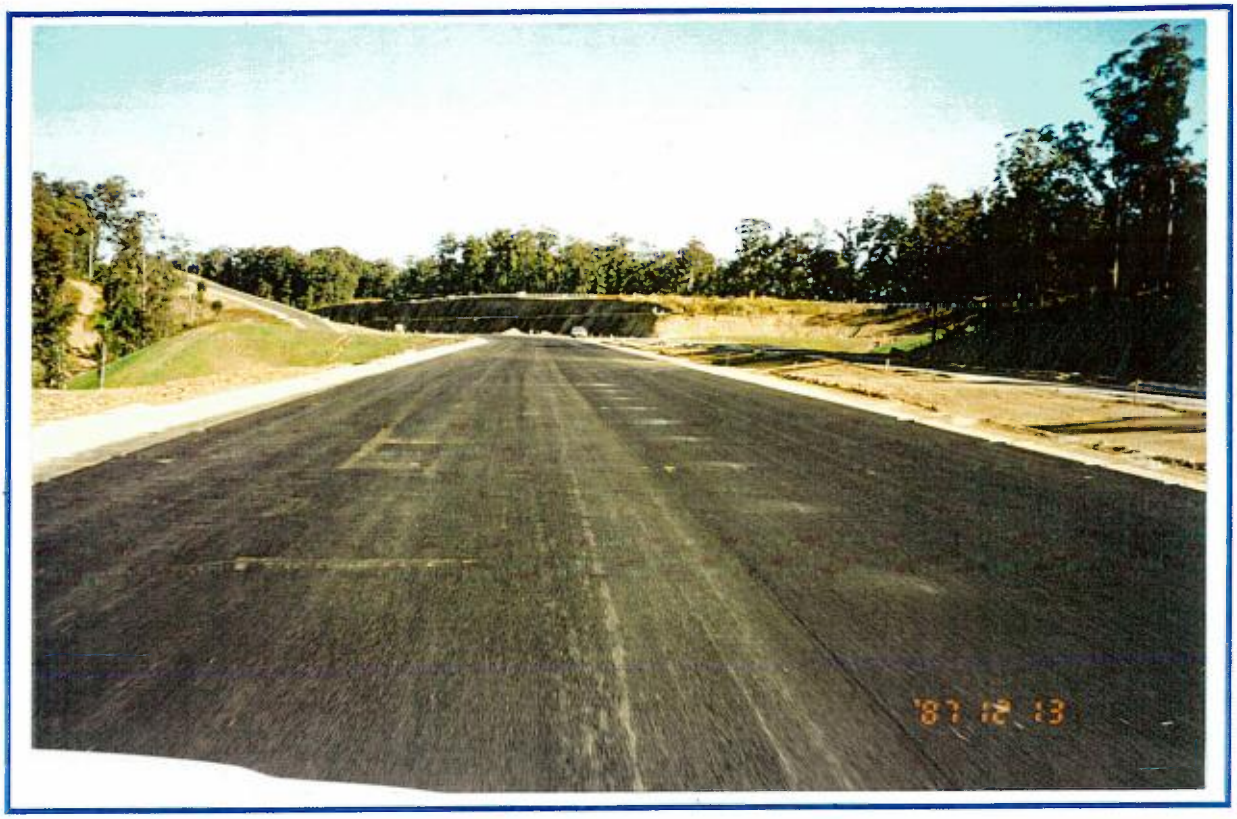
FILL MATERIAL QUARRY -
TAREE BYPASS
5606.01.CE



3. CUT B - VIEW NORTH (CH 161300)



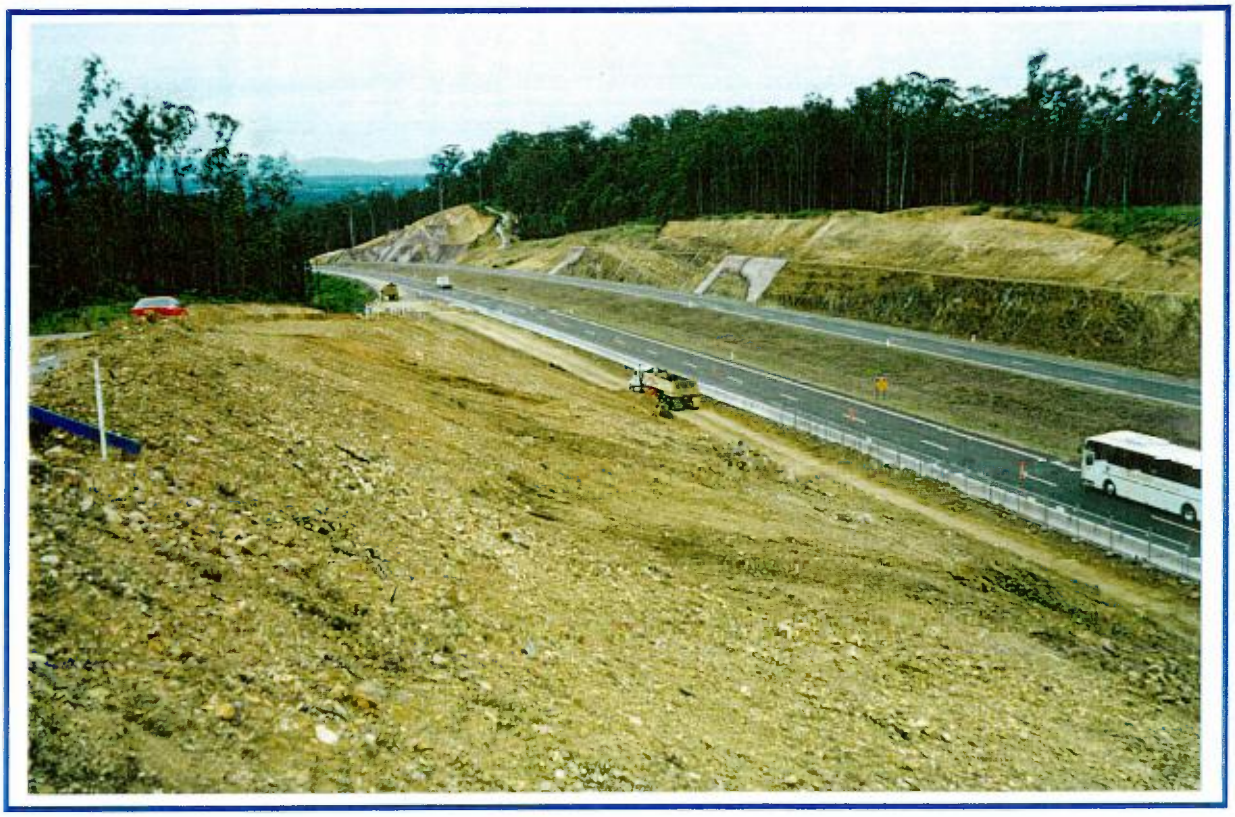
4. CUT B - VIEW TO NORTH OVER TAREE BYPASS SHOWING FORDS ROAD INTERSECTION (CH 161300)



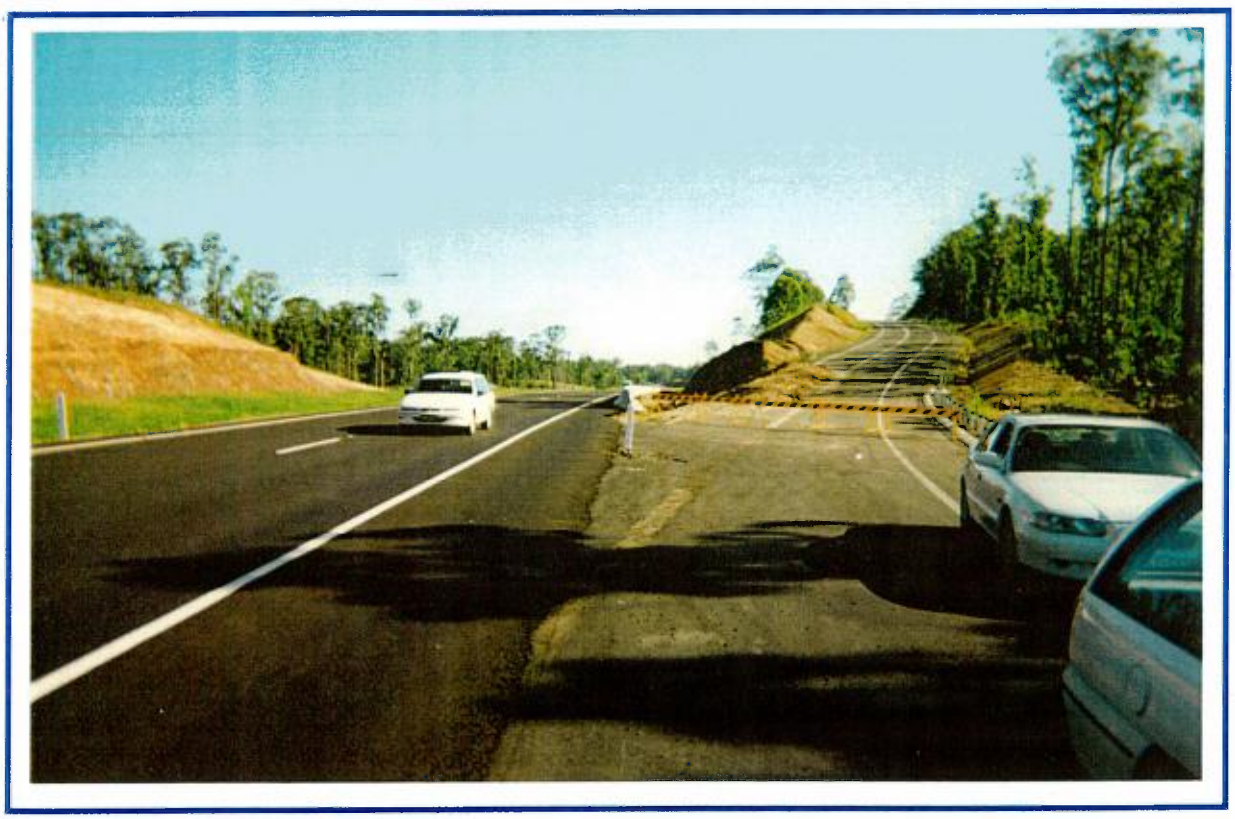
5. CUT A. - VIEW SOUTH TOWARDS CUT A (CH 161450)



6. PREVIOUS EXCAVATION OF CUT B FOR TAREE BYPASS



7. PREVIOUS HAULAGE OF EMBANKMENT MATERIAL FROM CUTB



8. PROPOSED QUARRY EXIT NORTH OF CUTB



9. FORDS ROAD INTERSECTION BATTERS TO BE EXCAVATED



10. VIEW TO NORTH EAST FROM FOUR MILE HILL SUMMIT

APPENDIX I
ECOLOGICAL STUDY - SPECIES LISTS

FLORA SPECIES LIST

Pteridophytes

DENNSTAEDTIACEAE

Pteridium esculentum

Monocotyledons

COMMELINACEAE

Commelina cyanea

GRAMINEAE

Imperata cylindrica

PHILESIACEAE

Eustrephus latifolius

Geitonoplesium cymosum

POACEAE

Cynodon dactylon

Paspalum dilatatum

Pennisetum clandestinum

SMILACACEAE

Smilax australis

XANTHORRHOEACEAE

Lomandra longifolia

Themeda australis

Dicotyledons

ASTERACEAE

Bidens pilosa

Hypochoeris radicata

CACTACEAE

Opuntia stricta

CASUARINACEAE

Allocasuarina torulosa

CONVOLVULACEAE

Ipomoea indica

CUNONIACEAE

Callicoma serratifolia

EPACRIDACEAE

Leucopogon juniperinus

FABACEAE

Hardenbergia violacaea

MIMOSACEAE

Acacia falcata

Acacia suaveolens

MYRTACEAE

Angophora costata

Eucalyptus acmenoides

Eucalyptus gummifera

Eucalyptus maculata

Eucalyptus paniculata

Eucalyptus punctata

Eucalyptus pilularis

Kunzea ambigua

Leptospermum polygalifolium

OLEACEAE

Ligustrum sinense

POLYGONACEAE

Persicaria strigosa

ROSACEAE

Rubus sp.

PROTACEAE

Persoonia linearis

VERBENACEAE

Lantana camara

Verbena bonariensis

APPENDIX J
AIR QUALITY GOALS

C.1 Air Quality Goals Relevant to the Quarry Operations

Pollutant	Goal	Agency
Total Particulate Matter	90μgl/m^3	NH&MRC
Particulate Matter < 10μm (PM_{10})	50μ/m^3 (annual mean) 150μg/m^3 (24-hour maximum)	USEPA
Lead	1.5μg/m^3 (90 day average)	NH&MRC
Carbon Monoxide	87ppm or 108mg/m^3 (15 minute maximum) 25ppm or 31mg/m^3 (1 hour maximum) 9ppm or 11mg/m^3 (8-hour maximum)	WHO WHO NH&MRC
Nitrogen Dioxide	0.16ppm or 328μg/m^3 (1-hour maximum) 0.05ppm or 103μg/m^3 (annual mean)	NH&MRC USEPA
Dust	maximum acceptable increase in dust fallout when existing levels between 3-4glm^2/month: residential land use: 0μglm^2/month other land use: 1μglm^2/month intermediate: 3-μglm^2/month	EPA

Source: Holmes Air Sciences, 1997.