EIS 337

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Environmental impact statement for No. 3 ventilation fan shaft at Pacific Colliery

BHP Steel
International Group

Collieries Division

Macquarie Collieries Group

Environmental Impact Statement for No. 3 Ventilation Fan Shaft at Pacific Colliery

January 1987

B.H.P. STEEL INTERNATIONAL GROUP

COLLIERIES DIVISION

MACQUARIE COLLIERIES GROUP

ENVIRONMENTAL IMPACT STATEMENT FOR NO. 3 VENTILATION FAN SHAFT AT PACIFIC COLLIERY

Prepared by:
MACQUARIE COLLIERIES, BELMONT NSW
and
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Environmental Consultants,
92 Young Street, Carrington 2294

January 1987

Form 4.

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

ENVIRONMENTAL IMPACT STATEMENT.

This Statement has been prepared by or on behalf of B.H.P. STEEL INTERNATIONAL GROUP, COLLIERIES DIVISION, MACQUARIE COLLIERIES being the applicant making the development application referred to below.

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

CONSTRUCTION OF AN UPCAST VENTILATION FAN SHAFT AT BOLTON POINT WITHIN THE CITY OF LAKE MACQUARIE, N.S.W.

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

No. ..... Street .....

Locality/suburb BOLTON POINT, LAKE MACQUARIE, N.S.W.

Real property description Part Lot 321, DP 700700 Being Part Portion 37 Parish of Awaba, County of Northumberland

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

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

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

G. FARNELL B.Agr.Sc.(Hons)
B.H.P. COLLIERIES DIVISION
MACQUARIE COLLIERIES GROUP
BELMONT. NSW. 2280.

Certificate.

I, GEOFF FARNELL, of B.H.P. COLLIERIES DIVISION hereby certify that I have prepared the contents of this Statement in accordance with clauses 34 and 35 of the Environmental Planning and Assessment Regulation, 1980.

Geoffrey K Farnell

Signature

30TH JANUARY, 1987.

Date

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SECTION 1 : EXECUTIVE SUMMARY

1.1 INTRODUCTION

The Macquarie Collieries of the B.H.P. Steel International Group, Collieries Division, proposes to construct an upcast ventilation fan shaft in a small area of bushland in the Awaba Bay - Bolton Point area.

The four collieries which comprise the Macquarie Collieries Group (Lambton, John Darling, Pacific and Stockton Borehole) currently operate a total of seven upcast ventilation fan shafts. Three of these facilities, located at colliery pit tops, are between 50 and 280 metres away from existing residential areas and cause minimum concern to the residents. The shaft at Bolton Point will be some 370 metres deep and of 7 metres internal finished diameter. The proposed shaft is located approximately 250 metres from the nearest existing residential area.

Increasing methane gas emissions at the colliery have required the building of an additional upcast ventilation shaft. This shaft, by providing additional ventilation within the mine will ensure the continuance of safe and efficient longwall mining operations at the colliery. The Pacific Colliery's present mining operations occur under Lake Macquarie and in the Teralba area. Future underground mining operations are planned for Booragul, Fennell Bay and Bolton Point areas.

Once the shaft is constructed, ventilation fans and an electrical control and switch room will be constructed adjacent to the shaft. It is proposed to relocate the fans from the John Darling No. 4 Ventilation Fan site in Belmont Lagoon to the Awaba Bay - Bolton Point site. This transfer is due to the planned closure of the John Darling Colliery in 1987 and the need for similar duty ventilation fans at the proposed Pacific Colliery No. 3 Venilation Shaft.

The shaft will not be used to provide man riding and materials handling facilities to the underground workings, nor will any coal transportation occur from this site.

The proposed development requires that an Environmental Impact Statement be prepared and that the Minister for Planning and Environment determine the Development Application.

The site is on land owned by the Department of Housing who have given their support in principle to the project. The Company has also made application to rezone 3 hectares of the land from 6(c) Open Space to 4(b) Special Industry (Coal Mining) and to obtain a Mining Purposes Lease from the Department of Mineral Resources.

1.2 DESCRIPTION OF THE PROJECT

The constraints placed upon the location of the proposed facility are many due to the area occupied by the Lake, residential developments, the mine plan and the need to minimise any potential environmental impacts.

The site chosen for the proposed facility is strategically located in a timbered gully and adequately meets the Company's mine plan requirements. The facility has been designed and located so that only a minimal area of approximately 2 hectares is required to be cleared for the development. The proposed site also ensures that no visual or noise impacts will occur to residences along The Ridgeway or on the northern and eastern shores of the Lake.

Following the receipt of approvals, a construction period of approximately 14 months will be required. This will involve building an erection pad, headframe, winder house, support facilities, and carrying out a routine sequence of drilling, blasting, mucking out (i.e., spoil removal) and concrete lining of the shaft.

It is anticipated that a crew of 6 to 8 men per shift will work 24 hours per day for 6 days per week during construction.

Material excavated from the shaft will be transported offsite, in line with the Company's commitment to minimise the area disturbed and occupied by the development. Spoil will primarily be transported to the Stockton Borehole Coal Preparation Plant for use in general construction and some spoil may be taken to the Fennell Bay Public School to assist in the construction of sports grounds.

Approximately 15 truck loads of spoil per day will be removed from the site. The trucks will be small (12t) and average approximately one load per hour.

Once the shaft is constructed the headframe and winder house will be removed and the fans and silencers erected and commissioned. The fans will have a noise specification of 55 dB(A) or less at 30 metres.

The water management system has been designed to minimise the impact of the development upon water quality in the gully and the Lake. All contaminated upslope runoff will be diverted around or piped under the facility. Any runoff from the site, water from the shaft and groundwater from the mine will be treated in a dual chambered sedimentation dam. The clarified water will be released via a pipeline to the Lake. The pipeline is to ensure that the mildly saline water from the dam cannot impair the ecology of the watercourse between the shaft and the Lake.

All disturbed ground including batters will be stabilised with appropriate grasses and ground cover species. Trees and shrubs common to the site will be replanted as soon as practicable. To assist in rehabilitation of the site any suitable topsoils present will be conserved for use in the landscaping and rehabilitation programme.

1.3 THE EXISTING ENVIRONMENT

The existing environment around the shaft site is in a degraded condition due to the illegal dumping of household rubbish, abandoned cars, logging, frequent fires and likely predation of native fauna by feral cats.

The soils in the area are generally poor and overlie the Teralba

Conglomerate. A small ephemeral creek exists in the gully which enters the Lake approximately 500 metres downstream of the shaft site. The groundwater to be encountered in the shaft and mine is of moderate salinity and the waters in the Lake are classified as saline.

The dominant vegetation communities are Spotted Gum/Grey Gum/White Stringybark (Community 1) and the Spotted Gum/Grey Gum/Bastard Mahogany (Community 2) eucalypt associations. No rare or endangered flora and fauna species were observed, nor were any archaeological sites or relics located in the area proposed for development.

The major sound source in the area is traffic noise. Background sound levels in the evening up to 11 p.m. are around 35 to 40 dB(A). Later in the night, background sound levels are 30 to 35 dB(A).

Additional housing developments in the general area are planned by the Department of Housing, however construction of the proposed Bolton Point School will not proceed.

The land in which the development is planned is an important landscape element in the Lake Macquarie area, especially when viewed from the northern and eastern shores of the Lake.

1.4 DESIGN AND OPERATIONAL SAFEGUARDS

Strict environmental controls will be designed and employed both in the construction period and the operational phase, once the facility is commissioned.

Dust levels will be low due to the small area disturbed, the relatively small volume of 'moist' spoil to be removed, the construction pad and access road sheeted with gravel, and regular waterings of the road and pad.

When operational, dust emissions will be low as dust levels within the colliery are strictly controlled and the exhaust air becomes moist in the shaft.

The moderately saline waters from the sedimentation dam will be low in suspended solids and will readily mix with the high salinity Lake waters. An oil and grease trap/skimming system will be installed to ensure that no contaminants are released from the site. A septic system will be installed for the construction workforce and periodically pumped out by a waste disposal contractor.

Small-scale blasting operations (200 to 300 kg) will occur between the hours of 7 a.m. to 5 p.m. They will be confined behind closed doors in the shaft and of such a small nature that the State Pollution Control Commission's comfort criteria for residential areas will be easily complied with. Periodic monitoring of blasts will be undertaken to ensure that this compliance occurs.

To minimise any possible intrusions to local residents from the haulage of spoil, truck movements will be restricted to within the hours of 6 a.m. to

10 p.m. inclusive.

Detailed site selection studies have determined that the barrier effects of the local topography and vegetation, combined with fan alignment at 53 degrees and noise specification of 55 dB(A) at 30 metres, will ensure that the overall environmental objective of 35 dB(A) in neighbouring residential areas is achieved. For most of the time, fan noise emissions are not expected to be discernible above background sound levels in neighbouring residential areas.

During construction the headframe will be visible from some parts of The Ridgeway although it should not be visible from the northern and eastern shores of the Lake. Once commissioned and landscaped the facility is not expected to be visible from most locations.

A monitoring programme will be conducted to ensure that design and operational safeguards are effective in minimising any environmental impact associated with the project.

1.5 ANALYSIS OF THE INTERACTION OF THE PROJECT AND THE ENVIRONMENT

Soil erosion will be minor due to the small area of the site, diversion drains and good site management. No impact on local air quality will occur and the impacts on local water quality, topography and flora and fauna will be minor.

The visual impact will be negligible due to the site selected, and access to the Lake via the existing track will not be encumbered by this proposal.

Construction noise levels will be slightly higher than for operational noise levels. However, the continuous noise level at any residential area will not exceed 40 dB(A) and therefore the potential for noise annoyance is assessed to be low.

When operational, no residential areas will have sound levels in excess of 30 dB(A) due to the operation of the fans, therefore the noise impact will be negligible.

At the completion of the life of the Colliery, the Company will seal the shaft, remove all structures and appropriately rehabilitate the site.

1.6 REVIEW OF ALTERNATIVES

If additional ventilation is not provided, increases in methane gas levels could render mining conditions unsafe and cause the premature closure of the Colliery.

An alternative site near the Marmong Sewage Treatment Works was examined. The alternative site causes coal sterilisation and has shorter longwall blocks. These factors do not assist with maintaining efficiency, and colliery viability, and therefore the site was rejected by the Company.

Existing ventilation facilities at the Colliery pit top could be upgraded but this would necessitate closing the mine for up to four months. The new ventilation circuit would be long and inefficient and would create additional safety hazards in the mine. Therefore the Company believes that the proposed ventilation shaft should be constructed at the Company's preferred site in the Awaba Bay - Bolton Point area.

Overall, the Company has a successful 'track record' in the construction and operation of ventilation fan shafts in the region and is confident that it can construct and operate this necessary facility at the Bolton Point location with minimal environmental impact to the local area. Approval from the various authorities to proceed with the development is now sought.

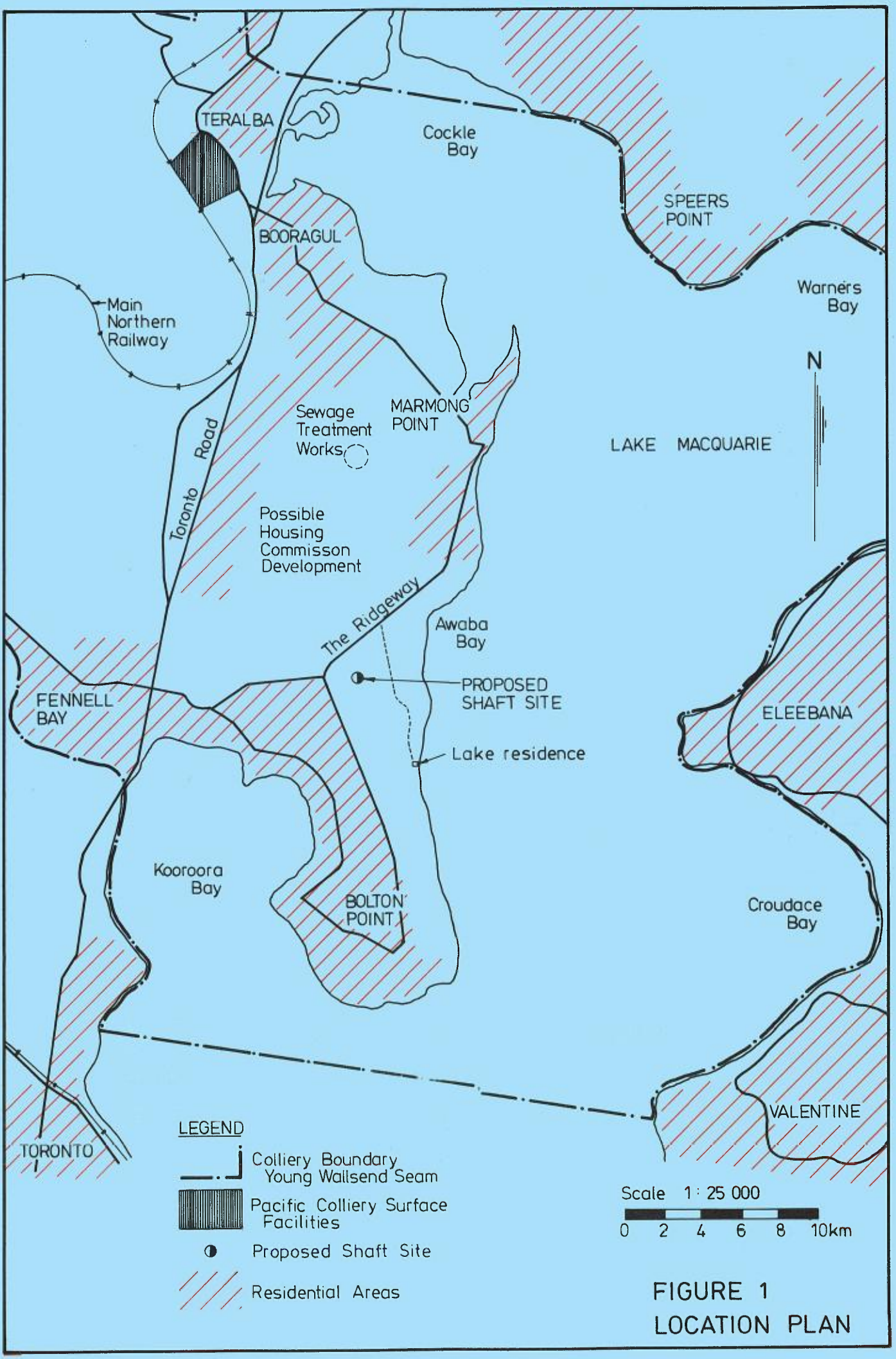


FIGURE 1
LOCATION PLAN

SECTION 2 : INTRODUCTION

2.1 SCOPE OF PROPOSAL

This Environmental Impact Statement (EIS) has been prepared to support a Development Application submitted to Lake Macquarie City Council for the proposed construction of an upcast ventilation fan shaft at Bolton Point. The proposal is a designated development within the meaning of Schedule 3 of the Environmental Planning & Assessment Regulation, 1980, as amended, and the EIS has been prepared in accordance with Clauses 34 and 35 of the Regulation.

This EIS describes the construction, operation and likely environmental impact of a ventilation fan shaft at Bolton Point. The site of the proposed shaft is shown in Figure 1. The shaft, to be known as the No. 3 Ventilation Fan Shaft, is required to allow the continuation of safe and efficient longwall mining operations at Pacific Colliery.

The shaft will be concrete lined, 370 m deep and 7 m internal finished diameter. Two upcast ventilation fans currently located at the John Darling Colliery (No. 4 Ventilation Fan Shaft at Belmont Lagoon) will be transferred and installed at the No. 3 Ventilation Fan Shaft site. The two upcast fans will each have a capacity of 150 cubic metres per second. One fan is required to be installed and operational by March 1988 and the second fan by 1991.

The underground mine plan for the Pacific Colliery requires that additional ventilation be provided in the general area of Bolton Point. Detailed investigations of available alternatives confirm that the construction and operation of the ventilation fan shaft at the preferred location will result in minimal environmental impact to the site and adjacent areas.

2.2 EXISTING OPERATIONS AT PACIFIC COLLIERY

The Pacific Colliery pit top which is located at Teralba is shown in Plate 1. It is one of four collieries which collectively form the Macquarie Collieries Group which supply coal to the Newcastle Steelworks and overseas. The Macquarie

Collieries is a part of the B.H.P. Steel International Group, Collieries Division. The mine currently produces 1.2 million tonnes of raw coal per annum which is washed at the Stockton Borehole Coal Preparation Plant and separated into coking and energy coal fractions. The energy coal fraction is exported. The coking coal fraction is used at the Newcastle Steelworks with any additional production being exported.

The colliery lease area includes the northern part of Lake Macquarie. Both existing and proposed workings are shown on the underground mine plan in Figure 2. The mine normally supports a full time workforce of 382 people.

2.3 NEED AND JUSTIFICATION FOR VENTILATION SHAFT

The ventilation shaft and associated fans are required to increase ventilation of the mine and to safely remove increased methane gas emission levels encountered since the longwall mining method was introduced at the colliery in 1983.

High levels of methane, experienced from longwall mining operations, necessitated the construction of a methane drainage plant at the colliery's pit top in 1985. The methane drainage plant creates a stability balance of methane levels within the mine. This is achieved by extracting excess methane make from mine goaf areas and methane drainage holes. The plant also provides a secondary role in assisting in the control of methane levels within the normal ventilation circuits. However, the prime role of controlling the methane levels in the ventilation circuit is achieved by the use of surface ventilation fan shafts similar to the one proposed at Bolton Point.

The purpose of providing adequate mine ventilation, in accordance with the Coal Mines Regulation Act 1982, is to render harmless,-flammable or noxious gases by dilution and to provide air containing not less than 19 per cent of oxygen in all parts of the mine. A further obligation is to provide adequate ventilation for the effective dilution of dust concentrations in the mine atmosphere.

Pacific Colliery's existing ventilation needs are satisfied by No. 1 downcast ventilation shaft and No. 2 upcast ventilation fan shaft, located at the Colliery's pit top at Teralba. The fan is presently operating at maximum

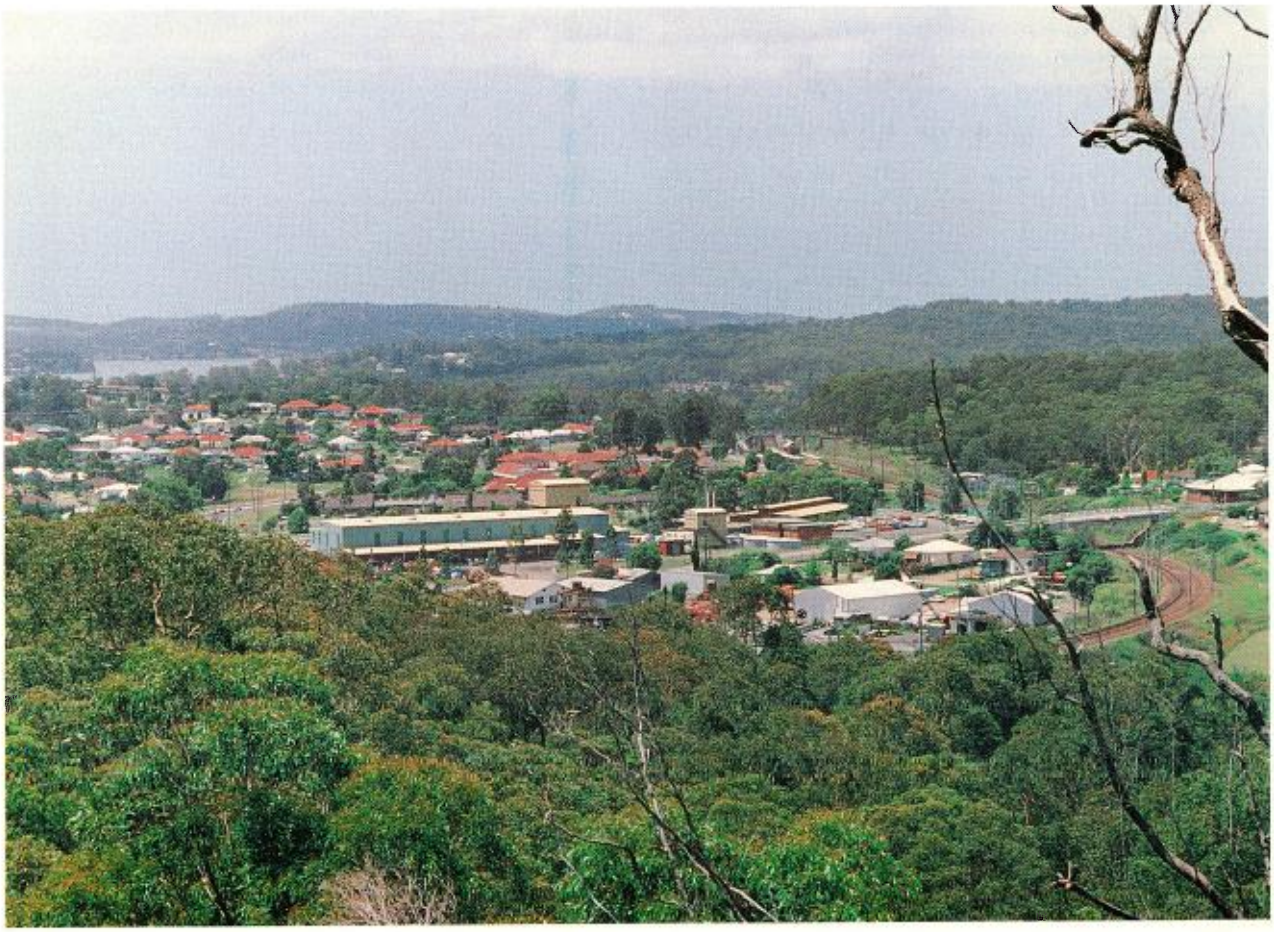


PLATE 1: GENERAL VIEW OF PACIFIC COLLIERY, SHOWING FACILITIES AND ADJACENT RESIDENTIAL AREA.

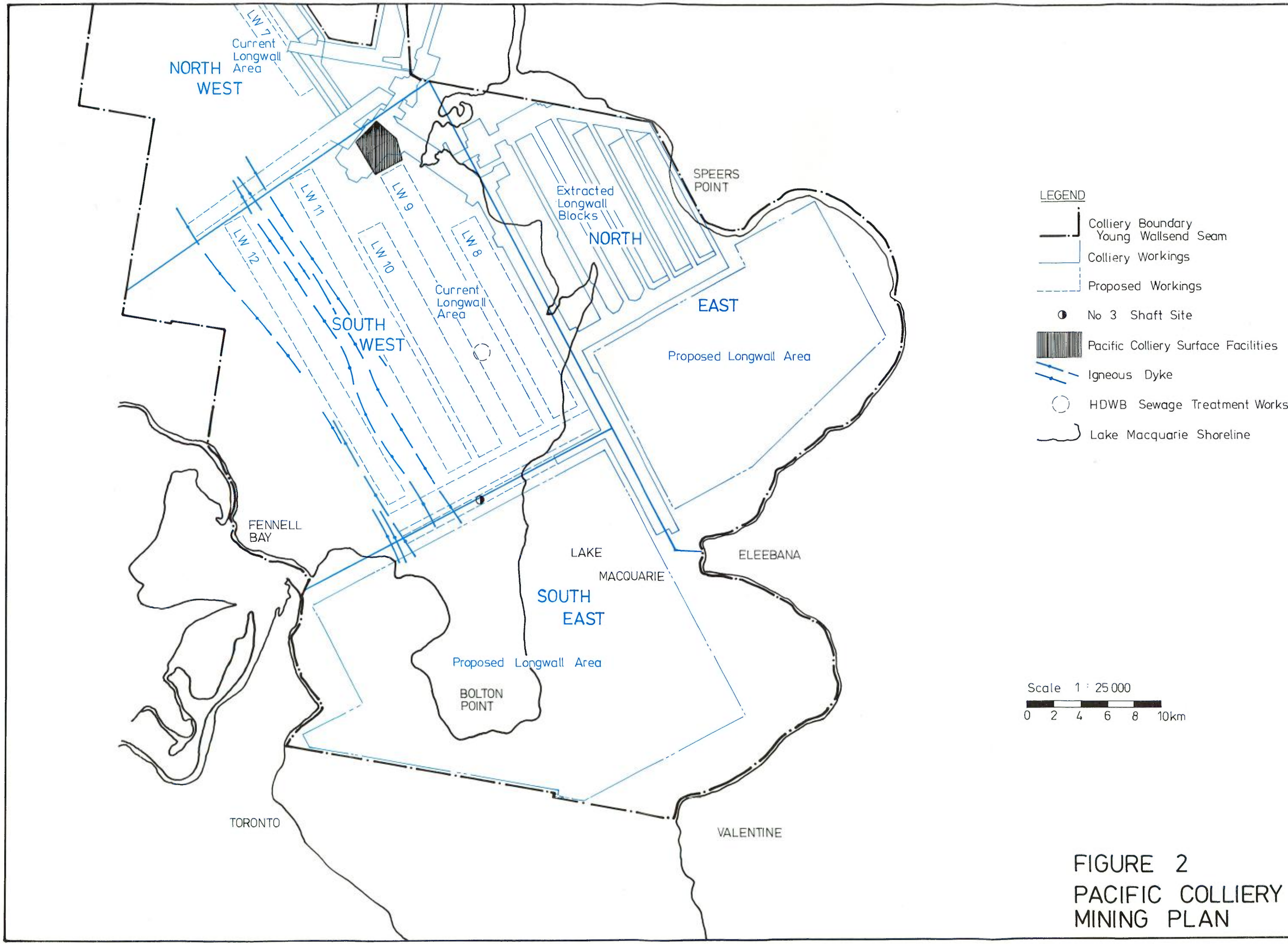


FIGURE 2
PACIFIC COLLIERY
MINING PLAN

capacity and will satisfy the Colliery's ventilation needs only until such time as the main longwall production unit transfers from the northwest area (longwall block number 7) to the southwest area of the colliery lease (longwall block numbers 8 to 11).

Planned future production operations at the Colliery have always relied upon the provision of an additional upcast ventilation fan shaft. The requirement of an additional upcasting ventilation fan shaft has been established by simulating ventilation requirements of planned future workings using both analytical and computer aided techniques. The new ventilation fan shaft needs to be strategically located to satisfy all the Colliery's ventilation needs for the orderly development and maximum recovery of the coal resource in the southwest and southeast quarters of the colliery lease in the immediate future.

2.4 APPROVALS SOUGHT FOR THE DEVELOPMENT AND AUTHORITIES CONTACTED

The Director, Department of Environment & Planning, Lake Macquarie City Council and other Government Departments having responsibility for the protection of the environment have been consulted with respect to the proposed development. The owners of the land, the N.S.W. Department of Housing have also been consulted with respect to the proposed development and have agreed in principle to use of the land. Conditions upon the development may be incorporated in the approval by the Department of Housing.

The Director, Department of Environment & Planning was consulted with respect to matters to be addressed by the EIS (Appendix 1). He advised that the proposed development is subject to a direction under S.101 of the Environmental Planning & Assessment Act and that consequently the Minister for Planning & Environment will determine the Development Application.

Lake Macquarie City Council has also specified a number of principal environmental issues to be addressed in the EIS. The proposed development site is located on land zoned 6(c) - Open Space (Local Reservation). B.H.P. Collieries has submitted a request to Council to rezone the small area required for the site to 4(b) - Special Industry (Coal Mining). Lake Macquarie City Council has expressed the view that a development application for the proposed

development may be determined under the provisions of Clause 22 of the Lake Macquarie Local Environmental Plan, without the necessity to await gazettal of the requested rezoning. This concurrence of two procedures will afford considerable time savings in obtaining final development consent.

Apart from the requirement to obtain a development consent, formal land tenure is required. This will take the form of a Mining Purposes Lease (MPL) for which application to the Department of Mineral Resources has already been made. In addition, approvals and licences will be sought from the State Pollution Control Commission for the construction and operation of this facility.

In preparing this EIS, the following Authorities have been consulted and their requirements noted.

* The State Pollution Control Commission
* The Soil Conservation Service
* National Parks & Wildlife Service
* Lake Macquarie City Council.

2.5 CONTENT OF THE IMPACT STATEMENT AND ENVIRONMENTAL INVESTIGATIONS

In the preparation of this document, reference has been made to the requirements of the relevant State and Local Government Authorities. In Section 3 of the EIS the project is described in detail. This is followed in Section 4 by an assessment of the existing environment and the presentation of the results of a number of specialist studies describing the site. Design and operational safeguards are then described and an assessment is made of environmental impact in Sections 5 and 6 in accordance with the Environmental Planning & Assessment Act 1979 and Regulation 1980. Alternatives to the proposal are then discussed in Section 7. Studies conducted for the project, and additional information, are provided in the Appendices.

The EIS was prepared by staff from the Macquarie Collieries Group in association with Croft & Associates, Environmental Consultants. Other specialist work was

undertaken by B.H.P. Engineering (acoustic studies), Australian Groundwater Consultants (groundwater investigation), Resource Planning (flora and fauna) and Ms. J. McDonald (archaeology).

SECTION 3 : DESCRIPTION OF THE PROJECT

3.1 PROJECT COMPONENTS

The proposed Pacific Colliery No. 3 Ventilation Fan Shaft will be concrete lined, approximately 370 metres deep and 7 metres internal finished diameter. Once the shaft is constructed by the conventional method of drilling, blasting and mucking out, a ventilation fan, transformers and electrical switch room will be constructed on the site. It is proposed to initially relocate one fan from the John Darling Colliery No. 4 ventilation fan shaft in Belmont Lagoon to this site and have this fan operational by March, 1988. The second fan from Belmont Lagoon will be required to be operational at the new shaft site by 1991. Neither man riding nor material handling facilities will be provided at the new shaft site.

The essential components of the project are listed below:

i. upgrading of an existing track off The Ridgeway to allow access to the site and the provision of electricity and water supplies

ii. the disturbance of an area of 1.2 ha to contain the ventilation shaft, sedimentation dam and surface facilities

iii. the construction of drainage and water management controls to prevent uncontrolled poor quality water leaving the site

iv. erection of temporary facilities on site for the 14 month shaft sinking period. The facilities will be removed when the first fan is commissioned.

v. the sinking of the lined air shaft involving sequential drilling, blasting, mucking out (i.e., spoil removal) and concrete lining

vi. the transport of spoil away from the site

vii. the installation of pipelines in the shaft to enable the supply to the mine of materials such as nitrogen, stone dust and fly ash if required in emergency situations

viii. the installation of two upcast ventilation fans

ix. the operation of the ventilation fans and maintenance activities once the fan(s) are commissioned

x. the controlled release of treated excess groundwater from the

sedimentation dam to the Lake.

Once the shaft is constructed and commissioned the operation of the fans will be automatically controlled and monitored.

No personnel will be permanently stationed at the site, however, electricians and fitters will visit the facility on a weekly basis for maintenance purposes. Cleaners and security personnel will also visit the facility on a regular basis.

3.2 FACTORS DETERMINING SHAFT LOCATION

The preferred location of the proposed shaft was determined by two major factors:

i. The shaft site is in an environmentally acceptable location and will result in minimal disturbance to the surrounding environment.

An over-riding factor in the selection of the location is the fact that a large portion of the colliery's lease holding is actually under Lake Macquarie and much of the adjacent land area is potentially residential. Therefore the number of available shaft locations is restricted by the area of land available and the mine plan.

The selected site is within a timbered gully below The Ridgeway and as such, the installation will be visually unobtrusive. The location and fan orientation within the gully was selected to minimise any potential noise impacts on neighbouring residential areas. Any other potential impacts also appear to be minimised by the choice of this site.

ii. The shaft site is compatible with the geology of the colliery lease, the mine planning layout and the underground ventilation networks.

Geological factors are significant constraints on mine development and layout planning for Pacific Colliery. The trend of geological structures (faults and dykes) dictates the orientation of access headings and longwall extraction blocks. Given geological and economic constraints, the mine plan divides the southern areas of the colliery lease into approximately two

equal parts, i.e., the southeast and southwest quarters (Figure 2). This division is required to maximise mining efficiency, minimise sterilisation and ensure viability of the colliery. The longwall mining system at Pacific Colliery is essential to enable the mine to be competitive against other efficient coal producers in the existing market place.

The No. 3 ventilation fan shaft location must conform to the mine plan for the colliery and satisfy the ventilation requirements of the remaining areas of the colliery lease. The location identified in the Awaba Bay - Bolton Point Area adequately meets these requirements.

3.3 LAND OWNERSHIP AND ZONING

The New South Wales Department of Housing owns the land between The Ridgeway and Lake Macquarie on which it is proposed to construct the ventilation shaft. The property description is Part Lot 321, DP 700700 being Part Portion 37, Parish of Awaba, County of Northumberland.

The land is currently zoned 6(c) Open Space (Local Reservation) by the Lake Macquarie City Council's Local Environmental Plan. B.H.P. Collieries has recently made application to the Lake Macquarie City Council for an area of 3 hectares comprising the proposed site and access track to be rezoned by Council to 4(b) Special Industry (Coal Mining).

The site selected for the ventilation fan shaft and surface facilities is shown in Figure 3 as is the area for which rezoning application has been made. The rezoning application has been placed on public display and has been sent to the Minister for Planning and Environment for his approval.

3.4 CONSTRUCTION AND OPERATIONAL DETAILS OF THE PROJECT

The details of the project are listed in the following sections.

3.4.1 Civil Engineering Works

i. Upgrade the existing access track with suitable road base to 5 m wide, suitable for single lane and extend to the site. The existing track is currently used for access to a small cottage (the lake residence referred to later). The Company will ensure that the existing access to the lake shore and cottage will not be encumbered by the proposal.

ii. Construct water management facilities including culverts for creek flow under the erection pad, upslope runoff diversion drains and a chambered sedimentation dam with an underflow pipe to the Lake.

iii. Clear vegetation from the 1.2 ha site and undertake the construction of a level erection pad. Civil works associated with the pad will involve the cut of approximately 6500 m^3 of material and the fill of approximately 6600 m^3.

iv. Construct a man-proof security fence and gates around the erection pad, sedimentation dam and batters.

v. Supply water and power services to the site.

vi. Deliver and erect all temporary buildings on the site. Temporary buildings will include on-site offices, bath house, lamp cabin, workshop and storage facilities.

3.4.2 Shaft Sinking Operations

i. A headframe will be erected on site and a winder house, winder and other facilities (cables, signals, compressed air lines, guide ropes, pump out lines and auxiliary ventilation fans) will be established during construction. The headframe will be approximately 24 m high while other structures will be less than 7 m. The auxiliary fans to provide for shaft ventilation during construction will be of 12 m^3/sec capacity.

ii. Follow a routine of sequential drilling, blasting, mucking out (i.e.,

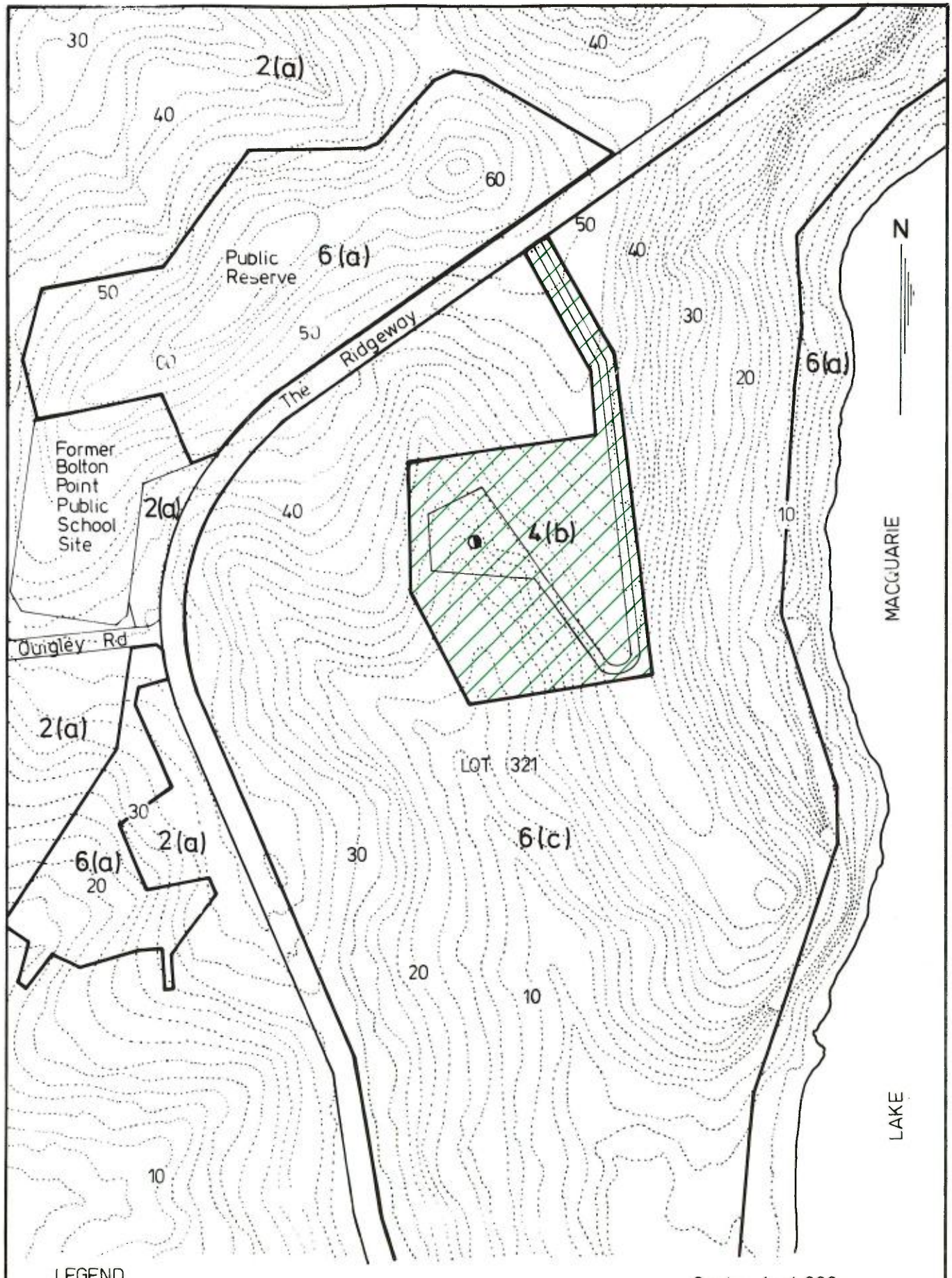


FIGURE 3
ZONING PLAN

cleaning rock out) and concrete lining during construction. It is intended that construction will average 2 metres of shaft digging and lining per day and that approximately 14 months will be required to construct the shaft, motor room, electrical control room and commission the facility to the fully operational stage.

iii. It is anticipated that a crew of 6 to 8 men per shift will work 24 hours per day for 6 days per week to achieve the commissioning date of March, 1988. Small-scale controlled blasting activities (200 to 300 kg) will be necessary up to 2 times per day during daylight hours to loosen rock to enable its removal from the shaft. Material won from the shaft will be placed in a small stockpile (60 cubic metres) from where it will be loaded into trucks for transport offsite.

iv. Progressively erect formwork and import and pour concrete from existing suppliers in the area. It is not proposed to establish a concrete batching plant on site.

v. Complete shaft sinking and lining and progressively remove headframe, winder house, winder and other ancilliary equipment from the site.

The layout of the site during shaft sinking operations is shown on Figure 4.

3.4.3 Spoil Removal

i. During construction approximately 15,000 bank cubic metres of spoil will be excavated from the shaft at the proposed site. Spoil originating from the shaft will primarily be transported by truck to the Stockton Borehole Coal Preparation Plant where it will be utilised for general construction purposes. However, some spoil may also be taken to the Fennell Bay Public School to assist in the possible construction of sports grounds.

ii. Trucks leaving the site will primarily travel in a northerly direction along The Ridgeway. Giveway signs facing the direction of the trucks leaving the site will be placed at the intersection of the access track and The Ridgeway.

The Lake Macquarie City Council have advised that the intersection of the access track and Ridgeway Road is of adequate standard as the number of truck trips per day is low and the construction period relatively short.

iii. During the construction period, trucks leaving the site with spoil will average 15 per day. It is anticipated that one, or possibly two, small 12t dump trucks will be used for spoil removal and that they will be loaded by a front-end loader from the spoil stockpile.

3.4.4 Ventilation Fan Commissioning

i. Dismantle and overhaul one ventilation fan and silencer from the Belmont Lagoon facility of John Darling Colliery.

ii. Transfer fan and silencer to shaft site.

iii. Erect fan and silencer at the prepared site and complete construction of permanent buildings and structures such as fan motor room, associated ducting, fan evasse', electrical control room and switchyard.

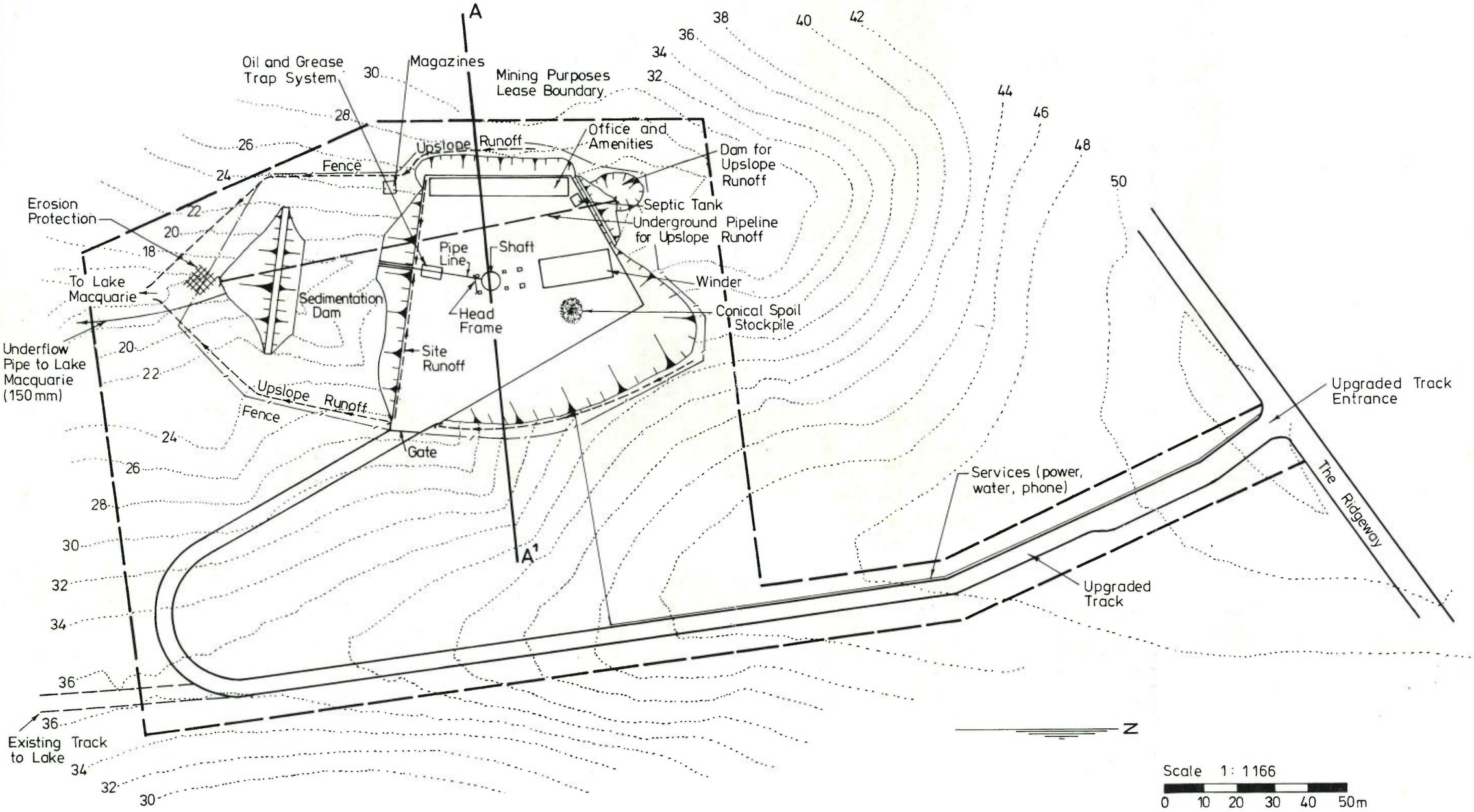
iv. Commission ventilation fan and silencer.

v. Repeat the process for a second ventilation fan and silencer from John Darling Colliery in 1990/91.

A detailed plan of the layout of the ventilation fan shaft, evasee', silencer, and motor room is shown in Figure 5 while Figure 6 shows the site when fully commissioned and with both fans operational. Approximately 2 ha of the 3 ha proposed to be rezoned will be disturbed by the proposal.

3.5 ON-SITE WATER MANAGEMENT

The ventilation shaft will be constructed across and near the head of a small gully which contains an ephemeral watercourse. To minimise any impact of the



LEGEND

Mining Purposes Lease (MPL) Boundary

32 Contours at 2m Intervals

FIGURE 4

SITE LAYOUT DURING CONSTRUCTION

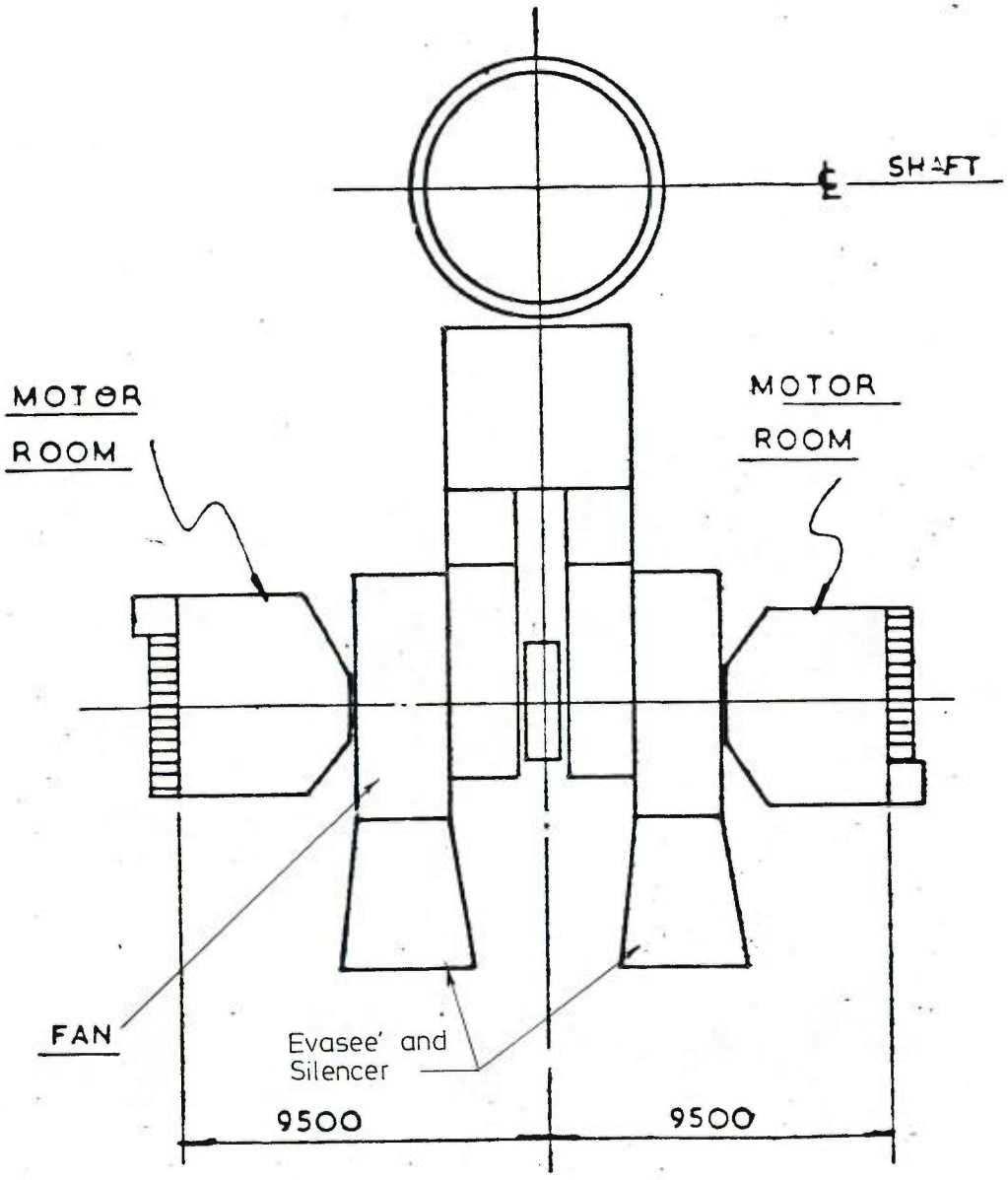
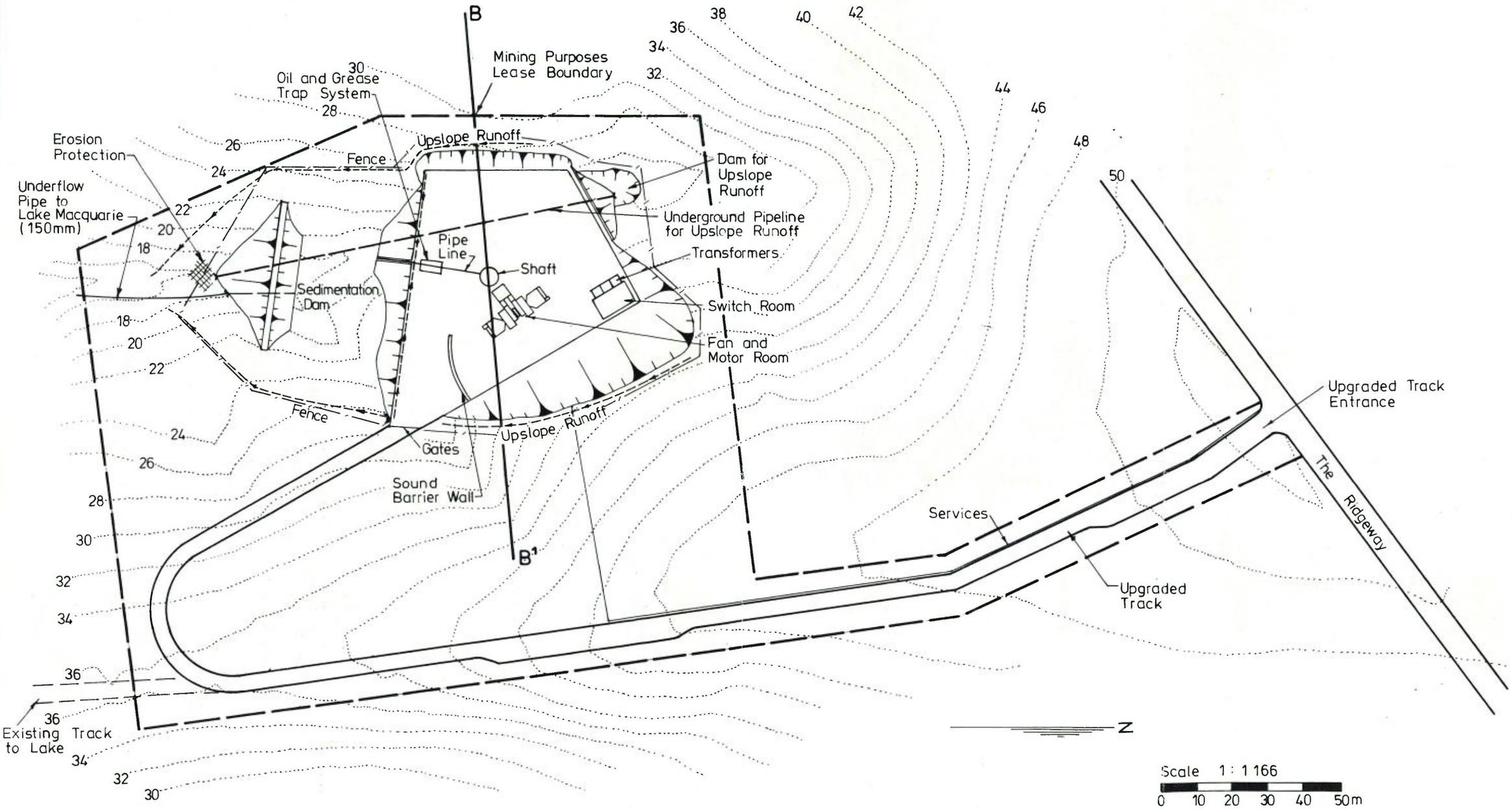


FIGURE 5

FAN, MOTOR ROOM AND SHAFT LAYOUT



LEGEND

Mining Purposes Lease (MPL) Boundary

32 Contours at 2m Intervals

FIGURE 6
SITE LAYOUT DURING COMMISSIONING

proposed development on the quality of water in the existing watercourse and in Lake Macquarie, the following principles will be implemented in the design and operation of the facility.

i. Uncontaminated upslope runoff will be diverted around or piped under the facility and allowed to continue toward the receiving water body. The runoff will be diverted by vegetated/stabilised diversion drains and an underground pipeline as indicated in Figures 4 and 6. Runoff from the catchment above the facility will be contained in a small dam and transferred under the site and sedimentation dam via a small diameter pipeline.

ii. A 2 ML sedimentation dam will be constructed downstream from the facility to collect runoff from the site itself and water accumulated in the shaft. This storage volume is sufficient to contain runoff generated by a 1 in 10 year design storm with a rainfall intensity of 70 mm/hr falling for a duration of 1 hour. Any solids in suspension will be settled before water is released via a buried underflow pipeline to the Lake. A water monitoring programme has established that the salinity of Lake Macquarie varies at this site between 17,000 and 27,000 mg/L and that the likely saline content of shaft water will be between 10,000 and 16,000 mg/L initially, falling to less than 1,000 mg/L at depth. After settling, the ground water will be able to be released to the Lake without any detrimental effects occurring in the receiving waters. The underground pipeline (150 mm diameter) will transfer the water over the 500 m from the dam to the Lake, where the ground water will mix with the saline lake water.

Water management and erosion controls are described in detail in Section 5.2.

3.6 FAN DESIGN, PERFORMANCE AND NOISE LEVELS

The ventilation fans, silencers and motors to be installed at the Bolton Point site will be those currently located at the John Darling No. 4 ventilation shaft in Belmont Lagoon. Initially, one fan only will be relocated to the Pacific Colliery fan shaft site with the other transferred in approximately 1991.

Prior to the selection of the site, a detailed investigation of fan noise and the effect of fan orientation and alignment to determine the optimal site for the facility was undertaken by B.H.P. Engineering. The site selected because of its topography and vegetation provides for minimal environmental impact and maximum protection for both existing residents in surrounding areas and future residents in the area bounded by The Ridgeway and Quigley Road respectively. In addition,

the fans to be commissioned are relatively new, will be refurbished and balanced and have acoustical treatments in their design.

A summary of the fan noise investigations and acoustical report is presented in Appendix 2.

The fans are Sturtevant 8132 type twin mine fans. Each is powered by a 550 kW variable speed electric motor with a maximum speed of 490 rpm. The impellors have eight backward inclined aerofoil section blades producing an airflow of up to 150 m^3/sec for a total pressure of 2.0 kPa. The discharge from the fans is horizontal.

The measurement and assessment of noise emissions from the operation of mine ventilation fans can be divided into three areas.

i. The measurement of sound emissions from the fans in their immediate vicinity, i.e., within 30 m of the site.

ii. The measurement of background sound levels in the neighbourhood or likely affected area of the proposed site.

iii. The evaluation of reductions in sound levels caused by topography, distance attenuation, vegetation and meteorological effects.

The assessment of the effects of noise emitted from the fans and the potential for noise annoyance comes from a comparison of the existing background sound levels with the sound levels expected from fan operation, at the nearest houses. This is the procedure given in Australian Standard AS1055-1984 "Acoustics - Description and Measurement of Environmental Noise" and the State Pollution Control Commission's "Environmental Noise Control Manual, 1984".

An "environmental goal" or acceptable sound level for the neighbourhood at various times of the day is selected. This is based on existing or acceptable background sound levels typical for the type of area. The potential for noise annoyance from a proposed development is then dependent upon the increase in sound levels above the environmental goal expected to be caused by the proposed development. For 24 hour continuously operating plant, the environmental goal is usually specified for the night period.

Background sound levels were measured at 17 locations in the residential neighbourhood of the proposed site (refer to Appendix 2).

Fan sound emissions were measured at the John Darling No. 4 fan shaft site in Belmont Lagoon. Only one fan (the northern unit) was operating during the measurements. The southern fan will be the unit to be moved initially, but as both fans are of identical specification and performance, the spectra and distance attenuation effects of both fans are in the Company's experience expected to be similar.

The sound level at 30 m from the front of the fan discharge was 70 to 75 dB(A). The fan specifications were for the sound level at 30 m to be 55 dB(A) or less, and during commissioning in 1984 this sound level was achieved. The increase of 15 to 20 dB(A) above specification is caused by poor maintenance of the noise control splitter silencer elements and inlet restrictions underground causing air stretching and turbulence. When the fans are moved, each will be overhauled and refurbished and measures taken to ensure that inlet restrictions and poor maintenance of silencer elements do not occur. The specification sound level of 55 dB(A) at 30 m will then be achieved and maintained.

3.7 WATER AND POWER SERVICES

Water to the site will be provided from the Hunter District Water Board's reticulated system. A 50 mm diameter pipe will be laid from the watermain at the nearest residential area and the route will follow the access road into the site. Approximately 2,500 litres will be required daily for potable and bath-house use and approximately 10,000 litres per day will be required for the shaft sinking and drilling operation. Details of water supply to the site have been discussed with Officers of the Hunter District Water Board.

As previously described, transformers and an electrical switch room will be constructed on site. Power required during construction and for the later operation of the fans will be obtained from an existing 11 kV transmission line. The route for the overhead transmission line to the site will follow the upgraded access track, then divert directly downslope to the facility. These arrangements have been discussed with Shortland Electricity.

3.8 REHABILITATION AND LANDSCAPING

Only the minimum area of land necessary will be cleared and disturbed for this development. The total area disturbed will be less than 2 hectares, and of this, 1.2 hectares will be occupied by the development when operational.

All disturbed ground including batters will be stabilised with appropriate grasses, and ground cover species. Trees and shrubs common to the site will be replanted as soon as is practicable. To assist in rehabilitation of the site any suitable topsoils present will be conserved for use in the landscaping and rehabilitation programme.

The metal cladding which shrouds the fans and motor rooms will be painted an olive green colour and any other materials used in the development will be appropriately coloured so as to be unobtrusive to any visitors to the area and so that the facility blends in harmoniously with the surrounding bushland.

3.9 ENERGY CONSERVATION

The construction of the shaft and erection of the fans will consume minor amounts of energy in the form of fuel to operate machinery, and power to operate the winder, lights and workshop, and other plant.

Once commissioned the main energy consumption onsite will be the power required to operate the motors which drive the fans and security lights. It is estimated that the operation of both fans will consume a total of approximately 22×10^6 mega joules per year.

This consumption of energy is about one millionth of the energy output of the colliery of approximately 24.5×10^{12} mega joules per year in the form of washed coal.

The major form of energy conservation employed by the proposed development is the use of variable speed fans. This ensures that the fan duty is matched to the mine's ventilation requirements and that energy is not needlessly consumed in operating fans at higher speeds than is necessary.

3.10 EXISTING VENTILATION SHAFT AT BELMONT LAGOON

It is currently proposed to cease mining at John Darling Colliery during 1987. If this closure occurs as planned, the No. 4 Ventilation Shaft and its two upcast fans which were constructed on the island in Belmont Lagoon will no longer be required.

It is proposed to eventually remove all buildings and structures from the island. The shaft will be sealed to ensure that it complies with the safety requirements of the Coal Mines Regulation Act, 1982. It will then be possible to rehabilitate the unvegetated portion of the island. The Company currently intends to retain the freehold title to the island and will finalise its plans for the use of the island in consultation with the Lake Macquarie City Council and other relevant authorities.

Two photographs of the existing facility at Belmont Lagoon are reproduced in Plates 2 and 3.

PLATE 2: GENERAL VIEW OF JOHN DARLING NO. 4 VENTILATION SHAFT IN BELMONT LAGOON, SHOWING THE AREA OCCUPIED BY THE FACILITY AND ITS SURROUNDS WHEN LOOKING TOWARDS THE WEST.

PLATE 3: VIEW OF JOHN DARLING NO. 4 VENTILATION SHAFT IN BELMONT LAGOON SHOWING THE HEIGHT OF THE FACILITY AND LANDSCAPING WHEN LOOKING TOWARDS THE SOUTHWEST.

SECTION 4 : THE EXISTING ENVIRONMENT

4.1 LOCATION AND TOPOGRAPHY

The preferred site is located in a timbered gully within a large area of bushland on the western side of Lake Macquarie in the Awaba Bay - Bolton Point area (Figure 1). The land is bounded by the Lake to the east (Awaba Bay) and a road known as The Ridgeway to the west. This bushland forms a part of an attractive landscape as a backdrop to Awaba Bay when viewed from the northern and eastern shores of the Lake.

Within this large area of bushland, an access track follows the main ridgeline which extends from the Ridgeway in a southeasterly direction towards the Lake. To the east of this ridgeline, the land slopes down to the water. To the west of the ridgeline the land slopes down to a small gully which has moderate slopes on either side. It is proposed to construct the No. 3 Ventilation Fan Shaft within this well hidden gully.

One existing cottage and series of small jetties are present on the shores of the Lake at the termination of the access track. The area near to the Lake is used for recreational pursuits such as walking and fishing. The land close to The Ridgeway, along the access track and sections of the creek is commonly used as an illegal rubbish dump for household refuse and abandoned cars.

The topography of the proposed site and the surrounding area is shown in Figure 3. The main topographical features are the small gully where it is proposed to construct the ventilation fan facility and a low ridge orientated on a northwest-southeast axis. Site slopes generally average about 11 degrees, although the average slope of the access track along the ridgeline is only of the order of 3 degrees.

4.2 GEOLOGY

The geological formation which outcrops in the vicinity of the shaft site is the Teralba Conglomerate. This unit is predominantly a pebble conglomerate with

sandy phases. It outcrops on the adjacent ridges and in the floor of the valley immediately west of the proposed shaft site. In the gully the bedrock is overlain by up to 3 m of soil and weathered strata.

During shaft sinking, the typical lithologies which will be intersected are conglomerate, sandstone, shale, tuff and coal. Of these, the conglomerate is expected to be the dominant lithology. Up to ten (10) separate coal bearing units will be intersected but only the Young Wallsend/Yard seam is of economic importance. Two other seams, the Australasian seam and the Montrose/Wave Hill seam may have marginal economic potential but are unlikely to be worked. The inferior coal seams consist of coal interbedded with shale or tuff.

The strata are typical of the Newcastle Coal Measures. No unusual lithologies or structures are expected to be intersected. The graphic borelog for BHP Pacific DDH 17 (N1739) is shown in Figure 7. This bore was drilled some 10 m from the centreline of the shaft. All core has been photographed, geomechanically logged and samples have been strength tested in relation to engineering properties.

4.3 SOILS AND LAND CAPABILITY

The soils of the area support native vegetation but are generally poorly developed for agricultural purposes. Soil types vary between podsols in the gullies and side slopes where there is a deeper profile to thin skeletals on the ridges. The soils are generally poor and tend to be susceptible to erosion. Land capability classification for the area according to the Soil Conservation Service is Class 6, which is described as being suitable for grazing but cultivation should not be practised.

4.4 HYDROLOGY

4.4.1 Surface Drainage

The drainage pattern can be inferred from the topographic plan shown in Figure 3. A number of small ephemeral tributaries converge downstream from the proposed site with surface runoff discharging into Lake Macquarie. Although the development will affect the small drainage line at the site, all upslope runoff

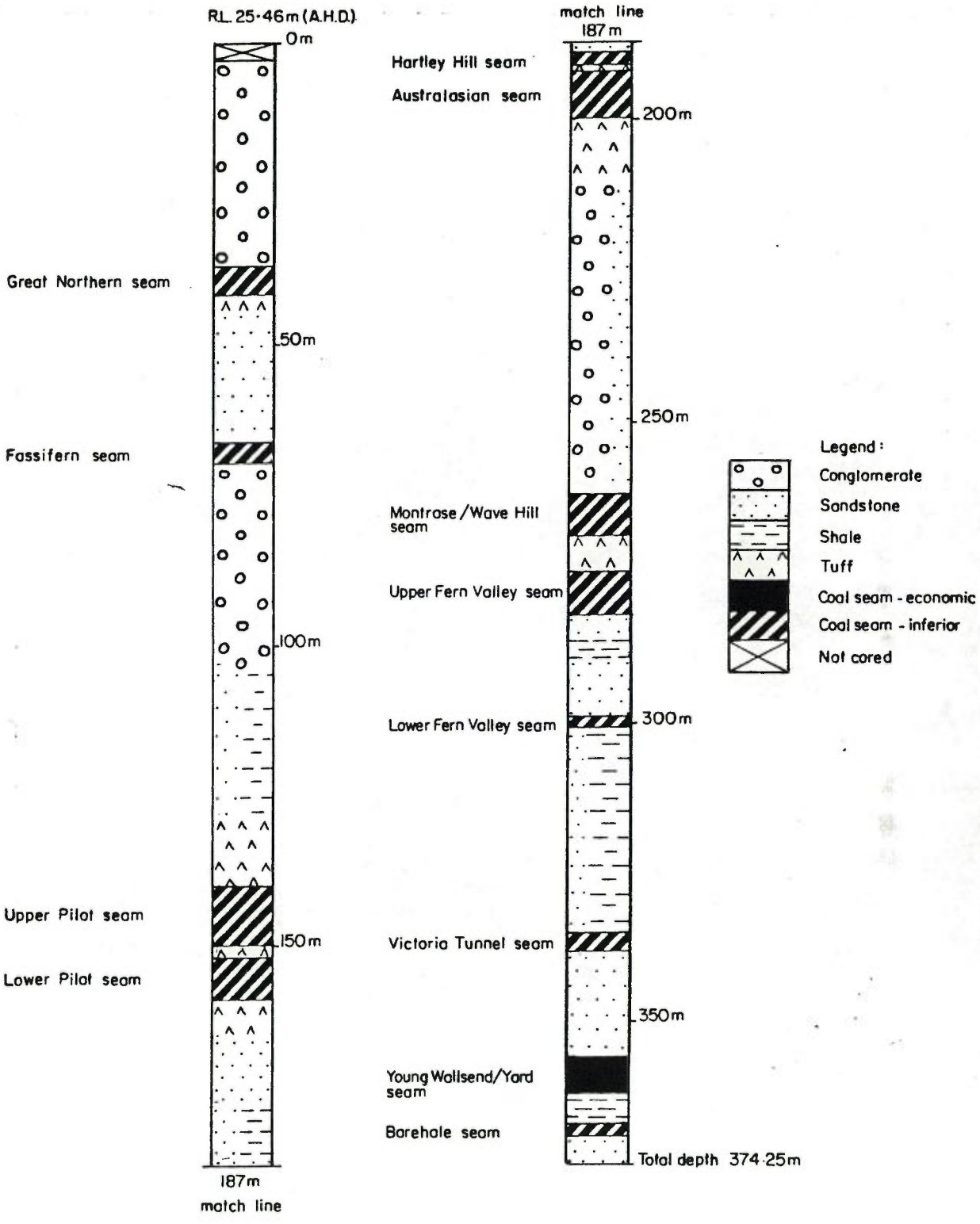


FIGURE 7
GEOLOGICAL BORELOG

will be channelled around or under the facility before freely discharging downstream. Runoff from the site only occurs after prolonged periods of rainfall.

Prior to the design of the on-site water management system, a water quality monitoring programme was undertaken to examine the quality of water in both the ephemeral watercourse and at the receiving point in Lake Macquarie. The results of monitoring are contained in Tables 1 and 2 and clearly indicate a significant difference between water sources.

While it is recognised that there is poor tidal flushing in Lake Macquarie, the conductivity results clearly indicate that the Lake water is highly saline at this location.

TABLE 1

EPHEMERAL CREEK AT SHAFT SITE

Date	pH	Non-filterable Residue mg/L	Conductivity mS/m	Biological Oxygen Demand mg/L O_2	Rainfall During Previous Week mm	Comments
6/8/86	6.3	22	18	<1	107.5	Flow
13/8/86	6.4	3	33	<1	16.5	Flow
20/8/86					6.8	No flow
27/8/86					4.0	No flow
3/9/86	6.3	10	39	1	2.0	No flow. Sample taken from pond 10 m upstream.
10/9/86	6.5	18	68	<1	0	No flow. Sample taken from pond 10 m upstream.
17/9/86	6.2	21	38	2	18.0	No flow. Sample taken from pond 10 m upstream.

By comparison, the creek water is of much lower conductivity, i.e. salinity, and of a lower pH. Following rainfall it is very likely that the creek water would be further diluted by upslope runoff resulting in lower salinities. On the other hand, concentrations of suspended solids, i.e. non-filtrable residue, would probably increase following rainfall.

TABLE 2

LAKE MACQUARIE AT CREEK DISCHARGE POINT

Date	pH	Non-filterable Residue mg/L	Conductivity mS/m	Biological Oxygen Demand mg/L O_2	Rainfall During Previous Week mm
6/8/86	7.8	35	2700	<1	107.5
13/8/86	8.1	4	3610	<1	16.5
20/8/86	8.1	28	4280	<1	6.8
27/8/86	8.2	30	3820	<1	4.0
3/9/86	8.1	24	4160	<1	2.0
10/9/86	8.1	26	3710	<1	0
17/9/86	8.0	29	3810	<1	18.0

The water quality of Lake Macquarie has previously been documented by the State Pollution Control Commission in the Environmental Audit of Lake Macquarie (1983). A number of prime environmental concerns related to deteriorating water quality in the Lake have been presented in this document. The results of environmental monitoring at this site indicate that surface runoff from this site is unlikely to affect water quality within the Lake.

4.4.2 Groundwater

Groundwater investigations were undertaken during the drilling of a borehole at the site to determine the groundwater environment expected during the excavation of the proposed Pacific Colliery No. 3 ventilation shaft. Investigations were conducted by the Company in conjunction with Australian Groundwater Consultants.

A copy of the Australian Groundwater Consultants' report is contained within Appendix 3. The main results of the investigations are as follows:-

i. Coal seams are the major aquifers.

ii. Groundwater pressures are expected to be close to hydrostatic in all coal seam 'aquifers'.

iii. Inflows during drilling were low, with no test yielding greater than 0.04 ML/day. Calculated permeabilities were generally less than 0.2 m/day and values of this order are anticipated over minor thicknesses only, with the majority of the hole yielding water at immeasurable rates.

iv. A range of inflow predictions have been made for each inflow zone. Initial flows of up to 0.3 ML/day have been calculated however these are considered upper limits, with flows more likely to be less than 0.1 ML/day initially, and decreasing to less than 0.05 ML/day after 3 days.

v. Water quality monitoring, although influenced by the introduction of potable drilling water, indicated that upper aquifers would be saline (10,000 to 16,000 mg/L) and lower aquifers would decrease in salinity to levels below 1,000 mg/L.

vi. There will be no detrimental effect on the regional groundwater regime as a result of the proposed development.

The results of the groundwater analyses for waters from the nearby Pacific Colliery are presented in Table 3. The results are indicative of waters likely to be encountered in mine workings in the Bolton Point area. The waters are of moderate salinity with reasonably high non-filtrable residue concentrations. Disposal of such waters to Lake Macquarie after a primary settling period will result in waters low in suspended solids leaving the site with salinities having little or no impact on the receiving waters due to the existing estuarine conditions.

TABLE 3

GROUNDWATER AT PACIFIC COLLIERY

Date	pH	Non-filterable Residue mg/L	Conductivity mS/m	Biological Oxygen Demand mg/L O_2	Rainfall During Previous Week mm
6/8/86	8.1	145	31	<1	107.5
13/8/86	8.5	425	573	1	16.5
20/8/86	8.6	1,450	455	14	6.8
27/8/86	8.5	380	570	2	4.0
3/9/86	8.6	1,260	608	2	2.0
10/9/86	8.5	310	530	1	0.0
17/9/86	8.7	420	543	4	18.0

4.5 FLORA, FAUNA AND ECOLOGY

The results of a commissioned flora and fauna survey of the site are contained in Appendix 4. The objectives of the survey were to:

i. Map and describe the main vegetation communities occurring on the site.

ii. Identify and list as many vascular plant and vertebrate fauna species occurring on or likely to utilise the site.

iii. Assess the conservation status and value of species, vegetation units and habitats and discuss the sensitivity of components to disturbance.

All of the area adjacent to the northwestern shores of Lake Macquarie between Bolton Point and Marmong Point, except for an access track to the water, retains a cover of bushland comprising mixtures of predominantly Spotted Gum, Grey Gum, Stringybarks, Mahoganies, Red Bloodwood and Smooth-barked Apple. This bushland extends to the north and south along the foreshore of Lake Macquarie and westwards for some kilometres.

There have been mumerous disturbances to the site in recent years including track development, rubbish dumping, logging and frequent fires. This has resulted in

an overall degradation of the bushland.

4.5.1 Flora

The dominant vegetation communities of the site are the Spotted Gum/Grey Gum/White Stringybark (Community 1) and Spotted Gum/Grey Gum/Bastard Mahogany (Community 2) eucalypt associations. The former occurs on the higher flanks of the ridge while the latter follows the drainage line that passes through the site.

The understorey vegetation of both communities includes typical dry sclerophyll species while that of Community 2 incorporates some wet sclerophyll or rainforest species, however these elements are very poorly represented on the site.

The impact of logging, repeated fires, access track clearing and weed infestations have all contributed to the degradation of the natural vegetation on the site.

No rare or endangered flora species were observed.

4.5.2 Fauna

A brief fauna survey conducted at the site indicated a relatively small and insignificant fauna population. This result reflects the degraded state of the habitat due to past land use practices and possible predation by feral cats.

No rare or endangered fauna species were observed.

4.5.3 Conclusions

The consultants who conducted the flora and fauna survey presented the following conclusions to the Company.

i. The site is directly linked with a strip of vegetation along the western foreshore of Lake Macquarie, but is separated from large tracts of bushland to the west by the Bolton Point - Marmong Point Road.

ii. There have been numerous disturbances to the site resulting in a somewhat degraded bushland habitat.

iii. The site retains a natural dry sclerophyll forest cover typical of the Lake Macquarie area. Most of the bushland comprises a Spotted Gum/Grey Gum/White Stringybark community. There is a minor rainforest/wet sclerophyll element along the small gully in the west of the site.

iv. Sixty-one plant species were recorded on the site. The small number being attributable to both degradation of the vegetation through frequent fires and the small size of the site.

v. The site does not provide high quality habitat for fauna species in general but would still support a small number of animals, particularly avifauna and reptiles.

vi. No flora and fauna species of particular conservation significance occur or would be expected to occur on the site.

vii. The main vegetation community is not well reserved within the State but the site does not support a particularly good example of this vegetation type.

viii. The main conservation significance of the site is in its location within a continuous strip of bushland along the shore of Lake Macquarie.

ix. The wet sclerophyll/rainforest elements and gully community would be the most sensitive to adjacent disturbances.

A number of recommendations made to assist in minimising impacts on flora and fauna at the site have been incorporated in the design and operational safeguards for the project discussed in Section 5.

4.6 ARCHAEOLOGY

The results of a commissioned archaeological survey of the ventilation shaft site and access track are contained in Appendix 5. The results of the survey state that no archaeological site or relic is located within the area proposed for development. On this basis there is no archaeological constraint to developing the area for the air shaft and associated surface facilities.

No further archaeological work in the study area is considered necessary. Copies of the report contained in Appendix 5 have been sent to the Regional Archaeologist with the National Parks & Wildlife Service and the Secretary of the Koompahtu Local Aboriginal Land Council. The National Parks & Wildlife Service

have informed the Company that they have no objections to the proposed development on an archaeological basis.

4.7 AMBIENT NOISE LEVELS

Measurements of sound levels were made in residential areas near the proposed site and across the Lake at Eleebana and Valentine in June when sound transmission characteristics of the atmosphere are conducive to enhanced transmission. Measurements were made in daytime and night-time conditions to determine existing background sound levels and sound transmission properties around the Lake. The results are listed in detail in Appendix 2 and reference should be made to this report for details.

Major sound sources during daytime and early evening were motor vehicle traffic. At night time from about 10.00 p.m. the traffic noise was related to individual vehicles, whereas in daytime the traffic noise is more 'regional' from all sides of the Lake.

Late at night at elevated locations (above 20 m) the major background sound was surf noise from Belmont beach. At this time transmission of sound across the Lake was enhanced, with traffic on one side being easily discernible and measurable on the opposite site, i.e., between Toronto/Bolton Point and Eleebana/Valentine.

Enhanced transmission across the Lake was generally evident until after 10.00 a.m.

Background sound levels were 35 to 40 dB(A) around 10.00 to 11.00 p.m. and 30 to 35 dB(A) later in the night. At the corner of Quigley Road and The Ridgeway, the closest houses to the proposed site, the background sound level at 1.45 a.m. was 30 dB(A).

4.8 LAND USE AND RESIDENTS IN PROXIMITY

As mentioned previously, the site is located within an area of bushland owned by the Department of Housing. The site and environs are presently not used for any

particular land use activity, with the exception of occasional recreational uses and the access provided via the track to the Lake Macquarie foreshores.

Reference to Figures 1 and 3 indicates that land west of The Ridgeway is used for a variety of other purposes. Although land has been set aside for the Bolton Point Public School by the Department of Education, recent discussions with the Department have indicated that they will not be proceeding with this plan and that the land will be disposed of. Landcom also has plans to establish further residential development west of The Ridgeway within the existing Woodrising Estate. This development will be several kilometres from the proposed shaft site.

The nearest residence to the proposed ventilation shaft site is located along The Ridgeway, south of the intersection with Quigley Road and some 250 m distant from the proposed development. A small area of land zoned 2(a) Residential "A" is located between The Ridgeway and the former Bolton Point Public School site. This small parcel of land is located 230 m away from the proposed shaft site and may be developed as a residential area in the future.

The land surrounding the proposed site is zoned 6(c) Open Space and immediately to the north of The Ridgeway is a Public Reserve zoned 6(a) which is surrounded by possible future residential areas. The long term use for the land surrounding the site is 6(c) Open Space.

4.9 VISUAL ASPECTS

The prominent, wooded ridges to the north and east of the development site are significant landscape elements in the northern Lake Macquarie area. An almost continuous expanse of vegetation from the Lake foreshore to the skyline forms a distinctive landscape character which contrasts with nearby urban areas. This expanse of bushland also provides a scenic buffer to residential development along the ridge as viewed from the east and southeastern shores of the Lake.

Views from The Ridgeway to the east are limited by the dense vegetation adjacent to the road and the steepness of the land as it falls away from the road towards the Lake. Views of the area from the eastern foreshores and the Lake body are more

extensive compared with those from The Ridgeway due to the generally unimpaired nature of the views and the aspect of the timbered flanks rising to the ridgeline.

The prominent feature of the bushland area is the central ridge containing the access track which trends in a northwest/southeast direction down to Lake Macquarie. The development as described in Section 3 is planned to occupy a small part of the total bushland area and be located in the upper part of a small gully away from the central ridgeline.

SECTION 5 : DESIGN AND OPERATIONAL SAFEGUARDS

Environmental controls described in this section are designed to minimise environmental impact during both the 14 month construction period and the operational phase once the facility is commissioned. The design and operational safeguards minimise the impacts associated with air, water and noise pollution during site preparation and shaft sinking operations and during the operational phase of the ventilation fans.

5.1 AIR QUALITY CONTROLS

5.1.1 During Construction

Likely dust sources during construction include site clearing, truck movements and shaft sinking operations.

All site preparation activities will be confined to the minimum working areas required so as to avoid indiscriminate damage to vegetation and disturbance of the ground. Bare areas will be rehabilitated as early as practicable to minimise soil erosion. The access road and the construction pad will be sheeted with gravel to minimise dust generation and will be watered on a routine basis. Site management controls will conform to the requirements of the Soil Conservation Service and the Lake Macquarie City Council.

5.1.2 Operational Phase

Once the facility is commissioned and operational, the air quality controls previously undertaken will ensure that dust generation from the site will be minimal. There will be no problems with dust levels in the vicinity of the ventilation shaft and its associated fans once they are commissioned and operational. The concentration of methane in the ventilation air drawn from the mine is small (less than 1 per cent) and this minor emission is readily dissipated in a harmless and safe manner into the surrounding atmosphere.

Dust levels within the colliery are strictly controlled by major dust suppression

systems. The air being expended from the shaft will be saturated with moisture due to the presence of water in the walls of the shaft. Any dust associated with the exhaust air generally becomes moist, and the air condenses upon discharge to fall as a mist immediately around the fan.

5.2 WATER MANAGEMENT CONTROLS

On-site water management controls to be undertaken at the commencement of construction will minimise sediment generated on the site and prevent the discharge of any sediment laden water to Lake Macquarie. The following on-site water management controls will be practised and monitoring will be regularly undertaken to ensure compliance with conditions and the efficiency of water management controls.

5.2.1 Surface Drainage

Diversion banks will be constructed around the site to prevent upslope runoff from entering the site. Upslope runoff will discharge into the existing drainage line downstream from the site. As the construction pad will be built across a small ephemeral drainage line, a small dam will be constructed upstream from the site. Water collected in this dam following rainfall events will be transported under the site via a 750 mm diameter pipeline. The discharge point of this runoff will be into the existing drainage line downstream from the site.

5.2.2 Site Drainage and Ground Water

Runoff from the site will be diverted into a sedimentation dam immediately downstream from the construction site. The dual chamber sedimentation dam will effectively settle out suspended solids from pad runoff. The dam, which will be sized to receive water from a storm of 1 in 10 year duration, will also receive water encountered during shaft sinking operations and groundwater makes once the fan is operational.

Following maximum settling time, a float valve will release underflow water from the dam into a 150 mm pipeline.

Chemical analyses have indicated that moderately saline water will initially be encountered during shaft sinking operations. As the shaft sinking progresses the salinity of the groundwater is expected to decrease to levels below 1,000 mg/L. The salinity of water in the mine workings is expected to range between 1,000 mg/L and 4,000 mg/L. These saline waters will assist in the settling out of suspended solids in the sedimentation dam by the process of flocculation.

Because of the possibility of this moderately saline water having an adverse impact upon the ecology of the creek between the shaft site and the Lake, the Company intends to release this clarified water into a buried pipeline. The pipeline, some 500 m long, will release water into the Lake where it will mix with the saline lake waters. The route chosen for the pipeline will be carefully selected to minimise its impacts on the local vegetation. The trench for the pipe will probably be dug with a small "ditch-witch" and the owners of the land downstream of the facility (The N.S.W. Department of Housing) do not object to the pipeline crossing their land. A mutually agreeable arrangement will be concluded with the landholder regarding the Company's rights of access and details on route rehabilitation.

Investigations by the Company indicate that water in the Colliery has total iron levels of around 5 mg/L and that groundwater likely to be encountered in the shaft will have total iron levels of 30 to 40 mg/L. If these iron levels precipitate out as a reddish iron oxide (Fe_2O_3) in the Lake an obvious discolouration will result. This is unlikely to occur due to aeration of the waters in a collection sump in the Colliery and/or in the dual chambered sedimentation dam on the surface. In addition, no such discoloration occurs when treated minewaters are released from the mine site at Teralba. In the unlikely event that these treatments prove ineffective, the Company will take whatever remedial action necessary to prevent any discoloration from occurring.

The Pacific Colliery mine workings are relatively dry and the volume of water make in the mine averages 135 KL/day. When the mine workings extend to the southwestern and southeastern quarters of the lease, the Company expects to encounter similar mining conditions to those currently being experienced. Therefore, water volumes are not expected to vary to any great extent.

5.2.3 Oil and Grease Disposal

An oil and grease trap/skimming system will be installed to ensure that no such contaminants are released from the site. Any oils and greases collected by this system will be stored in a tank and safely removed by a waste disposal contractor as required.

5.2.4 Septic System

A small septic tank will be installed on site to receive sewage and other waste water generated by the construction team and surface facilities. The system will conform to the various requirements concerning design capability and performance and will periodically be serviced and pumped out by a waste removal contractor. When the facility is commissioned, the septic system will be completely removed from site.

In summary, the Company will ensure that there are no discharges of untreated/polluted waters from the site and that the requirements of the Clean Waters Act will be met in all respects.

5.3 NOISE EMISSION CONTROLS

5.3.1 Shaft Sinking and Construction

Potential noise sources during construction include drilling, blasting, plant noise (front-end loader, compressors, trucks, etc.), the motor winder and the auxiliary exhaust fan. All machinery used on the site will be of modern design and equipped with silencers and acoustic treatments to ensure compliance with SPCC criteria.

Drilling operations will be below ground level apart from during the first week of shaft sinking. As such, the drilling operations will be audible at first and then inaudible to any nearby residences as the shaft sinking progresses.

Blasting operations will occur up to two times per day, will be very small due to the small surface area involved, will be confined to the hours of 7 a.m. to 5 p.m.

and will be initiated behind closed doors in the shaft. Given the small size of the blasts, modern blasting technology, sound blasting practice and small quantities of explosives (200-300 kg) to be used, the Company will have no difficulty meeting the comfort criteria to be placed upon the operation by the State Pollution Control Commission (SPCC).

The limiting criteria for the control of blasting impact at the nearest residence is that any blasting activity will not exceed the comfort criteria for noise, vibration and overpressure levels of 85 dB(A), 5 mm/sec and 115 dB(linear) respectively. The Company will periodically monitor blasting at the site, in particular the initial blasts, to ensure that compliance occurs.

Plant noise during construction will emanate from earth moving equipment and the small trucks used to transport spoil from the site. The frequency of truck movements once the pad is constructed will approximate 1 cycle per hour and truck noise will not be discernible over the normal vehicle movements along The Ridgeway. To minimise any possible intrusions to local residents from the haulage of spoil, truck movements will be restricted to within the hours of 6 a.m. to 10 p.m. inclusive. The noise level of the spoil removal trucks will not exceed 85 dB(A) at 7 m.

Table 4 lists the equipment to be used in the shaft sinking operations and their corresponding expected sound levels.

TABLE 4

EQUIPMENT USED DURING SHAFT SINKING AND THEIR OPERATING SOUND LEVELS

Equipment	Total Number on Site	Sound Level at 7 m dB(A)	Sound Level at 30 m dB(A)
600 hp Sinking Winder*	1	70	60
50 hp Sinking Winder*	1	70	58
Auxiliary Ventilation Fan 100 hp	1	65	55
Rotary Screw Compressor	2	70	58
Piston Reciprocating Compressor	1	70	58
Caterpillar 950 Rubber-tyred Front-end Loader	1	85	75
Spoil Removal Truck	2	85	73

* Only one winder can be in operation at one time.

5.3.2 Fan and Building Installation

Erection of fans and buildings on the site will include mobile plant such as cranes, welders, concrete mixers, compressors, trucks, etc. These items of plant will be of modern design and equipped with acoustic treatments.

This phase of the construction/installation activity will be over a period of approximately eight weeks and is expected to occur during daylight hours only.

5.3.3 Operational Stage

After commissioning, noise emissions from the site will be caused by the fans and their drive motors, and the ventilation fan for the electrical control room. The fan motors will be housed in masonry block-walled buildings which have a high noise transmission loss. Ventilation air for the fan motor rooms and electrical control room will inlet and exhaust through high performance louvres. The fan casing, inlet and exhaust ductwork are of 6 mm steel plate, and a discharge silencer with acoustic absorption filled splitter elements have been designed to meet the specification of 55 dB(A) at 30 m from each fan.

The fan alignment on the site (53 degrees) and location of the shaft relative to the local topography have been selected to ensure that the environmental objective sound level of 35 dB(A) in the neighbouring residential areas is achieved. For most of the time, fan noise emissions are not expected to be discernible above background sound levels in the neighbouring residential areas.

5.4 VISUAL IMPACT AND SITE MANAGEMENT CONTROLS

5.4.1 Soil Erosion and Site Rehabilitation

Soil erosion controls for the project will be comprehensive and will include measures to prevent sediment moving off-site, and to minimise the area of land disturbed. Revegetation and stabilisation of all batters, the pipeline route and other disturbed areas associated with the project will be undertaken immediately.

Guidelines established by the Soil Conservation Service will be closely followed in managing the site and close liaison will be maintained with the Local Office of the Service and the Lake Macquarie City Council's Environmental Officer.

5.4.2 Visual Assessment and Landscaping

The shaft and surface facilities are to be constructed in a natural depression in a heavily vegetated area. Existing tree screens surround the site and only parts of the development will be visible from isolated vantage points. Landscaping will be undertaken as soon as practicable to further assist in reducing any visual impact by screening the facility. The landscaping will also assist in the control of any soil erosion on the site.

During construction, the most conspicuous item will be the top of the head frame which may protrude above the existing tree canopy. This is illustrated in Figure 8 which shows a cross-section through the site during the construction period. The head frame will be visible from parts of The Ridgeway, although with distance and the more elevated land west of the Ridgeway, it should not be visible from the eastern shores of Lake Macquarie. Other on-site temporary buildings may also be visible from parts of The Ridgeway.

At the completion of construction and commissioning, all temporary buildings will be removed from the site as will the winder and head frame. The remaining buildings will not be evident from the majority of vantage points and this is clearly evident in the cross-section in Figure 8. Locations north of Eleebana will not have a view of the site as the facility is located in a natural depression. However, it is possible that part of the cleared area, in particular the access track along the ridgeline, may be visible from locations south of Eleebana, such as Valentine.

Sufficient lighting will be provided at the construction site to allow for safe working conditions on the surface. The location of the facility combined with good design will ensure that lights will not be directed onto any residential areas either during construction or once the facility is operational. When operational, some lighting in the gully may be discernible from a few locations along The Ridgeway.

In summary, construction of the ventilation shaft at the proposed site will not significantly affect the visual amenity of the local environment. The completed facility will only be apparent to those who, having a viewpoint, know of its existence as it will be surrounded by significant stands of existing native vegetation and the cladding coloured to merge into the background.

5.4.3 Bushfire Risk

Discussions with the N.S.W. Fire Brigade have indicated their preference for the maintenance of a mown or slashed 3 m wide strip around the perimeter fence of the facility. As fires reported in the area are commonly illegally lit groundfires, the mown strip should assist in the protection of the facility from these fires. For this reason, it is proposed to take great care in the landscaping of the facility to avoid the possibility of fires occurring within the perimeter fence.

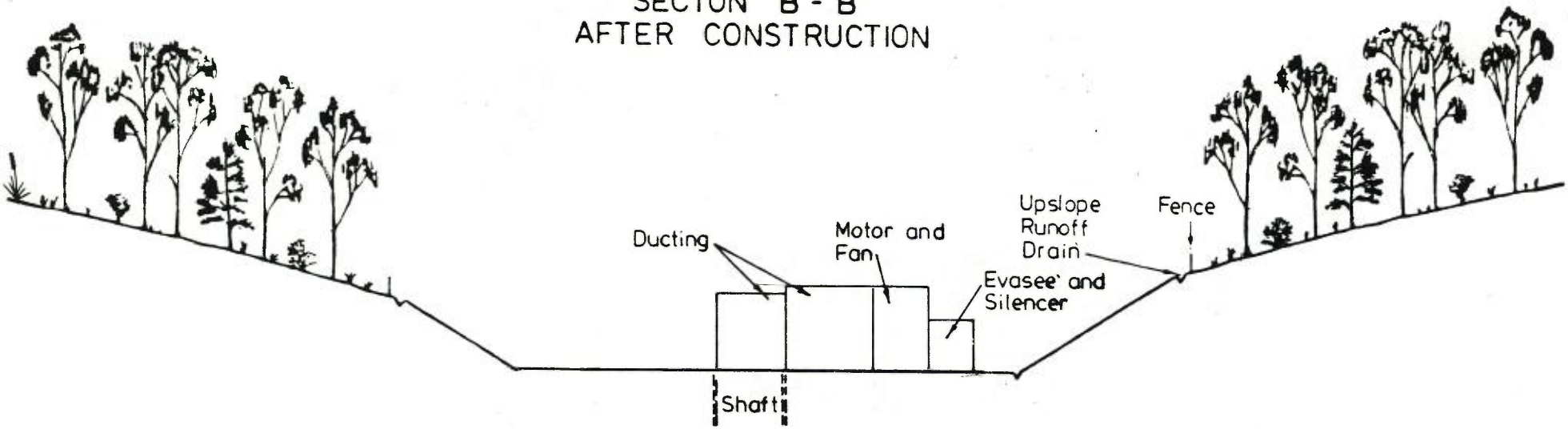
The small area cleared as a result of this project is not significant in terms of the existing total area of bushland on the western foreshores of Lake Macquarie. Safety requirements relating to bushfires and upcast ventilation fans have been adhered to in the design and layout of the facility.

5.5 MONITORING PROGRAMME

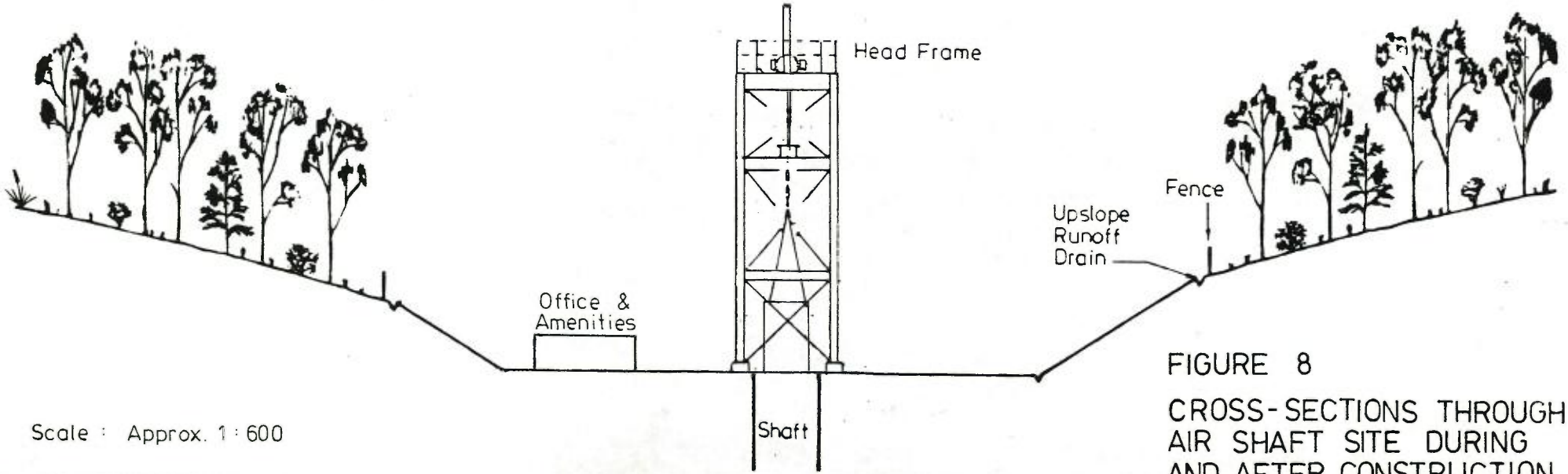
The Company proposes to undertake a monitoring programme on site during both the construction and operational phases of the project. The monitoring programme will consist of the regular sampling and measurement of water quality and sound levels to ensure that the design and operational safeguards are effective in minimising any environmental impact associated with the project.

The results of the monitoring programme will be incorporated into annual reports and submitted to the various regulatory authorities as requested.

SECTON B - B¹
AFTER CONSTRUCTION



SECTON A - A¹
DURING CONSTRUCTION



Scale : Approx. 1 : 600

FIGURE 8

CROSS-SECTIONS THROUGH AIR SHAFT SITE DURING AND AFTER CONSTRUCTION

SECTION 6 : ANALYSIS OF THE INTERACTION OF THE PROJECT AND THE ENVIRONMENT

6.1 TOPOGRAPHY AND SLOPES

The topography of approximately 2 ha of native bushland area will be altered by the proposal to construct an upcast ventilation fan shaft at the Bolton Point location. Approximately 1.2 ha of land will be required for the construction pad, surface facilities and shaft, with the remaining area being required for the upgraded access road.

A level pad will be created by cut and fill across an existing drainage line. Road upgrading will cause minor changes to levels on site. The localised changes to the topography of the site will not create a significant impact on the surrounding environment.

6.2 SOILS AND EROSION

The small quantities of soil stripped during the shaft sinking operation and construction of the surface facilities will be stockpiled and used in landscaping and site restoration works.

Soil erosion will be negligible from the construction site due to the site management techniques to be adopted. Any soil/spoil materials which are entrained in surface runoff from the site will be retained in the sedimentation dam which will be desludged as required to ensure that its operation and design capability are maintained.

Surface waters will be directed around the site by a number of diversion drains. These drains will be vegetated/stabilised to prevent any excessive soil erosion from occurring. The water quality of Lake Macquarie will not be affected by the development as effective controls to minimise any sediment loss from the site will be employed.

6.3 DRAINAGE AND WATER QUALITY

The existing drainage system at the site will be affected by the development. The watercourse will be channelled underneath the facility for 123 m and upslope diversion drains will be constructed. Flows in the creek will not be affected to any significant degree as a result of the development.

Water generated from the site itself and from the shaft will be stored in a sedimentation dam below the site. After a retention period, water will be piped toward Lake Macquarie. Water of moderate salinity will enter the Lake, but as the shaft and mine waters are of significantly lower salinity than the Lake waters, no environmental impact is likely to occur.

The quality of water entering the Lake from the diverted upslope runoff will be unchanged by the development. The impact of the proposal on drainage and water quality will be minor.

6.4 AIR QUALITY

It is likely that the only dust generated on site will be during construction of the facility and access track upgrading. It is proposed to periodically water these areas to minimise dust generated. As the excavation of the shaft will normally be conducted in moist conditions, dust is not likely to be generated in the sinking operations or in spoil handling and transport.

When the facility is commissioned and operating no impact upon air quality will occur.

6.5 NOISE CLIMATE

6.5.1 Shaft Sinking and Construction

The equipment used in shaft sinking and construction and their sound levels have previously been listed in Table 4. The combined sound level of all equipment if it were operating simultaneously at the shaft site has been calculated. The predicted total L_{10} noise level for the construction site at 30 m is approximately

77 dB(A). The major components of this sound level are the front-end loader and tip truck for spoil removal, which only operate for short periods and not at night. At other times, the continuously operating sound sources of the compressors and auxiliary ventilation fan will be the dominant noise sources. The compressors will be specially treated silenced units designed to achieve a sound level of less than 70 dB(A) at 7 m. The continuous sound level at 30 m from the site is expected to be 60 dB(A).

As the construction period will last for 14 months and include 24 hour operation, Monday to Saturday, the activity will also have to achieve an environmental objective sound level at the nearest residences. The objective selected is 40 dB(A) at night-time which is considered acceptable for the maximum sound level caused by a construction activity, and is in accordance with the guidelines of the SPCC environmental noise control manual.

Sound levels expected at the nearest residences have been calculated for construction activities and operational conditions. These have been compared with measured background sound levels at six receptor points in the neighbouring residential areas, taken from Table 2 of Appendix 2, and are given in Table 5 below.

TABLE 5

PREDICTED SOUND LEVELS AT RECEPTOR RESIDENCE POINTS
(dB(A))

	Location	Background Sound Level		Predicted Construction Noise		Operational Noise	
		Day	Night	Maximum	Continuous	1 Fan	2 Fans
i.	Cnr. Quigley Rd. and The Ridgeway	43	30	45	35	31	33
ii.	The Ridgeway	41	30	49	39	30	31
iii.	George St.	43	32	32	32	32	32
iv.	Lake Residence	39	30	48	38	30	30
v.	Rocky Pt. Eleebana	42	36	40	35	36	36
vi.	Hartley Pt. Valentine	39	32	32	32	32	32

The construction noise levels will not be significantly in excess of background levels and the potential for noise annoyance is assessed to be low.

6.5.2 Operational Stage

Sound emissions will arise from the fan discharges, fan drive motors and ventilation fans for the fan motor room and electrical switchroom. Fan motor room and electrical switchroom noise control will be by masonry block walls and acoustic louvres on ventilation inlets and outlets. The fan design and specification for performance have been to achieve a sound level of 55 dB(A) at 30 m from the fan discharge.

Appendix 2 describes the process in which estimations of the noise levels experienced at the nearest residences due to fan operation were made.

Reference to the results presented in Table 3, Appendix 2 show that no residential areas will have sound levels in excess of 30 dB(A) due to the noise from both fans when operating together. These levels when combined with existing background sound levels (see Table 5) show that the increase in background sound levels will at all locations be less than 5 dB(A), and comply with the criteria established by the SPCC.

6.5.3 Conclusion

On the basis of this detailed assessment, the construction and operation of the ventilation fan at the preferred location will result in minimal impact on the existing noise climate. The Company proposes to reduce noise levels at the Lake Residence by constructing a suitable barrier as outlined in Appendix 2 to attenuate construction and operating noise levels likely to be experienced at this location.

The Company will also ensure that the fans will operate at the specified noise levels once the facility is commissioned and operational. With the treatments proposed and the suggested alignment of the fans, noise levels will generally not be measurable above existing background sound levels.

6.6 FLORA, FAUNA AND ECOLOGY

Clearing at the site will result in the removal of approximately 1.2 ha of native bushland. Additional vegetation will be removed as the access track is upgraded and cleared for the provision of services. In total, approximately 2 ha of land will be required for the development.

The results of the vegetation and fauna survey indicate that no rare or endangered species occur within the site. There have been numerous disturbances to the site resulting in a degraded bushland habitat. A significant impact will not result when the site is cleared for the proposed development.

6.7 ARCHAEOLOGY

The archaeology survey reported that no sites or relics of any importance are located within the area proposed for the development. No further archaeological work is considered necessary.

6.8 VISUAL ASPECTS

The landscape character of the Lake Macquarie foreshore areas is unique in the Lower Hunter Region. Its visual character is affected by the quality of views of the foreshores. Accordingly, the prominent treed ridgelines at the peninsulars (e.g., Bolton Point) which are unbroken by urban development are distinctive visual elements on Lake Macquarie's foreshores.

The impact of the development on the visual amenity of the Bolton Point area will be negligible. The ventilation fan shaft surface structures will not be visible from the Lake or vantage points on the eastern foreshore during either the construction or operating phases of the project. The intervening northwest/southwest ridgeline and tall (17 m), dense vegetation will effectively absorb the development.

The development may be partially visible from vehicles travelling on The Ridgeway. The visual impact on the wooded landscape character of the area during the operational phase will be ameliorated by the choice of appropriate exterior

colour for the surface structures.

6.9 LAND USE AND RESIDENTS IN PROXIMITY

The land surrounding the proposed facility is generally steep and covered by native vegetation. Only a small area of this land will be required for the proposed development and the proposed development will not significantly alter the overall use of the surrounding lands.

Although the closest residence will be approximately 250 m from the fan, no significant environmental impacts due to the fan noise are predicted if the fan meets the operating specifications and with acoustic treatments in place. The Company has given an undertaking to meet the necessary fan specifications to minimise any environmental impact.

6.10 PLANNING

The proposed development will require the rezoning of approximately 3 ha of land from 6(c) open space to 4(b) special industry use. An application has been made to Lake Macquarie City Council for rezoning and an application has also been made to the Department of Mineral Resources for a Mining Purposes Lease to cover the rezoned area.

6.11 TRAFFIC ASPECTS AND SERVICES

The access track to the site will be upgraded prior to construction commencing on site. During construction there will be a temporary increase in the number of vehicles using the track with up to 15 trucks leaving the site daily. Other vehicles driven by the shaft sinking and other contractors will also enter and leave the site daily. A Give-way Sign will be placed at the intersection of the track and The Ridgeway.

After the fan is commissioned, access to the site will be limited to approximately one visit per week for routine maintenance purposes.

An area will be cleared adjacent to the access track to provide water, power and

telephone services to the site.

6.12 ABANDONMENT OF SITE

The life of this proposed development is the same as the life of the Pacific Colliery, that is approximately 25 years.

At the completion of the life of Pacific Colliery the Company will seal the shaft and remove all facilities and structures from the site.

The dominant land use in the area is open space/passive recreation/scenic bushland. The Company will appropriately rehabilitate the site when no longer required to ensure that land use compatibility occurs upon abandonment. The site will be left in a condition acceptable to relevant authorities.

SECTION 7 : REVIEW OF ALTERNATIVES

The Company's proposal to sink the ventilation fan shaft has been designed with the ultimate aim of providing adequate ventilation facilities to the underground workings at Pacific Colliery. The location of the shaft has been determined on the basis of compatibility with the mine plan and the underground workings and on the basis of an assessment that minimal environmental impact will result to the Lake and existing and future residential areas. This Environmental Impact Statement has been prepared to support the construction and operation of an upcast ventilation fan shaft at the preferred location.

The Company believes that the constraints on development at this site are minimal and, that for the continued safety of mining at Pacific Colliery, the development should be allowed to proceed.

7.1 ALTERNATIVES TO THE PROPOSAL

7.1.1 The "No Development" Option

The consequences of not proceeding with the development will mean that increases in methane gas levels in the workings at Pacific Colliery could render future mining conditions unsafe as defined by the Coal Mines Regulation Act (1982).

The unsafe mining conditions would necessitate the premature closure of the mine. Closure of the Colliery would result in a significant loss of employment to the region of about 762 jobs (381 x regional multiplier of 2) and loss of export income of $30 million dollars to the national economy.

This alternative and its consequences are unacceptable to the Company and to the community as a whole.

7.1.2 Alternative Location Near the Sewage Treatment Works

Prior to the introduction of longwall mining systems at Pacific Colliery, it was envisaged that an additional upcast ventilation fan shaft for the mine could be

located on Water Board land in the vicinity of the Marmong Sewage Treatment Works.

The suitability of this site for locating a ventilation fan shaft has been re-examined by the Company for compatibility with its mine plan layout for the longwall mining system.

One of the key determinants for the viability of the Pacific Colliery is the length of the longwall blocks. Therefore, the mining plan for the Colliery is designed around optimising this parameter, given geological constraints and an overriding objective of minimising coal sterilisation within the lease.

In Table 6, lengths of longwall blocks for the Company's preferred site, the Water Board site and the first five longwall blocks mined in the northeastern quarter of the lease are compared.

TABLE 6

COMPARISON OF LENGTH OF LONGWALL BLOCKS (metres)

Longwall Block Numbers	Length of Blocks NE Quarter (m)	Longwall Block Numbers	Length of Blocks Water Board Site	Length of Block Preferred Site
1	1,180	8	650	1,600
2	1,360	9	1,250	2,200
3	760	10	930	1,880
4	990	11	1,490	2,440
5	970	12	1,450	2,400
Average lengths (m)	1,052		1,154	2,104

The Company's recent experience has been that the length of longwall blocks in the northeastern quarter of the lease were not sufficient to ensure the future viability of the mine. Given that the lengths of blocks for the Water Board site are similar to those of the northeastern quarter, then the Water Board site is not regarded as a viable option for the Company. By comparison, the mean length of longwall blocks for the Company's preferred site is some 82 per cent longer than

for the Water Board site. This will help ensure viability of the colliery. In addition, the use of the Water Board site as a ventilation shaft sterilises some 6 million tonnes of excellent quality coal in the southwestern quarter of the lease.

The alternative shaft site location near the sewage treatment works is therefore, in the Company's opinion, not compatible with efficient underground mine design and workings at Pacific Colliery.

7.1.3 Upgrade Existing Ventilation Facilities at Pacific Colliery

The existing ventilation facilities at the mine site at Teralba are operating at their maximum capacity and producing approximately 200 m^3/sec at a pressure of 1.5 kPa water gauge. The new ventilation facility is required to produce 300 m^3/sec at a water gauge of 2 kPa.

It is not possible to simply put in larger fans and motors at Teralba as this would necessitate ceasing mining operations for up to 4 months while the changeover occurred. Therefore to maintain continuity of mining, a new fan facility would need to be constructed adjacent to the existing facilities and connected into the existing fan drift.

Under these circumstances an underground ventilation circuit of over 10 km would exist. Such a long circuit is extremely inefficient and the high ventilation resistance of the mine would create an unacceptably high mine pressure difference (approximately 3.5 kPa). Such a high pressure difference would create the following safety hazards in the mine.

(a) Increase the possibility of spontaneous combustion.

(b) Problems with higher methane emissions in goaf areas.

(c) Problems with higher dust emissions.

Given that the mine does not currently have these safety problems, then to construct a facility which actually creates safety hazards is an unacceptable

proposition for the Company, its workforce and the community.

7.2 CONCLUSIONS

The Company is of the view that the preferred site, the design of the surface facilities and the implementation of environmental controls, both during the construction and operation of the facility, will result in minimal environmental impact. In addition, the operation of a ventilation fan shaft at this site will provide adequate ventilation for Pacific Colliery and will minimise the build up of dangerous methane gas in the underground workings. The suggested alternatives to the project described in this Environmental Impact Statement are not acceptable for the future of mining at Pacific Colliery. The proposal to excavate and operate a ventilation fan shaft at the Bolton Point site will result in minimal impact on the local environment and will result in an improvement in mining conditions at the Colliery.

Accordingly, approval of the Minister for Planning & Environment, the Lake Macquarie City Council, the State Pollution Control Commission and the Department of Mineral Resources is sought to proceed with this development.

APPENDIX 1

COMMENTS FROM THE DEPARTMENT OF ENVIRONMENT AND PLANNING

New South Wales Government

Department of Environment and Planning

Remington Centre
175 Liverpool Street, Sydney 200
Box 3927 G.P.O. Sydney 2001
DX. 15 Sydney

General Operations Manager,
Macquarie Collieries,
P.O. Box 171,
BELMONT. N.S.W. 2280 62

ORIGINAL TO: G.FARNELL
RECEIVED 16 OCT 1986
Copies To

Telephone: (02) 266 7111 Ext 7235
Contact: V. Thomson
Our reference: 83/812
Your reference:

Attention: G. Farnell

Dear Sir,

PROPOSED VENTILATIONS SHAFT,
PACIFIC COLLIERY - ENVIRONMENTAL IMPACT ASSESSMENT

Thank you for your letter of 4 September, 1986 indicating that you are consulting with the Director with regard to the preparation of an environmental impact statement (EIS) for the above development. It is noted that Council is of the view that a development application for the proposed development may be determined under the provisions of Clause 22 of the Lake Macquarie Local Environmental Plan and whilst the proposed development site is located on land zoned 6(c) - open space (local reservation), Council is proceeding to rezone the site to 4(b) - special industrial.

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

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

- Visual quality protection measures in relation to the Lake Macquarie foreshore and ridge line;
- Acoustic protection measures in relation to the adjacent residential area and future school site;
- Construction stage sediment controls to protect water quality of Lake Macquarie;
- Assessment of potential bushfire risk; and
- Rehabilitation of Belmont Lagoon ventilation fan site after commissioning of proposed facility.

.../2

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

5. The proposed development is subject to a direction under S.101 of the Environmental Planning and Assessment Act and consequently the Minister for Planning and Environment would determine the development application.

6. In preparing your EIS you should approach Lake Macquarie City Council and take into account any comments Council considers may apply to this proposal.

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

Yours faithfully,

10/10/86

C.J.Wright
Manager, Assessments Branch
Delegate for the Director

DEPARTMENT OF ENVIRONMENT AND PLANNING
ATTACHMENT No.1

STATUTORY REQUIREMENTS FOR ENVIRONMENTAL IMPACT STATEMENTS.

In accordance with Part 1V of the Environmental Planning and Assessment Act,1979, an environmental impact statement (EIS) must meet the following requirements:

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

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

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

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

DEPARTMENT OF ENVIRONMENT AND PLANNING
ATTACHMENT No.2

ADVICE ON THE PREPARATION OF AN ENVIRONMENTAL IMPACT STATEMENT (EIS) FOR AN UNDERGROUND COAL MINING OPERATION

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

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

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

1. Description of the proposal.

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

This section should provide specific information on the nature, intent and form of the development. It should, as far as possible, include such details as the location and extent of the underground mining of coal proposed, mine access works, ventilation shafts, and surface facilities involving proposals for coal handling, coal screening, crushing and washing, water management and treatment, disposal of wastes, and surface rehabilitation and landscaping. A description should also be provided of associated operations such as the transport of coal.

Particular details that may be relevant include:

- Characteristics and economic significance of the resource
- Quantity of materials to be mined.
- Coal mining techniques, plans of operations.
- Type of machinery and equipment to be used.
- Coal handling at the pit head.
- Coal preparation including any washing.
- Expected life of the operation
- Number of persons to be employed.
- Hours of operation.

.../2

- Power requirements.
- Water management, including water supply, surface site drainage and erosion controls, proposals for dealing with interception of ground waters and containment of runoff, water reuse, treatment and discharge offsite.
- Disposal of coarse and fine coal washery reject and proposals for mechanical dewatering.
- Proposals for underground gas drainage and use or disposal.
- Proposals for rehabilitation and landscaping of surface features.
- Coal haulage on site and transportation offsite.
- Proposals for environmental monitoring, including mining induced subsidence.

2. Description of the Environment.

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

3. Analysis of Environmental Impacts.

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

- Dust emissions from surface facilities, and controls.
- Likely noise/vibration disturbance caused by the surface operations, including transportation, on any nearby residences.
- Other impacts of transport movements, including access on to highways.
- Water pollution potential.
- Disposal of coal washery rejects.
- Any effects on valuable fauna and flora.
- Effects of surface facilities on the visual environment.
- Potential effects on surface features and facilities due to mining induced subsidence.
- Rehabilitation and landscaping of surface features.
- Any likely affectation of sites of Aboriginal archaeological or European heritage value (including industrial heritage) if located in vicinity of operations.
- Socio-economic implications including effects on the nearby community facilities and services, and proposal with regard to Government's Infrastructure Financing Policy.

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

4. Contact with relevant Government Authorities.

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

- The State Pollution Control Commission in regard to air, water and noise impacts and relevant pollution control legislation requirements;
- The Department of Mineral Resources in regard to requirements under the Coal Mining Act.
- The Mine Subsidence Board with regard to relevant aspects of subsidence caused by the underground extraction of coal.
- The Soil Conservation Service regarding appropriate erosion control and rehabilitation procedures;
- The Water Resources Commision in regard to water supply and down stream water users.
- The Department of Agriculture if prime agricultural land may be affected by the proposal; and
- The Heritage Council of NSW if the proposal is likely to affect any place or building having heritage significance or if aboriginal places or relics are likely to be affected.

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

APPENDIX 2

NOISE ASSESSED SITE SELECTION STUDY AND VENTILATION FAN NOISE INVESTIGATIONS

Prepared by:
ENVIRONMENT DEPARTMENT
B.H.P. ENGINEERING,
NORTH SYDNEY

1. INTRODUCTION

Geological and mine planning studies by BHP Steel International Macquarie Collieries have identified a preferred location for the Pacific Colliery No. 3 Ventilation Fan Shaft. This is in an area of bushland between Marmong Point and Bolton Point on the western shore of Lake Macquarie, shown in Figure 1.

This report was undertaken to optimise the site and fan arrangement selected within the general area so that any development will cause only minimal increase in environmental noise in the surrounding area. Further, the study is to assist in obtaining relevant regulatory approvals from the State Pollution Control Commission (SPCC) and Lake Macquarie City Council (LMCC).

2. ENVIRONMENTAL CONSTRAINTS

Following "general" location selection on an operational/geological and engineering basis, the environmental constraints of possible sites were considered and the proposed site and fan alignment selected. If it can be shown that the construction and operation of a ventilation fan on the proposed site will have an insignificant effect on the surrounding environment, then the various regulatory and council approvals can be obtained in minimal time and potential future conflict with the surrounding community minimised.

Environmental constraints are in turn used as input to engineering design to allow capital expenditure for environmental controls to be kept to an economic level.

The general location selected for the Pacific No. 3 Ventilation Fan Shaft is relatively close to the residential areas of Marmong Point and Bolton Point. Environmental constraints on the site are in terms of "emissions" and changes to the environment.

Experience is that the area is prone to noise problems exacerbated by meteorological conditions typical of the area. Eraring Power Station has had noise problems caused by low level atmospheric inversion, conditions resulting in enhanced noise transmission to houses over one kilometre distant.

The general location selected is between 250 m and 500 m from houses and this is the major constraint. As residential locations are on three sides of the site, and sound levels are much higher in front of the fans than to the rear or sides, alignment of the discharge direction will be important.

Specific site selection was made to take advantage of natural topography for "barrier" effects to assist in noise reduction but natural barriers are not available in all directions.

Proximity to Lake Macquarie is also a significant constraint in that transmission of sound over water involves lower attenuation rates than over land.

With the proposed location being close to Lake Macquarie and 1.6 km across the Lake to waterfront residential areas of Eleebana and Valentine, the analysis will consider these locations because increases in sound levels could be significant if they were ignored.

3. ENVIRONMENTAL OBJECTIVES

The provisions of the N.S.W. Noise Control Act 1975 require that new developments apply to the SPCC for approvals to construct and emit noise to the environment. The SPCC assesses the likely effects of the proposal against 'environmental objectives' for the area. These objectives are sound levels which the development will be required to achieve during operation (or construction as the case may be) and assessment of the approval of the project is in terms of this objective.

The SPCC Noise Control Manual recommends outdoor background sound levels for residential locations. For night-time in a residential area the acceptable sound level is 35 dB(A) with a maximum of 40 dB(A) not to be exceeded.

SPCC will approve proposals whose emissions are limited such that the sound level at nearest residences do not exceed 35 dB(A) at night-time.

Should the fan sound emissions alone cause 35 dB(A) to occur at the nearest residences, when this is added to the background of 35 dB(A) the resultant sound

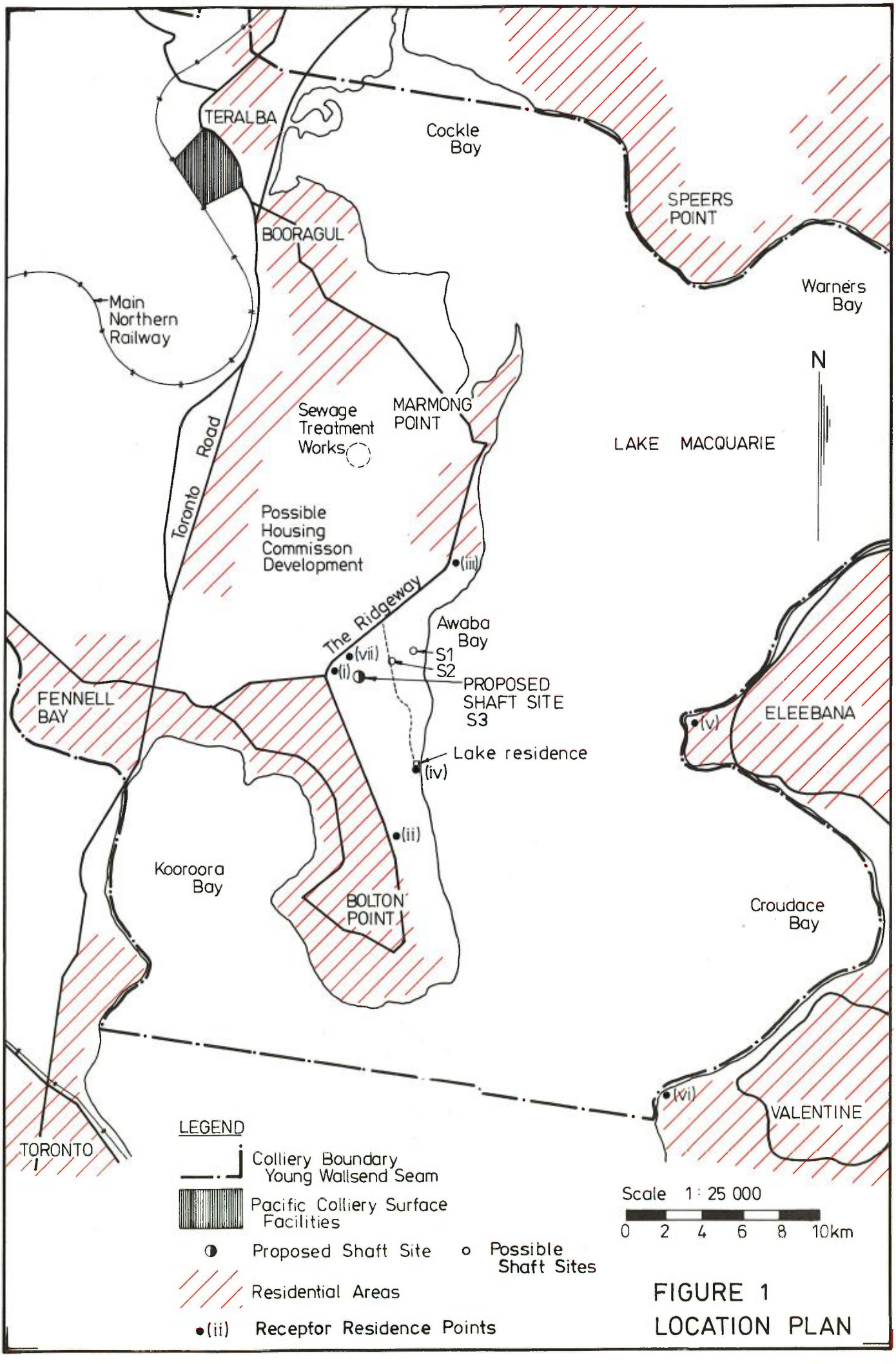


FIGURE 1
LOCATION PLAN

level could be 38 dB(A). To avoid this 'creeping background effect', the SPCC seeks to set limits for new developments below the acceptable level to ensure the acceptable level is not exceeded.

As the existing background has been measured to be 30 dB(A) on occasions, it is expected that the limit which the SPCC will request for this proposal will be 30 dB(A) or less caused by fan emissions, at the nearest house. It is recommended for this project that the environmental goal for sound levels caused by fan emissions be 30 dB(A) or less at residential areas. This will avoid the creeping background effect and ensure that the resultant background sound pressure level should not exceed 35 dB(A).

4. FAN SOUND LEVELS

It is proposed to progressively transfer the fans used at John Darling No. 4 Ventilation Shaft, Belmont Lagoon, to the Bolton Point site.

Sound levels from the operating fan (northern) at Belmont Lagoon were measured on 30th June 1986 during day and night-time conditions. These measurements gave information on sound levels in front, to the side and behind the installation. Actual reduction in sound levels with increasing distance were measured. This gives actual attenuation rates rather than using theoretical rates or those determined from other installations with different configurations. These are then used in the analysis.

The results of measurements at locations given in Figure 2 are listed in Table 1.

Figures 3, 4 and 5 show comparisons of actual attenuation with theoretical curves for increasing distance from the fans.

For the A-weighted sound levels, the attenuation rate in front of the discharge is around 4 dB per doubling of distance. This is comparable to the 4.5 dB rate found for twin fan installations discharging vertically. For the low frequency bands 63 Hz to 250 Hz where most sound energy occurs, the distance doubling rate was around 3 dB. For sound levels to the side of the fans, distances only up to 29 m were able to be measured because of site limitations (the fan site is on an

island).

Other sound emissions on site came from the fan motor house - ventilation openings, and fan allowed emission of noise from the motor house which has 102 dB(A) internal sound levels, and from the switchroom pressurising fan. These are not considered in the later analysis as control of these emissions is relatively simple and of low cost.

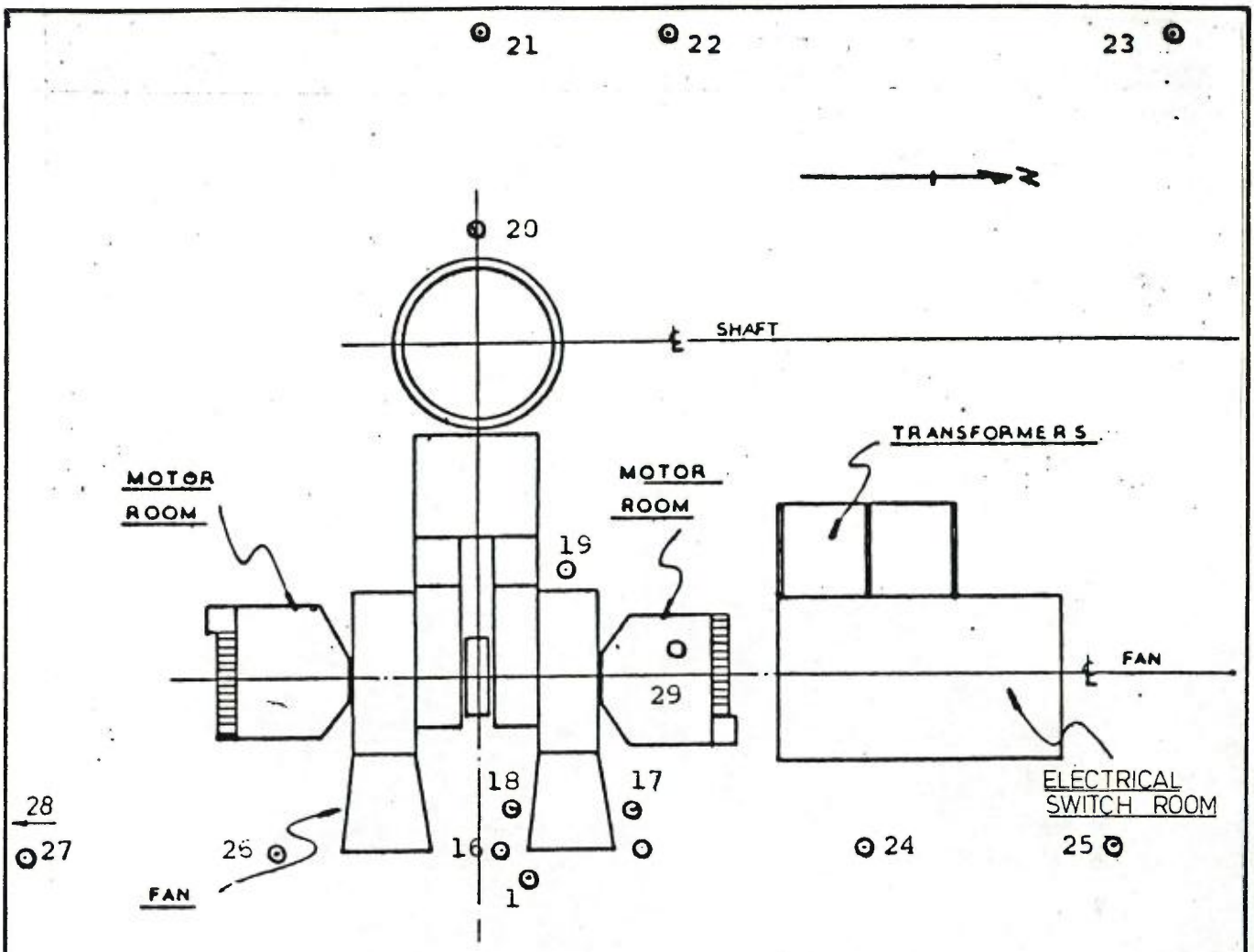
The sound level 30 m from the front of the fan discharge was 70 to 75 dB(A). The noise emissions were characterised by an almost regular surging every 15 to 20 seconds which increased sound levels by 5 to 10 dB(A) above the lowest value.

The performance specification of the fans is that the sound level at 30 m shall not exceed 55 dB(A) for a single fan or 56.5 dB(A) for two together. This is currently exceeded by up to 20 dB(A) for the operating fan. At times when there was no surge the sound level was 15 dB(A) above specification. The fans apparently achieved specification in July 1984 commissioning tests, with the major source being the motor room vent fans.

The evasee' splitters in the operating fan are completely encrusted with solidified material, clogging the perfmetal and probably leading to increased sound levels (from increased stream flow velocities and reduced absorption of noise). Alternatively, the fan may be in need of attention for out of balance or other problems, or inlet restrictions are causing air stretching and turbulence.

The fan was running at 85 per cent rated capacity. As the maximum speed is 490 rpm, it is assumed the operating speed was 416.5 rpm. With an eight bladed impellor, the fundamental blade passing frequency is 55.5 Hz. This matches the maximum octave band sound pressure levels found in the 63 Hz band.

Sound levels caused by the fan at distances greater than 400 m in front and 30 m to the side were not able to be measured because of site limits. At the edges of the lagoon, background sound levels from the surf or traffic were too high to measure fan noise accurately, if at all.



2

3

4

5 6 to 15

FIGURE 2

MEASUREMENT LOCATION AT JOHN DARLING N° 4 SHAFT SITE

5. COMMUNITY SOUND LEVELS

Measurements of sound levels were made in residential areas near the proposed site and across the Lake at Eleebana and Valentine. Measurements were made in daytime and night-time conditions to determine existing background sound levels and sound transmission properties around the Lake. The results are listed in Table 2 and the 17 locations are shown in Figure 6.

Major sound sources during daytime and early evening were motor vehicle traffic. At night-time, from about 10.00 p.m., the traffic noise was related to individual vehicles, whereas in daytime the traffic noise is more 'regional' from all sides of the Lake.

Late at night at elevated locations (above 20 m) the major background sound was surf noise from Belmont beach. At this time transmission of sound across the Lake was enhanced, with traffic on one side being easily discernible and measurable on the opposite site, i.e., between Toronto/Bolton Point and Eleebana/Valentine.

Enhanced transmission across the Lake was evident until after 10.00 p.m.

Background sound levels were 35 to 40 dB(A) around 10.00 to 11.00 p.m. and 30 to 35 dB(A) later in the night. At the corner of Quigley Road and The Ridgeway, the closest houses to the proposed site, the background sound level at 1.45 a.m. was 30 dB(A).

6. SITE EVALUATION AND ANALYSIS

Assessment of the most suitable site along the selected underground heading in the vicinity of the "general" location, in terms of sound levels expected to be caused at nearest residences, with regard to topographical shielding and alignment direction of the fans, was undertaken.

Three possible sites were selected. These were:

i. On the eastern side of the main "tracked" ridge, adjacent to the Lake shore at a level of 20 m.

ii. At the site near the top of the ridge at a level of 45 m.

iii. On the western side of the tracked ridge, close to the creek (i.e., in the gully) at a level of about 25 m.

These locations are shown on Figure 1.

For the purpose of evaluating the impact of the new development, six "receptor residence points" were chosen as the nearest residences for each of the three possible sites selected. These were:

i. Corner Quigley Road and The Ridgeway, Bolton Point.

ii. The Ridgeway, Bolton Point: by the northern-most house on the eastern side of The Ridgeway (there are houses between this point and Quigley Road on the western side of The Ridgeway. These houses will have sound levels between those of 'i' and 'ii'.

iii. George Street, Marmong Point, adjacent to the southern-most house.

iv. Lake Residence at the southern end of the tracked ridge.

v. Rocky Point, Eleebana, and

vi. Hartley Point, Valentine. (Both 'v' and 'vi' are the closest points on the eastern side of Lake Macquarie.)

Receptor sites 'i' to 'vi' are also shown on Figure 1.

It is assumed that the fan to be moved, which was not operating and not measured, has a similar sound emission and attenuation rates to the measured fan, and when relocated will meet its specification of 55 dB(A) at 30 m. The attenuation rates will be virtually the same but the frequency spectrum may be different because of the improved performance of the splitters at higher frequencies.

Directivity effects or (sound levels to the sides of the airflow direction) are determined from theory for the alignment selected. Air attenuation is not included to allow for the enhanced transmission of sound over water.

7. RESULTS OF ASSESSMENT

The results of the analyses are given in Table 3. They show that for Site 3, aligned at 53 degrees, the maximum sound level with both fans operating is 34.1 dB(A) at the Lake Residence. Other receptor points have sound levels less than or equal to 30 dB(A), which is generally much less than the existing background levels.

On the basis of this analysis and the visual impact associated with Sites 1 and 2, it is recommended that Site 3 be chosen as the preferred site for the Pacific Colliery No. 3 Ventilation Fan Shaft.

Sound levels at the Lake Residence could be further reduced by a barrier of 6 m high at a distance of up to 20 m from the evasee'. Such a barrier would effectively shield the one remaining side to the side which does not have a natural barrier. This barrier is not expected to present a significant civil engineering problem.

TABLE 3

SITE SELECTION ANALYSIS

Receptor Residential Points		Relative Angle	Site 1 Aligned 273° Sound Level dB(A)	Relative Angle	Site 2 Aligned 318° Sound Level dB(A)	Relative Angle	Site 3 Aligned 53° Sound Level dB(A) -BW	+BW
i.	Quigley Rd.	-45°	21.5	-78	37.3	-155°	30.0	30.0
ii.	The Ridgeway Bolton Point	-108°	18.0	-139	26.0	122°	28.3	28.0
iii.	George St.	94°	34.1	77.5	34.2	-20°	22.8	22.8
iv.	Lake Residence	-116°	23.9	-153	30.1	103°	34.1	25.5
v.	Rocky Pt.	172°	19.9	102	27.5	37°	21.2	18.0
vi.	Hartley Pt.	-148°	20.5	143	20.9	95°	24.6	18.0

BW = Barrier Wall

8. BARRIER EFFECTS

The effects of a barrier to sound transmission are in terms of its noise reduction effects and possible effects on fan aerodynamic performance.

Aerodynamic performance can be affected if a barrier is placed such that the discharge from the evasee' is restricted. If this occurred, the barrier could be considered a part of the fan system and loss coefficients and resultant pressure effects determined.

Available information suggests that if a barrier is placed across the air discharge path at a distance greater from the evasee' than the duct width, then the loss coefficient is negligible. In this case if at least two duct widths (8 m) are maintained between the evasee' and a barrier location, then there should be no aerodynamic effects on the fan system.

On the basis of the results in Table 3, significant advantages to Site iv, the Lake Residence, occur if a suitable barrier wall is constructed on the southeastern side of the fan facility. It is therefore recommended that this barrier wall be constructed.

Given the results presented above, converting the fan discharge to vertical has the effect of removing the advantages of directivity to any locations and the barrier effects of natural topography and vegetation are also virtually eliminated, thus creating much higher noise levels than if a specifically aligned horizontal discharge system was used.

TABLE 1

TABLE 1: FAN SITE SOUND LEVELS AT JOHN DARLING No.4 AIR SHAFT - NORTHERN FAN

	LOCATION/SUBJECT	SOUND PRESSURE LEVELS OCTAVE BAND CENTRE FREQUENCY - HERTZ (Hz)										WEIGHTING		
		31.5	63	125	250	500	1000	2000	4000	8000	16000	A	C	L
1	1m to front	100	100	98	95	91	84	77	71	63	54	88-93	106	114
2	10m in front	94	104	98	94	87	79	74	70	60	52	82-87	100	106
3	20m in front	82	98	93	87	81	77	69	61	56	46	77-83	100	101
4	30m in front	87	96	88	81	75	66	60	54	46	33	70-75	91	98
5	40m in front											70-75		
6	50m in front	85	94	86	77	66	62	58	48	39	22	65-73	91	96
7	60m in front											65-70 (68-74)	89	92
8	80m in front	77	87	79	69	58	54	49	44	28	21	60-65 (64-71)	88	90
9	100m in front	74	88	78	66	57	52	48	38	25	14	58-65 (61-67)	87	88
10	120m in front											57-65		
11	150m in front	74	81	70	64	57	48	44	34	26	14	54-63 (58-64)	79	85
12	200m in front	71	79	73	68	53	47	46	36	20	9	55-64 (58-65)		
13	250m in front	66	79	75	69	52	44	38	30	17	10	52-63 (55-63)	76	80
14	300m in front	68	79	71	67	50	44	40	31	13	3	52-60 (55-62)	74	77
15	400m in front											(50-58)		
16	1m to side evase edge	95	97	89	85	80	73	68	58	52	44	79-85	98	103
17	Half way along evase, north side	92	103	93	85	76	72	62	51	41	30	77-80	98	101
18	Half way along evase, south side	92	102	92	85	74	67	62	55	45	35	81	101	104
19	By scroll casing at rear of fan	94	97	90	83	71	66	60	53	44	34	73-77	98	100
20	By inlet shaft, western side	78	85	78	72	60	54	52	43	34	30	62	84	89
21	9m to rear of shaft	78	84	75	63	56	54	51	44	37	30	61	82	87
22	Behind motor house, same line as above	80	86	76	68	61	59	53	48	45	36	66	89	90
23	20m to side of above	77	84	74	65	56	55	51	47	38	28	64	84	89
24	10m north of evase edge											73	90	96
25	20m north of evase edge(motor room nz)											69	89	92
26	10m south of evase edge											65-69	90	93
27	20m south of evase edge(shielded)											59-65	86	90
28	29m south of evase edge(shielded)											54-60		
29	Motor room	95	97	90	94	102	101	89	83	78	69	102	104	106
	Bolton Point Wattle St. Background, 10.17pm surf at Belmont	52	55	52	41	35	30	16	10	6	3	37	54	62

NOTES: 1 Brackets indicate night measurements

2 Locations 22-25 affected by motor room noise

3 Locations 26-29 shielded partially by southern fan

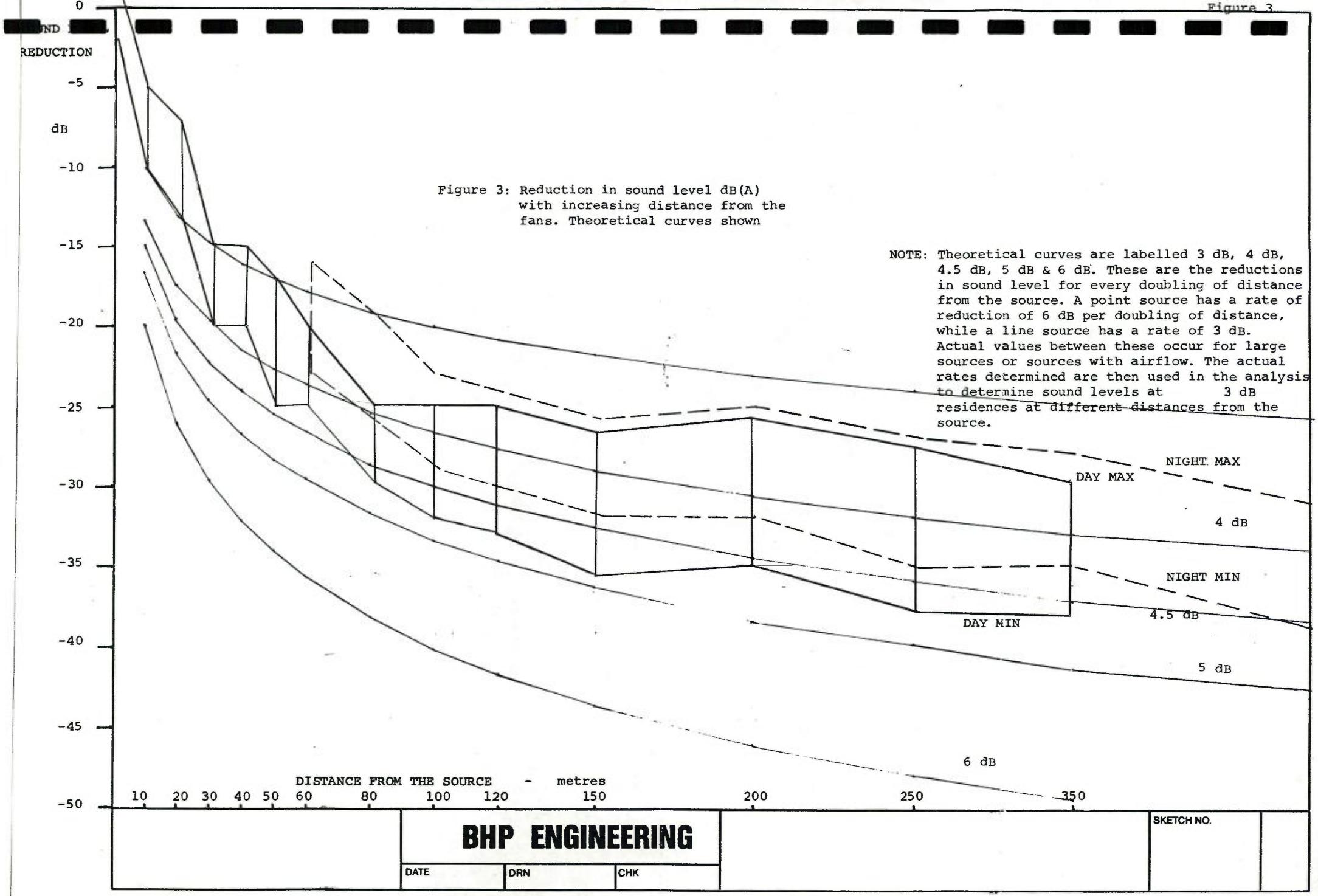


Figure 3: Reduction in sound level dB(A) with increasing distance from the fans. Theoretical curves shown

NOTE: Theoretical curves are labelled 3 dB, 4 dB, 4.5 dB, 5 dB & 6 dB. These are the reductions in sound level for every doubling of distance from the source. A point source has a rate of reduction of 6 dB per doubling of distance, while a line source has a rate of 3 dB. Actual values between these occur for large sources or sources with airflow. The actual rates determined are then used in the analysis to determine sound levels at 3 dB residences at different distances from the source.

BHP ENGINEERING

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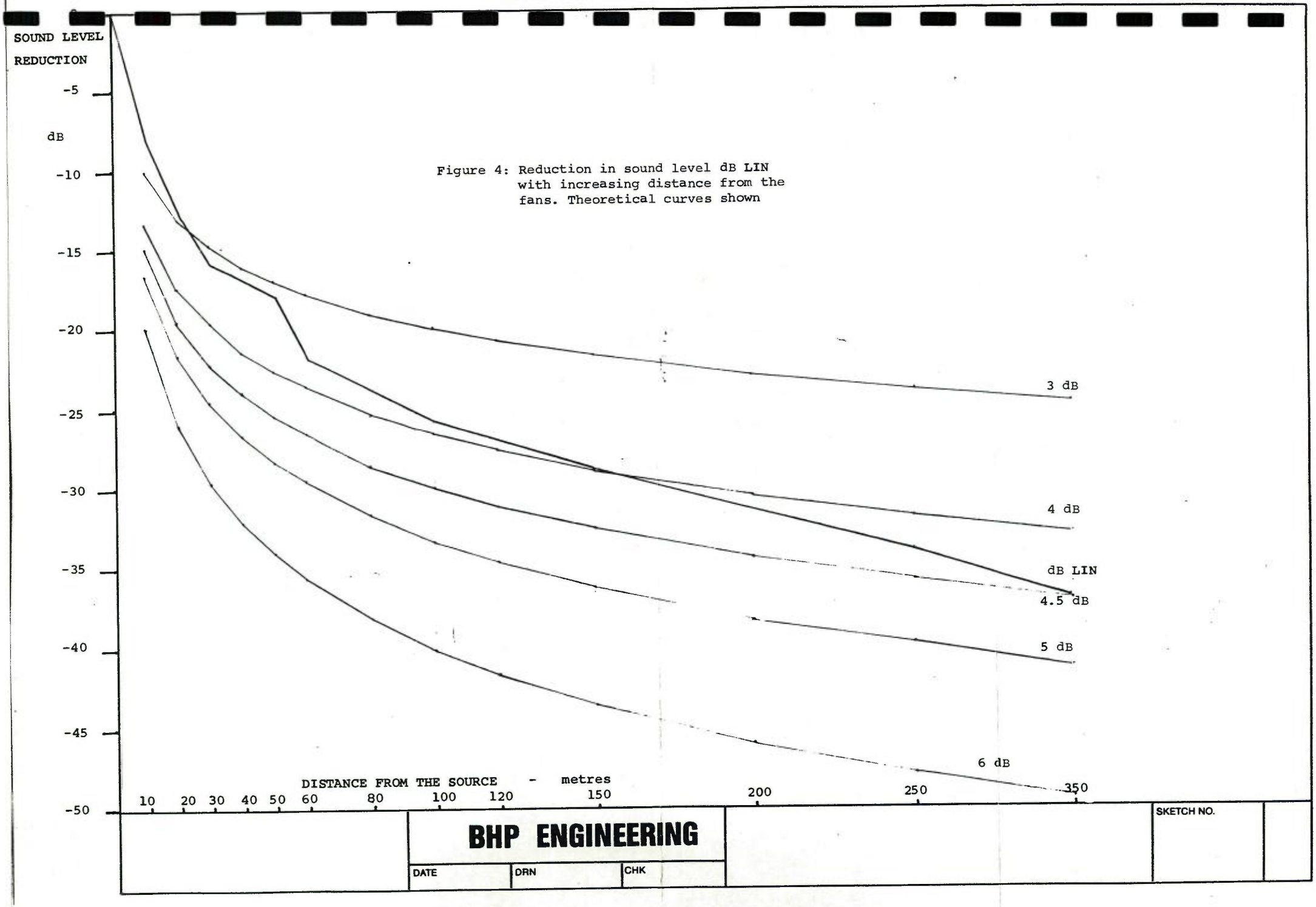

Figure 4: Reduction in sound level dB LIN with increasing distance from the fans. Theoretical curves shown

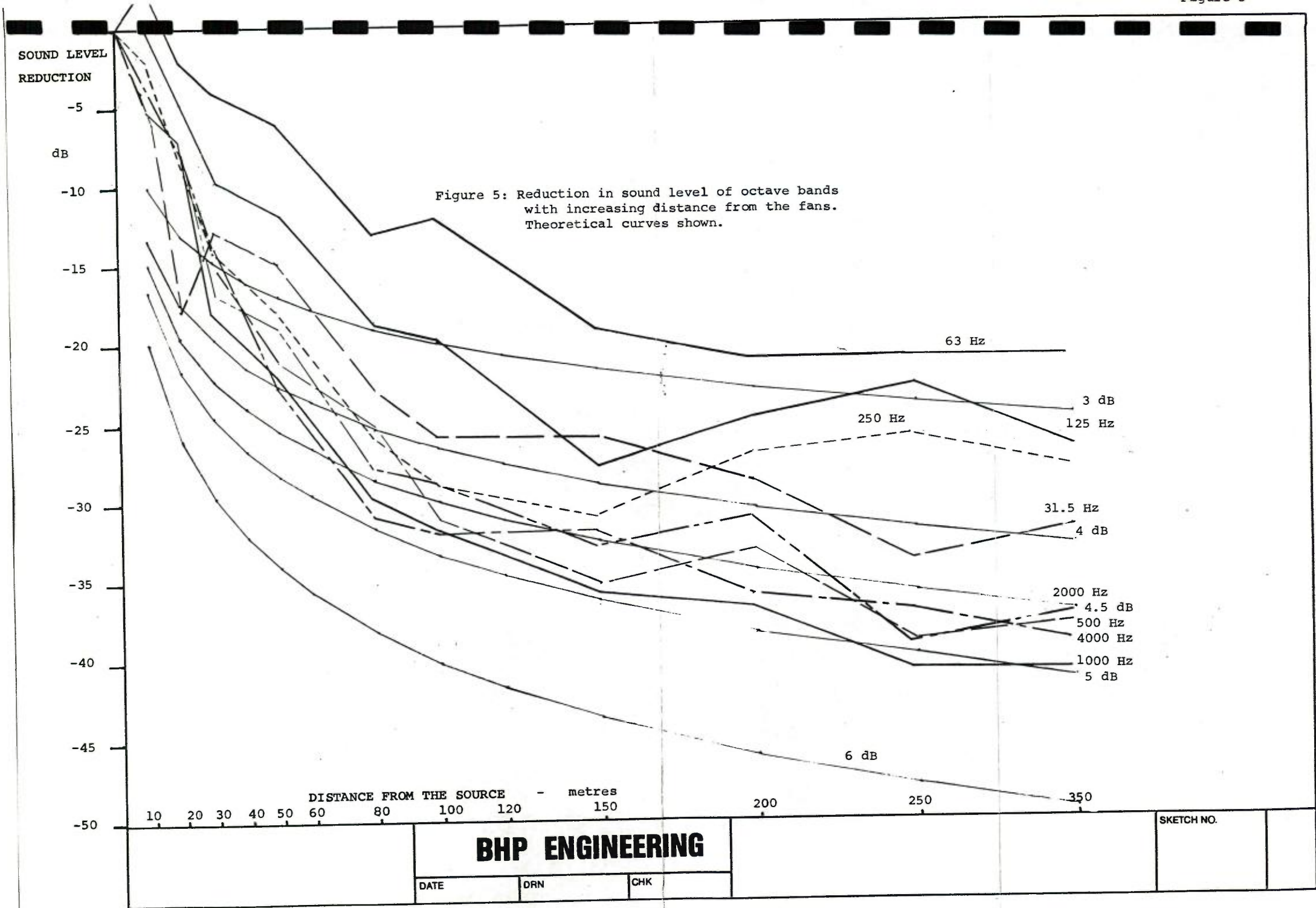

Figure 5: Reduction in sound level of octave bands with increasing distance from the fans. Theoretical curves shown.

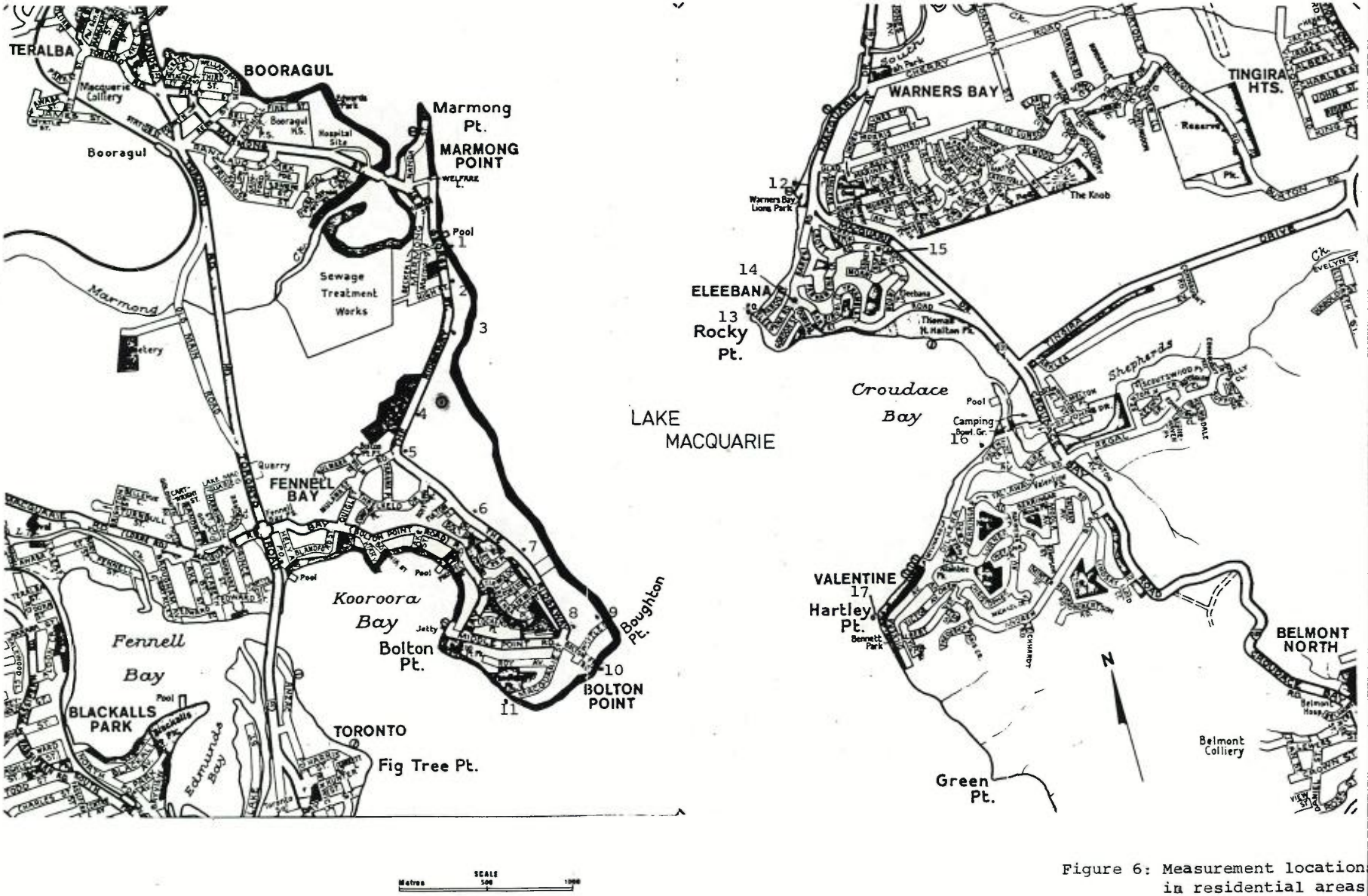

Figure 6: Measurement locations in residential areas.

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TABLE 2: SOUND LEVELS AT RESIDENTIAL LOCATIONS

	LOCATION	TIME	SOUND LEVEL dB(A) BACKGROUND	AVERAGE	COMMENTS -MAJOR SOURCES EVENT
		NIGHTTIME 30/6			
3	George St, 50m south of houses	6.00pm	37	38	Traffic from east and north sides of Lake.
5	Quigley St corner with the Ridgeway	6.20	37		Distant traffic on Toronto Road
9	Wattle St, north end	10.17	37	38	Surf at Belmont is background.
11	Macquarie St south end	10.25	40		Trains and road traffic in Toronto
10	Bolton Pt Rd east end	10.30	40		Trains and traffic in Toronto surf, Pacific Hwy traffic.
8	Ex Service-men home gate	10.35	38	39	Surf, traffic on Toronto Road
7	By north end house Ridgeway east side	10.38	36	38	Surf is background. Traffic trains.
6	Cnr Bolton Close	10.41	36	40	Surf, trains and traffic
5	Quigley	10.45	36	39	Traffic and trains. Surf occasionally.
3	George	10.59	33	35	Traffic west and east surf occassionally.
4	Ridgeway highest point	11.06	33	35	Traffic east, west and south. Surf is background.
2	Cnr George & High Sts	11.10	34	36	Traffic Warners Bay, train Teralba.

TABLE 2: SOUND LEVELS AT RESIDENTIAL LOCATIONS

	LOCATION	TIME	SOUND LEVEL dB(A) BACKGROUND	AVERAGE	COMMENTS -MAJOR SOURCES EVENT
1	Park, George St	11.14	36	38	Traffic Warners Bay and Eleebana clearly discernible 8°C, 94% rh clear, calm.
12	Warners Bay	11.33	38	40	Traffic north and west
13	Rocky Point	11.38	36	40	Traffic north
14	Cnr Boreeki Dr & Toonibal St Eleebana	11.46	34	37	Trains Teralba & Toronto, traffic north and south
15	Cnr Croft & Corwood, Eleebana	11.55	35	36	Surf is background. Traffic on Violet-town Rd Eraring visible. No noise from west.
	1/7am				
16	Valentine Ave Valentine	12.10	34	38	Traffic - motorcycle on Ridgeway.
17	Hartley Pt Valentine	12.20	32		Traffic in Toronto, also traffic east and north.
12	Lion Park Pt	1.25	36	40	Traffic north.
3	George	1.37	32	33	Traffic Pacific Hwy, surf train at Teralba
5	Quigley	1.47	30	32	Traffic east side. Surf
7	Ridgeway eastern houses	1.55	30	32	Traffic. Surf
	DAYTIME AM				
3	George	8.56	43	45	Regional traffic from all sections of lake. 10°C, 92%rh, calm, low haze.
5	Quigley	9.10	43	48	Traffic all areas

TABLE 2: SOUND LEVELS AT RESIDENTIAL LOCATIONS

	LOCATION	TIME	SOUND LEVEL dB(A) BACKGROUND	AVERAGE	COMMENTS -MAJOR SOURCES EVENT
6	Bolton Cl	9.20	43	46	Trains west and south Traffic mainly west but low frequency from east.
7	Ridgeway east houses	9.26	41	43	Traffic east, west and south equal.
8	Ex-service men gate	9.130	44	46	Regional traffic and birds
9	Wattle St	9.34	41	43	Birds. Distant traffic
10	Bolton Pt Rd	9.36	41	44	Traffic south and east Aircraft at Belmont
11	Macquarie St	9.41	44	47	Traffic
4	Ridgeway Top	9.45	40	42	Distant traffic all directions
	Fan Site	9.48	43	45	Traffic east at Warners Bay, some south west. Siren from Speers Point.
	Plateau in track below fan site	9.55	43	46	Traffic south west above traffic east
1	Park George St	10.04 PM	41	43	Traffic east
13	Rocky Pt	12.00	42	44	Traffic mainly Warner Bay Discern west
15	Croft	12.05	36	38	Traffic Warners Bay. Cannot discern west
17	Hartely Pt	12.10	39	42	Traffic around Eleebana Toronto traffic discernible

APPENDIX 3

GROUNDWATER REPORT

BHP STEEL
MACQUARIE COLLIERIES

PACIFIC COLLIERY NO 3 SHAFT

GROUNDWATER STUDY

NF 86/09

REPORT 1362/1
NOVEMBER 1986

AUSTRALIAN
GROUNDWATER
CONSULTANTS
PTY LIMITED

AUSTRALIAN GROUNDWATER CONSULTANTS PTY LIMITED
INCORPORATED IN N.S.W.

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2nd December, 1986

BHP Steel
Macquarie Collieries
PO Box 171
BELMONT NSW 2280

Attention: Mr W A Williams

Dear Sir

PACIFIC COLLIERY NO 3 SHAFT GROUNDWATER STUDY

Enclosed is our report on the groundwater investigations carried out for the EIS and engineering studies for the No 3 Shaft for the Pacific Colliery. Details are included on testing carried out and the predicted inflows during construction.

Please contact us should you require any further information.

Yours faithfully
AUSTRALIAN GROUNDWATER CONSULTANTS PTY LTD

W.H. MORTON
PRINCIPAL

F.J. MOHEN
ASSOCIATE

TABLE OF CONTENTS

SUMMARY AND CONCLUSIONS

A ventilation shaft is proposed at the Pacific Colliery. In order to predict construction of environmental factors a cored hole has been drilled in the location of the proposed shaft.

Airlift and recovery testing has been carried out as the hole progressed and water levels monitored prior to daily drilling.

The hole was completed to a depth of 374.25 m and a suite of geophysical logs were carried out. Geological logging has been carried out by BHP.

From all of the available data, estimates have been made of potential inflow zones and associated permeabilities. These were then used to predict potential inflow during shaft construction.

Inflows during drilling were low, with no test yielding greater than 40 m^3/day. Calculated permeabilities were generally less than 0.2 m/day and values of this order are anticipated over minor thicknesses only, with the majority of the hole yielding water at immeasurable rates.

A range of inflow predictions have been made for each inflow zone. Initial flows of up to 300 m^3/day have been calculated however these are considered upper limits, with flows more likely to be less than 100 m^3/day initially, and decreasing to less than 50 m^3/day after 3 days.

Water quality monitoring was carried out during drilling and although influenced by the introduction of potable drilling water, indicated that upper aquifers would be saline (10000 to 16000 mg/L) and lower aquifers would decrease in salinity to levels below 1000 mg/L.

1.0 INTRODUCTION

BHP Macquarie Collieries are carrying out EIS and Engineering studies for the construction of the No 3 Fan Ventilation Shaft at their Pacific Colliery.

The shaft will be constructed approximately 7 m in diameter and will proceed to a depth of approximately 375 m. The proposed location is shown in Figure 1. Australian Groundwater Consultants Pty Ltd (AGC) have been engaged to evaluate the potential groundwater inflows.

2.0 GEOLOGY

The shaft is sited in an area where it will intersect sediments of the Newcastle Coal Measures. These form a north-south synclinal structure dipping to the south with Lake Macquarie relatively centrally located in the north.

The sediments consist of coal, other carbonaceous material, conglomerate, sandstone, sandy shale, shaly sandstone, shale and tuff. The recorded thickness of the measures ranges from a maximum of 460 m at Toronto, to 70 m some 10 km to the west near Mulbring Gap. (Packham, 1969).

3.0 INVESTIGATION PROGRAMME

An "H" size (96 mm ID) cored hole has been drilled approximately 10 m from the centre line of the proposed shaft. The hole has been geologically logged by BHP and a suite of geophysical logs have been run. Selected logs are presented in Figure 2.

During the drilling of the hole a number of airlift recovery tests were carried out.

Initially it was proposed to airlift using the annulus between the rods and the hole for air entry and forcing water up the centre of the rods. This necessitated the cementing of steel casing at the top of the hole. A length of approximately 6 m was installed and cement grouted in place. Headworks to facilitate airlifting by the method proposed were constructed as shown in Figure 3.

The first test was carried out at a depth of 88.5 m. The result of pressurising the annulus was a general escape of air from the ground surface surrounding the rig, for a distance of up to 10 m. This was possibly due to the cement grouted steel casing failing to extend to sufficient depth to pass some fracturing in the upper section of conglomerate.

Due to the problems associated with this method the first three tests were carried out using the drillrods for air entry and the annulus for discharge. The same headworks were used with the direction of flow reversed. Airlifting was carried out for 30 minutes followed by careful monitoring of the recovery. As the hole progressed, and testing was deeper, it was necessary to introduce 'BQ' rods as the air entry pipe during airlifting due to the excessive hydrostatic head on the HQ rods. Modifications were made to the headworks to accommodate this. Testing continued and the final test was carried out at 374.25 m, the total depth of the hole. Water samples were collected at the conclusion of airlifting during each test. These were analysed and the results are presented in Table 1. At the conclusion of drilling geophysical logs were run.

The water level in the hole was recorded prior to the commencement of daily drilling. These are plotted in Figure 4.

In order to obtain the hydrostatic pressure at various sequences throughout the depth of the hole a double packer assembly was utilised. The assembly is shown diagramatically in Figure 5.

The packers were initially installed at depths of 355.2 and 361.3 m. Pressure testing and airlifting were carried out. Attempts were then made to reinstall the assembly higher in the hole. This was unsuccessful due to damage occuring to the neoprene sleeves of the packers.

Due to time delays in repairing the packers no further testing was carried out. The hole was backfilled with cement grout and a piezometer was installed.

Subsequent tests on this piezometer indicated that it was probably blocked.

TABLE 1

WATER SAMPLE ANALYSES

Analysis

Test No.		1	2	3	4	5	6	7
Sample No.		M199	M219	M220	M221	M222	M226	M227
Date Sampled	1986/10/	02	09	10	13	17	23	28
Time Sampled		12.50pm	12.20pm	11.13am	11.45am	11.42am	10.10am	10.12am
pH		7.2	6.3	6.9	7.9	8.9	9.1	8.6
Non-filtrable residue	mg/L	490	333	900	1830	8400	48000	18800
Conductivity	mS/m	1490	2370	1500	647	130	120	75
Chloride	mg/L CL	6250	8900	5300	2220	400	280	140
Carbonate	mg/L $C0_3$	Nil	Nil	Nil	Nil	36	40	6
Bicarbonate	mg/L $HC0_3$	290	220	260	320	115	190	160
Calcium Hardness	mg/L $CaC0_3$	1270	2420	1140	380	60	10	5
Total Hardness	mg/L $CaC0_3$	2800	5270	2620	820	100	40	50
Ammoniacal Nitrogen	mg/L N	2.4	3.1	2.2	1.2	0.68	2.5	1.7
Nitrite Nitrogen	mg/L N	<0.01	<0.01	<0.01	<0.01	<0.01	1.0	<0.01
Nitrate Nitrogen	mg/L N	0.01	0.09	0.02	<0.01	<0.01	<0.01	<0.01
Sulphate	mg/L $S0_4$	300	690	320	110	96	70	56
Orthophosphate	mg/L P	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.07
Sodium	mg/L Na	2700	4200	2700	1300	320	290	160
Potassium	mg/L K	16	28	25	12	8.0	32	12
Total Dissolved Salts (Calculated)	mg/L	10400	15700	9400	4200	1000	910	550

4.0 ANALYSIS OF RESULTS

Due to the low permeability of the sequences intersected, classic pumping test recovery analysis could not be utilised. The volume of the hole is a dominating feature in the recovery. The rising head test analysis was more appropriate.

Cedergren (1977) describes a method based on shape factors for open holes as set out by the US Dept of the Navy, Naval Facilities Engineering Command (1974).

The method can be adopted using the total open hole length as the aquifer thickness or reducing the aquifer thickness to include only sequences considered likely to contribute measurable inflows.

The later method was considered more appropriate due to the predicted long lengths of hole with virtually no permeability.

The equation is summarised as follows:

$$k = \frac{R^2}{2L(t_2-t_1)} \ln\left(\frac{L}{R}\right) \ln\left(\frac{h_1}{h_2}\right)$$

for $\frac{L}{R} > 8$

Where $F = \frac{2\pi L}{\ln (L/R)}$

and

k = permeability
R = hole radius
L = length of hole contributing
t = time
h = residual drawdown

Potential inflow zones were delineated using all available information, including; daily water level records, geophysical logs, descriptive geological logs, water sample analysis and general airlift recovery trends. The selected zones are summarised in Table 2.

A range of values were obtained from each rising head test due to the uncertainty in the contributing aquifer thickness and the variation in recorded recovery rate with time. The results are summarised in Table 3 and plotted in Figures 6 to 12.

TABLE 2

Probable Inflow Zones

Probable Zone	discharge m^3/day	TDS mg/L	From (m)	To (m)	Notes
Gt Northern			38.3	45.0	Minor seep - no w.l. change. drop in resistivity (13500-13250)
Top of Fassifern			53.5		Increase in water level. Possible minor faulting.
Fassifern				67.12	Sub-vertical fracture (log) res.low in coal
Test 1 88.5 m	*	10400			
Upper/lower Pilot. Various (allow for coal/shale only in thickness)			139	166	Minor core loss. Subvertical calcite filled fractures
Test 2 172.5	30	15700			
Australasian (partial)			189	193.5	Dilution of Test 2 sample
Test 3 193.5	*	9400			
Australasian (cont'd)			193.5	200	Further dilution increase in T
Test 4 205.5	29	4200			
Montrose/Wave Hill			265	268.5	Drop in resistivity in coal. Decrease in salinity
Test 5 271.5	27	1000			
Shale, coal lense (base Lower Fern Valley Seam)			305.9	306.3	High angle slickenside increase in T
Test 6 331.5	33	910			
Coal, Victoria Tunnel Seam			334	372	Caliper, low resistivity in coal
Young Wallsend/Yard Borehole Seams	43				core not available, packer test indicates low permeability
Test 7 374.25		550			

* insufficient to measure

TABLE 3

RISING HEAD TEST RESULTS

INFLOW ZONE	FROM (m)	TO (m)	Permeability (m/day) (average)	Transmissivity (m^2/day) Total Sequence	Inflow Zone
Great Northern	38.3	45	v.low	v.low	
Fassifern	53.5	67	.05-.11	.13-.3	.1-.3
Upper/Lower Pilot	139	166	.009-.025	.2-.4	.2-.4
Australasian (partial)	189	193.5	.001-.05	.2-.4	0-.2
Australasian (cont'd)	193.5	200	.002-.02	.25-.4	.05-.2
Montrose/Wave Hill	265.6	268.5	.001-.015	.25-.45	0-.2
Shale, coal lense (base of Lower Fern Valley Seam)	305.9	306.3	.001-.01	.25-.4	0-.15
VT Seam,YW/YSeam and Borehole Seam	334	372	.005-.01	.3-.4	.05-.15

A general trend of increasing transmissivity with depth is evident as is a decrease in average permeability.

Water quality analysis from the tests are plotted as Schoeller diagrams in Figure 13. A general dilution with depth is evident with the exception of the sample from Test 2 below the Upper/Lower Pilot seams.

The upper inflow zones appear to be saline, with possible connection to the Lake system. The sample from Test 1 is possibly a combination of saline water from the Great Northern Seam and a lower salinity water from the Fassifern seam.

The increase in salinity during Test 2 indicates that the Upper/Lower Pilot seams are of a higher salinity than the Fassifern. As testing continued the water quality continued to improve and reached a minimum TDS of 550 mg/L at the completion of the hole.

This dilution could be due in part to ingression of drilling water which was potable, and would be assisted by the sealing of the upper more saline aquifers with clay from the formation carried in the circulating drilling water. No substantial water loss (or make) was encountered during drilling indicating that the dilution is predominantly due to formation water.

The sealing of the upper aquifers during drilling is further suggested by the less than expected increase in calculated transmissivity as the hole progressed. The dilution factor indicates a greater input from lower aquifers in later testing than the recovery readings indicate.

A number of swelling clay layers were also evident in the hole (eg 264 m) which may have also restricted flow from upper aquifers during later testing due to blocking of the annulus betwen the rods and the hole.

The attempt to obtain a piezometric head for the individual aquifers using the double packer assembly was inconclusive.

The packers were set isolating a sequence from 355.2 to 361.3 m within the Young Wallsend/Yard Hill seam. The water level recorded from this zone was 1.5 m below ground level. Subsequent recovery readings after airlifting indicated that the zone would not have established to this high water level in the time following setting of the packer and that it was more likely an introduced head due to displaced water in the hole. A 'pump in' test was carried out on the sequence. However leakage past the packer, evident by a flow of water from the annulus indicated that the test was unsuccessful.

An airlift recovery test was then carried out, the results of which are included in Figure 4. A low yield (less than 10 m^3/day) was accomplished from the zone and the very slow recovery indicated a relatively low permeability although affected by leakage of the packer.

Further isolated zone testing using the packers was not possible due to damage to the unit when resiting higher in the hole and the required replacement parts were unavailable in the time available.

5.0 INFLOW PREDICTIONS

As the shaft progresses downwards the aquifers described previously will be intersected. These aquifers are all confined by various impermeable sequences and for the purposes of calculating inflows have been assumed to have a similar piezometric level of approximately 20 m below ground level.

This could not be confirmed by testing. The general declining trend in daily water level records suggest that the piezometric level in the lower aquifers was less than that in the higher aquifers, resulting in larger calculated inflows.

The inflow predictions have been made based on the transmissivity calculated for the various inflow zones. It has been assumed that the zones when intersected have the original piezometric level and that the shaft instantaneously reduces the head to the base of the inflow zone. It is probable that depressurisation will occur gradually as the shaft sinking progresses due to leakage upwards from the lower aquifers resulting in lower levels when the aquifers are reached.

The calculation of inflow has been made based on a transient seepage situations as described by Hazel, (1973), after Jacob & Lohman (1952). The equation used is a solution of the partial differential equation to radial flow of groundwater and assumes that the drawdown is constant and that the discharge varies with time.

The equation is -

$$Q = T.2\ G(\alpha)s_W$$

where $$= \frac{T\,t}{Sr_W^2}$$

s_W = constant drawdown
r_W = radius of bore (shaft)
$G(\alpha)$ = the G function of α (see Hazel)
T = transmissivity
S = storage coefficient
t = time.

The inflow predictions using this equation and based on the transmissivity range previously calculated, are presented in Table 4.

It should be noted that the method tends to overestimate the discharge and therefore actual values are likely to be less than those presented. This trend will be further enhanced by probable depressurisation of aquifers by upward leakage prior to the shaft reaching them.

Predicted water quality based on sampling carried out during testing is included in Table 4. Some dilution may have occurred due to the introduction of potable drilling water although is not considered significant.

6.0 SUMMARY AND CONCLUSIONS

A ventilation shaft is proposed at the Pacific Colliery. In order to predict construction of environmental factors a cored hole has been drilled in the location of the proposed shaft.

Airlift and recovery testing has been carried out as the hole progressed and water levels monitored prior to daily drilling.

TABLE 4

INFLOW PREDICTIONS

Inflow Zone	Depth	Flow (m^3/day)			Predicted
		(30 min)	(6 hrs)	(3 days)	TDS (mg/L)
Fassifern	67m	40-100	20-50	10-30	10000 mg/L
Upper/Lower Pilot	166	150-250	80-140	60-100	> 15700
Australasian	200	70-310	30-170	20-120	< 9000
Montrose/Wave Hill	269	0-230	0-130	0-90	< 1000
Lower Fern Valley (base)	306	0-210	0-120	0-80	< 1000
VT, YW/Y and Borehole Seams	372	130-270	60-150	40-100	< 1000

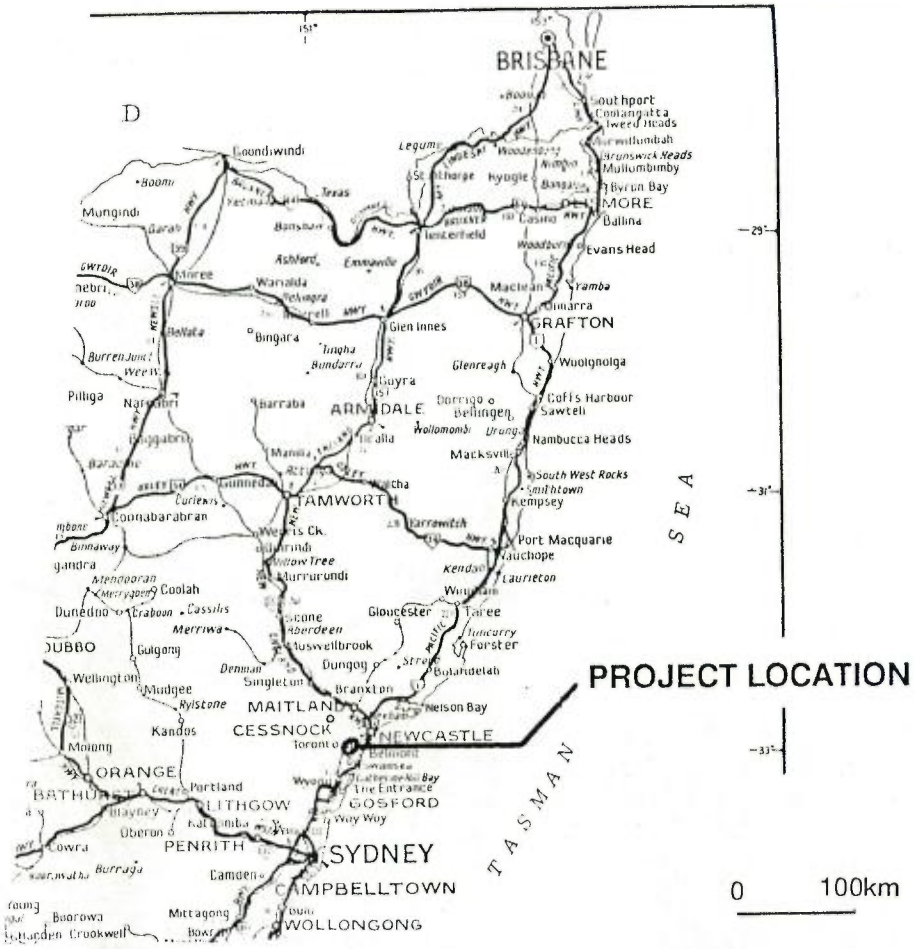
The hole was completed to a depth of 374.25 m and a suite of geophysical logs were carried out. Geological logging has been carried out by BHP.

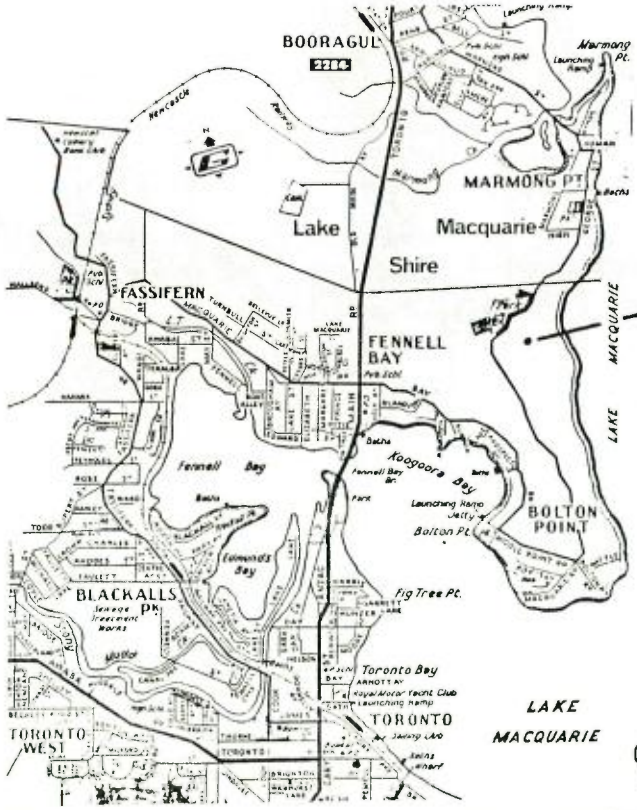
From all of the available data, estimates have been made of potential inflow zones and associated permeabilities. These were then used to predict potential inflow during shaft construction.

Inflows during drilling were low, with no test yielding greater than 40 m^3/day. Calculated permeabilities were generally less than 0.2 m/day and values of this order are anticipated over minor thicknesses only, with the majority of the hole yielding water at immeasurable rates.

A range of inflow predictions have been made for each inflow zone. Initial flows of up to 300 m^3/day have been calculated however these are considered upper limits, with flows more likely to be less than 100 m^3/day initially, and decreasing to less than 50 m^3/day after 3 days.

Water quality monitoring was carried out during drilling and although influenced by the introduction of potable drilling water, indicated that upper aquifers would be saline (10000 to 16000 mg/L) and lower aquifers would decrease in salinity to levels below 1000 mg/L.





N1739

E 357 129.97
N 1 348 104.09
RL 25.46

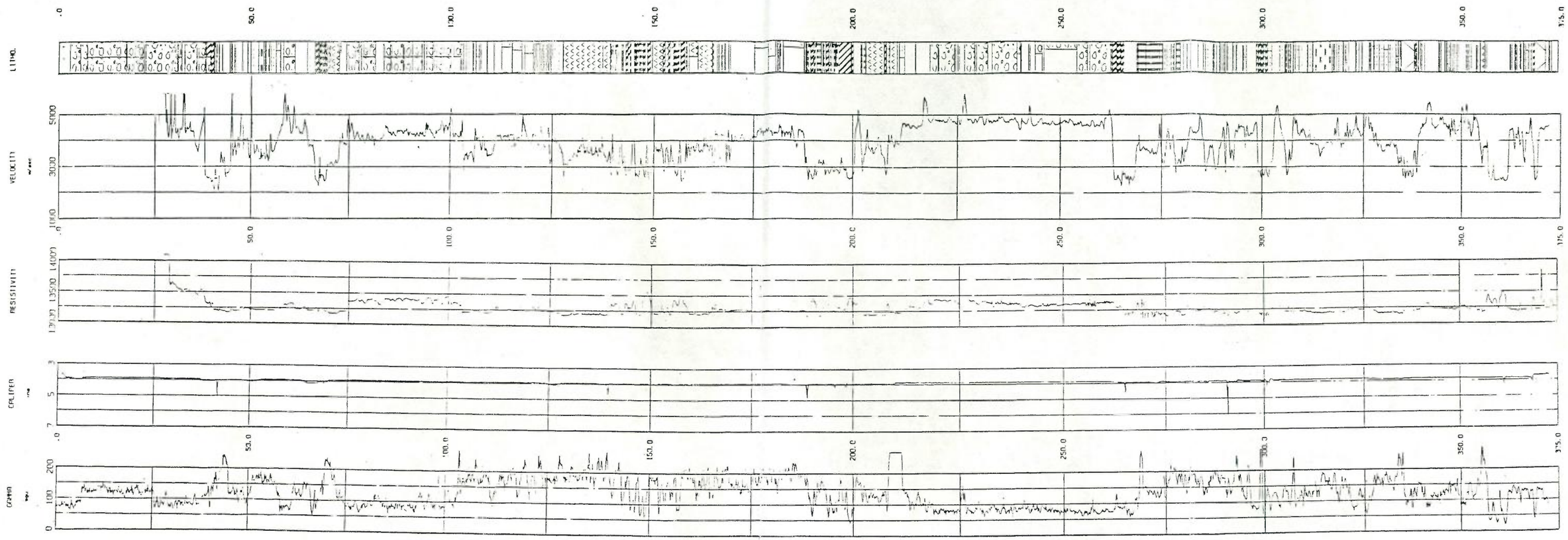
AUSTRALIAN GROUNDWATER CONSULTANTS PTY. LIMITED

BHP STEEL - MACQUARIE COLLIERIES

PACIFIC COLLIERY No.3 SHAFT GROUNDWATER STUDY

LOCALITY PLAN

DATE	DWG. NO.	FIG. NO.
Nov 86	1362/	1



LEGEND
LITHOLOGY REFERENCE

- SAND
- CONGLOMERATE
- SANDSTONE - MEDIUM GRAINED
- SANDSTONE - VERY FINE GRAINED
- TUFF
- SANDSTONE - FINE GRAINED
- SILTSTONE
- MUDSTONE
- SANDSTONE - COARSE GRAINED
- CLAYSTONE
- COALY SHALE
- CLAY
- COAL

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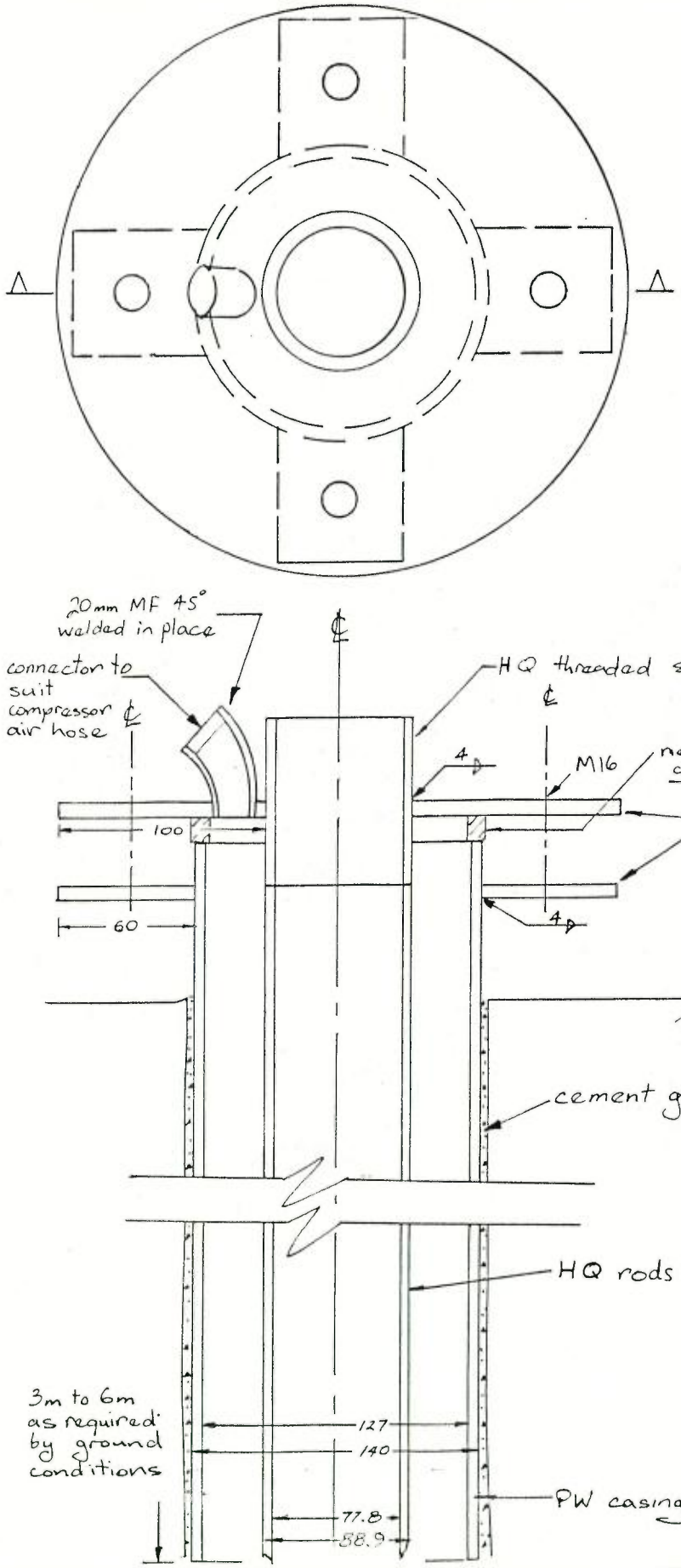
PACIFIC COLLIERY No.3 SHAFT GROUNDWATER STUDY

BORE 1739 LOGS

DATE	DWG. NO.	FIG. NO.
Nov 86	1362/2	2



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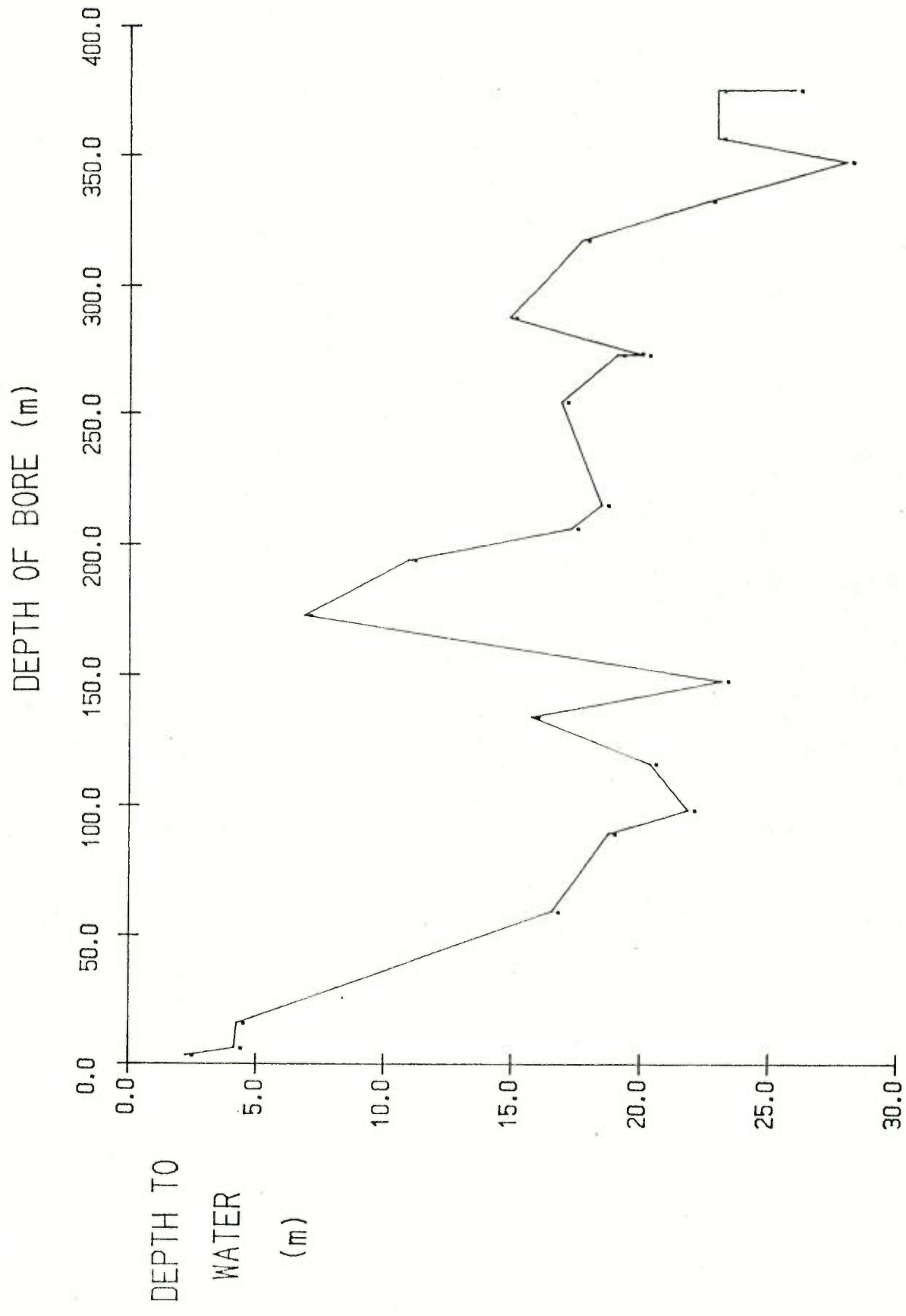
BHP STEEL - MACQUARIE COLLIERIES

PACIFIC COLLIERY No.3 SHAFT GROUNDWATER STUDY

BORE TESTING HEADWORKS

DATE	DWG. No.	FIG. No.
Nov 86	1362/	3



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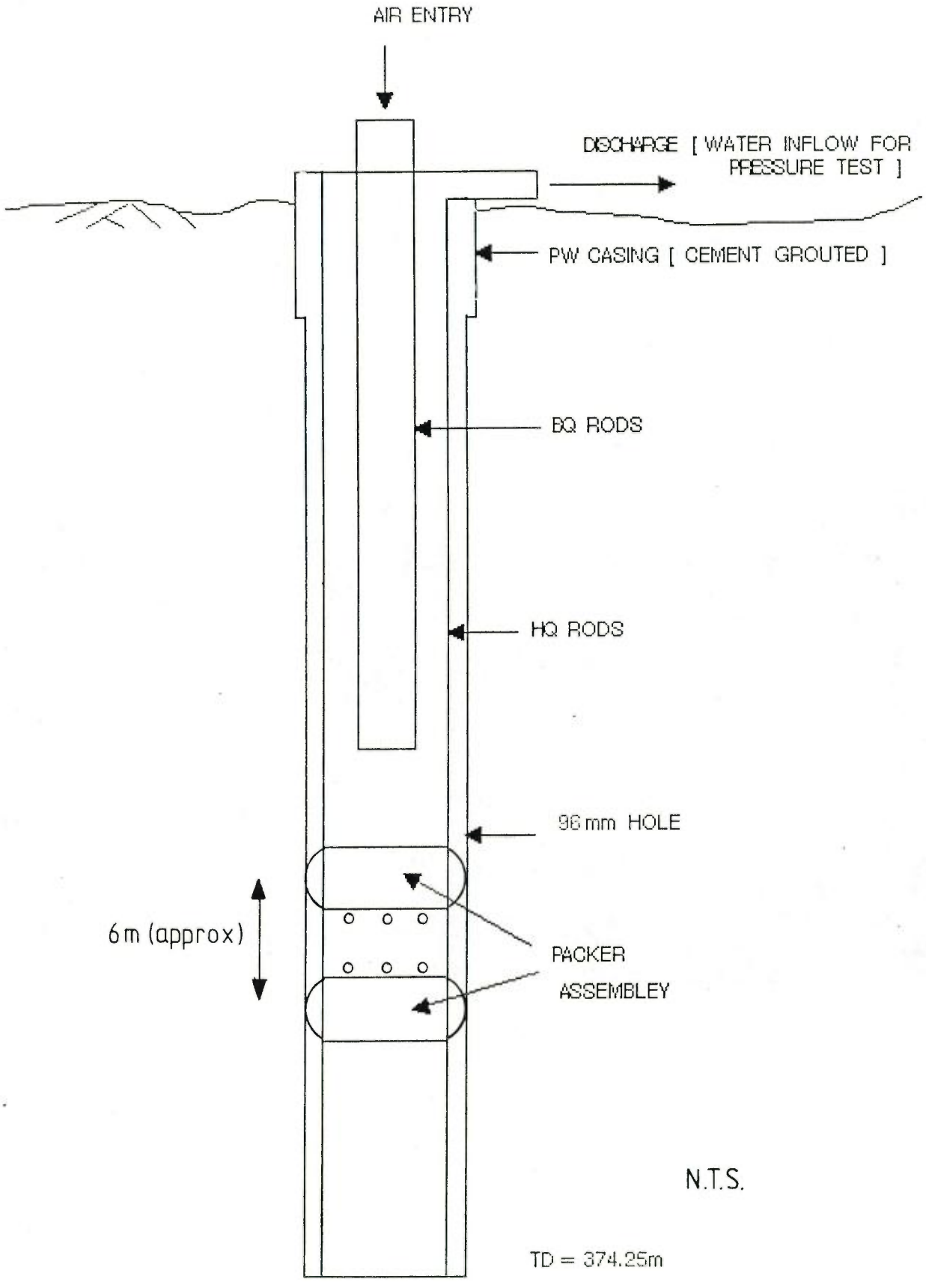
PACIFIC COLLIERY No.3 SHAFT GROUNDWATER STUDY

BORE WATER LEVELS

DATE Nov 86	DWG. Nº. 1362/	FIG. Nº. 4



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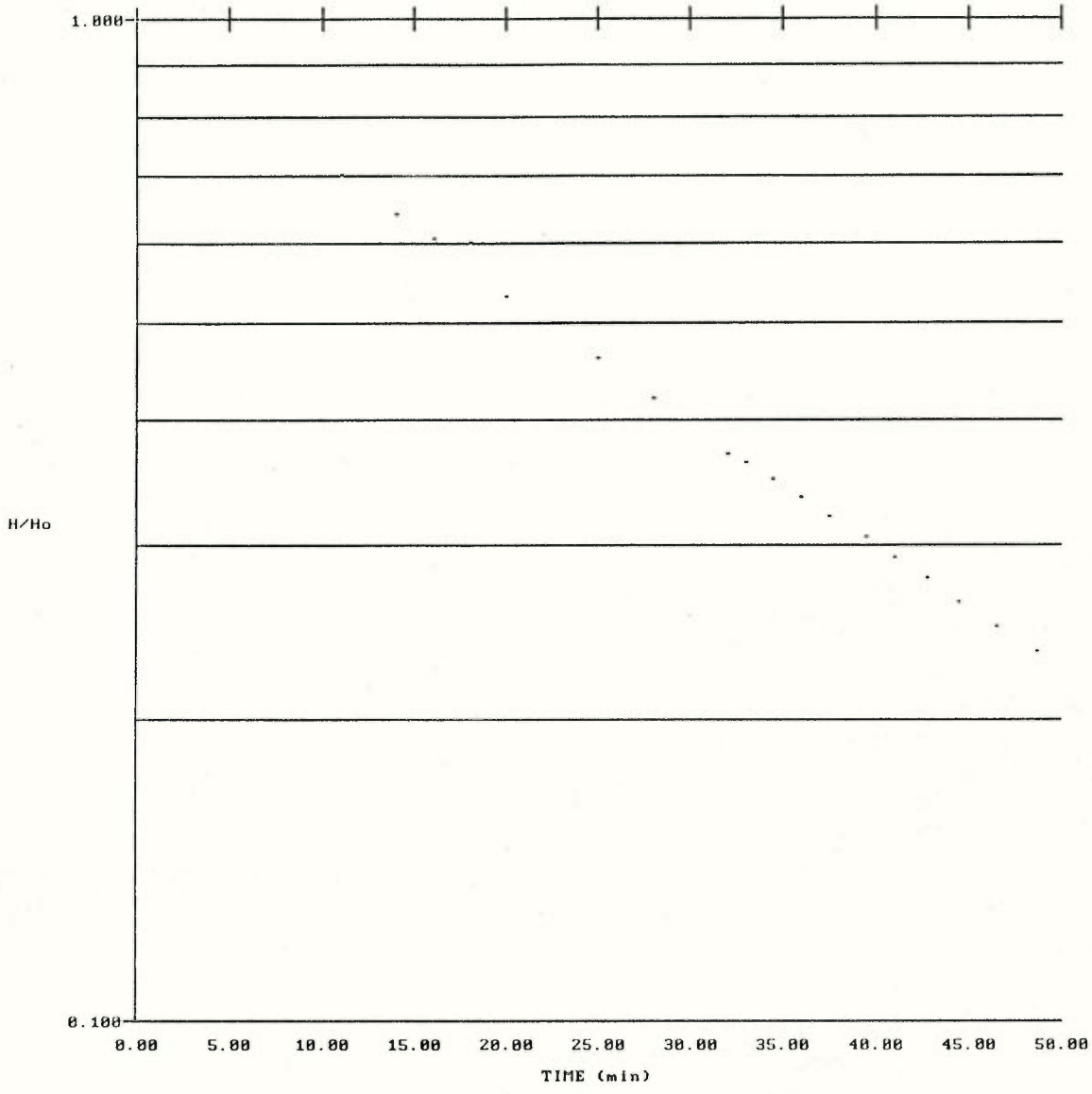
BHP STEEL - MACQUARIE COLLIERIES

PACIFIC COLLIERY No.3 SHAFT GROUNDWATER STUDY

PACKER TEST CONFIGURATION

DATE	DWG. No.	FIG. No.
Nov 86	1362/	5



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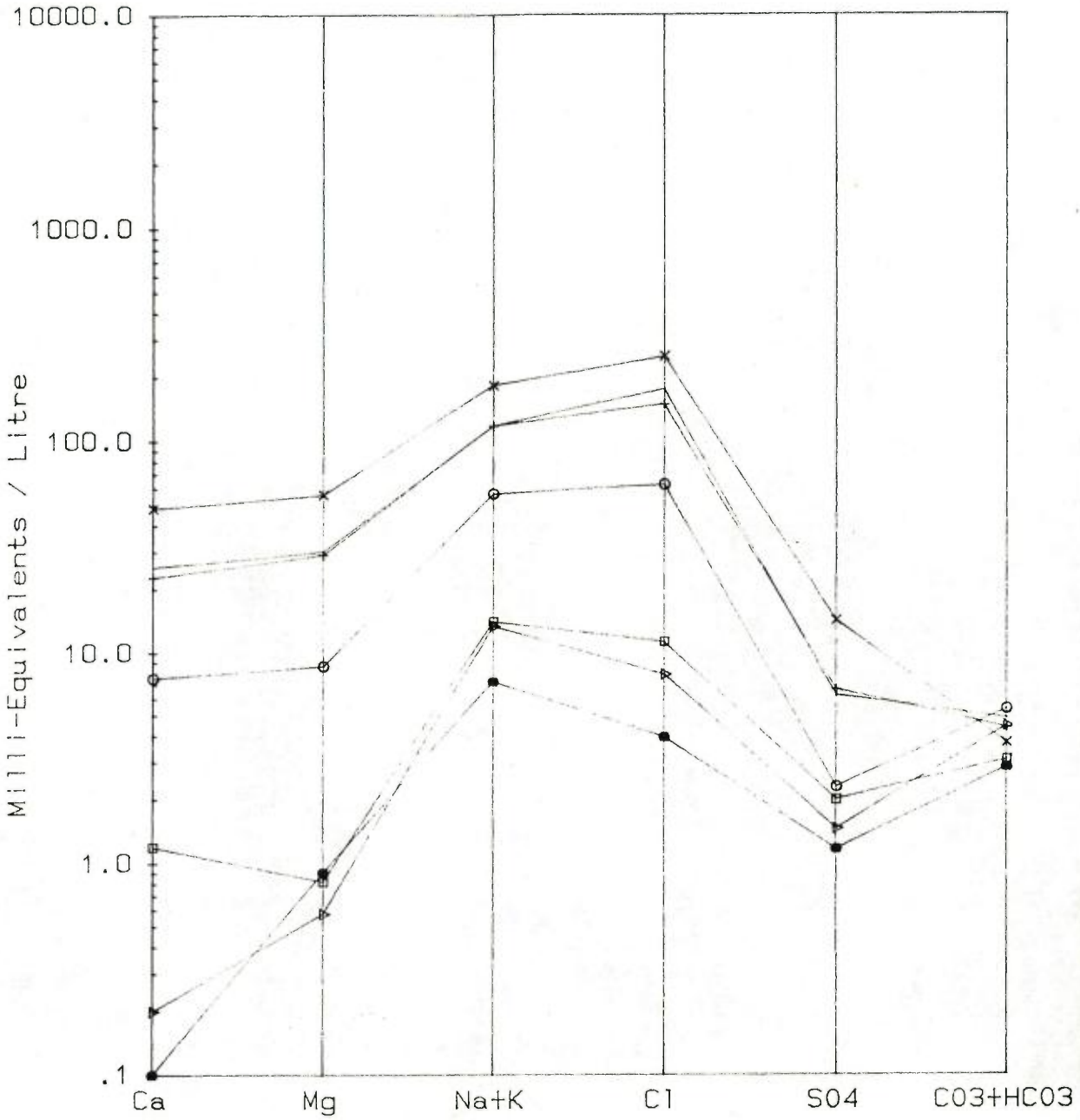
BHP STEEL - MACQUARIE COLLIERIES

PACIFIC COLLIERY No.3 SHAFT GROUNDWATER STUDY

RISING HEAD TEST 1

DATE	DWG. No.	FIG. No.
Nov 86	1362/	6



KEY

- TEST 1
- × TEST 2
- \+ TEST 3
- o TEST 4
- □ TEST 5
- ▽ TEST 6
- ● TEST 7

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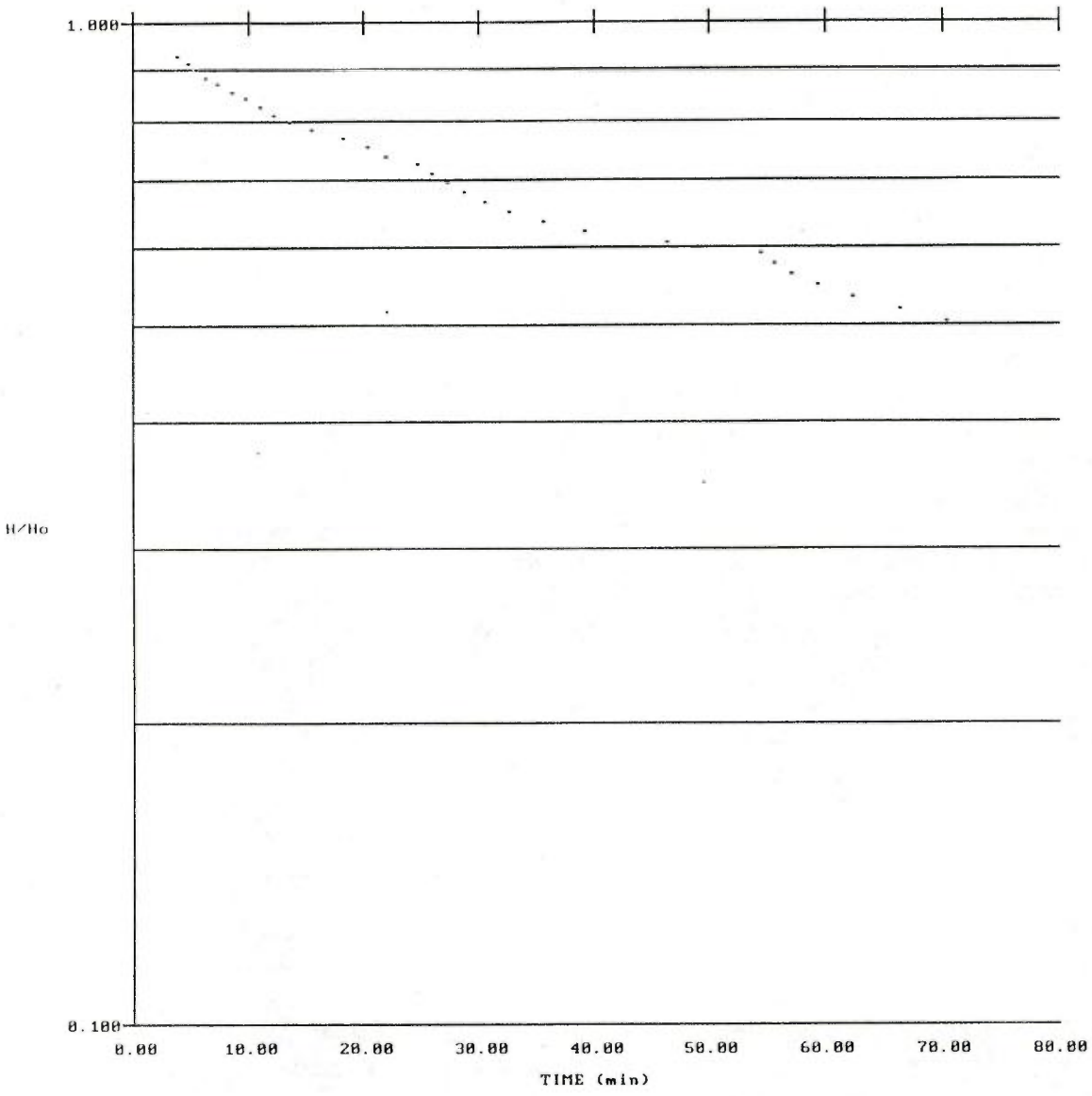
BHP STEEL - MACQUARIE COLLIERIES

PACIFIC COLLIERY No.3 SHAFT GROUNDWATER STUDY

SCHEOLLER DIAGRAMS

DATE	DWG. No.	FIG. No.
Nov 86	1362/	13



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BHP STEEL - MACQUARIE COLLIERIES

PACIFIC COLLIERY No.3 SHAFT GROUNDWATER STUDY

RISING HEAD TEST (PACKER)

DATE	DWG. No.	FIG. No.
Nov 86	1362/	14

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APPENDIX 4

FLORA AND FAUNA

THE BROKEN HILL PROPRIETARY CO. LIMITED
MACQUARIE COLLIERIES
PACIFIC COLLIERY

FLORA AND FAUNA

OF THE

PROPOSED NO 3 VENTILATION SHAFT SITE

A. Bartrim

August 1986

TABLE OF CONTENTS

1.0 INTRODUCTION

A brief survey of the flora and fauna of a 3 hectare site of bushland at Bolton Point, Lake Macquarie was required as part of an Environmental Impact Statement for the proposed No 3 Ventilation Shaft for Pacific Colliery. The survey was subsequently carried out over a two day period in August 1986.

The main objectives of the survey were defined as being:

* To map and describe the main vegetation communities occurring on the site.

* To identify and list as many vascular plant and vertebrate fauna species occurring on or likely to utilise the site.

* To assess the conservation status and value of species, vegetation units and habitats and discuss the sensitivity of components to disturbance.

2.0 BIOLOGICAL SETTING

The site is located virtually adjacent to the northwestern shores of Lake Macquarie between Bolton Point and Marmong Point. The general area forms part of the Elrington Land System which is typified by rounded hills and open valleys with podzolic soils, some skeletal soils and earths (**Story et al., 1963**). A gently sloping ridge-line running along the eastern boundary of the site drops more steeply down to the lake some 200m southeast of the site. Immediately to the east of this ridge, the land slopes down to the water. To the west, within the site boundaries, there is a small gully with gentle slopes either side. At the time of the field survey, this gully contained a small flowing watercourse, but for most of the year, the channel would be dry. All drainage from the site would flow directly into Lake Macquarie.

All of the described area, except for an access track to the water, retains a cover of bushland comprising mixtures of predominantly Spotted Gum, Grey Gum, Stringybarks, Mahoganies, Red Bloodwood and Smooth-barked Apple. This bushland extends to the north and south along the foreshore of Lake Macquarie and westwards for some kilometres. However, this large tract of vegetation to the west is separated from the site by the road connecting Bolton Point and Marmong Point and is itself broken by the major transport routes of Toronto Road and the Great Northern Railway at Fassifern, and by urbanisation.

There have been numerous disturbances to the site in recent years including track development, rubbish dumping, logging and frequent fires. This has resulted in an overall degradation of the bushland.

3.0 FLORA

3.1 METHODS

Vegetation communities and plant species occurring on the site were investigated over a two day period in August 1986. A total of approximately one man-day was

spent in the field.

Most of the site was traversed on foot and all identifiable species were recorded. A small number of plant specimens were sent to the National Herbarium for further identification.

Communities were described in terms of dominant trees and structural characteristics as outlined by **Specht et al (1974).**

3.2 VEGETATION COMMUNITIES AND GENERAL FLORISTIC CHARACTERISTICS OF THE SITE

A total of 61 plant species have been recorded for the site and are listed in **Table 1.** The majority of these comprise members of the MYRTACEAE, MIMOSACEAE, and FABACEAE families.

Most of the site supports a dry sclerophyll open-forest dominated by Spotted Gum, Grey Gum, and White Stringbark with a sparse to moderate shrub understorey. Detailed descriptions of this Community and two variations are presented in **Table 2.** The variations are associated with the presence of the small gully on the western side of the site and with a recent fire. Such sheltered gullies often support wet sclerophyll or rainforest species but these elements are very poorly represented on the site.

The distribution of the communities recognised is shown in **Figure 1.**

Another vegetation type common in the general locality, the Smooth-barked Apple/Bloodwood Community, occurs immediately to the west of the site and the two dominant tree species extend into the northwest of the site as occasional specimens.

3.3 REHABILITATION SPECIES

A number of plant species occurring naturally in the area would be potentially suitable for rehabilitation purposes. These species are indicated in **Table 1** and include trees, shrubs and groundcovers.

3.4 ASSESSMENT OF THE CONDITION OF THE VEGETATION

Although the site retains a relatively natural vegetation cover, much of this is in poor condition, probably in part as a result of a high incidence of fires. Dumping of rubbish along the eastern access track and weed infestations also detract from the overall appearance of the vegetation. Logging has been carried out over most of the site resulting in a cover of predominantly immature trees.

The condition of the site vegetation therefore cannot be considered to be very good although the majority of disturbances could be temporary if full revegetation were allowed to take place.

3.5 CONSERVATION STATUS OF FLORAL COMPONENTS

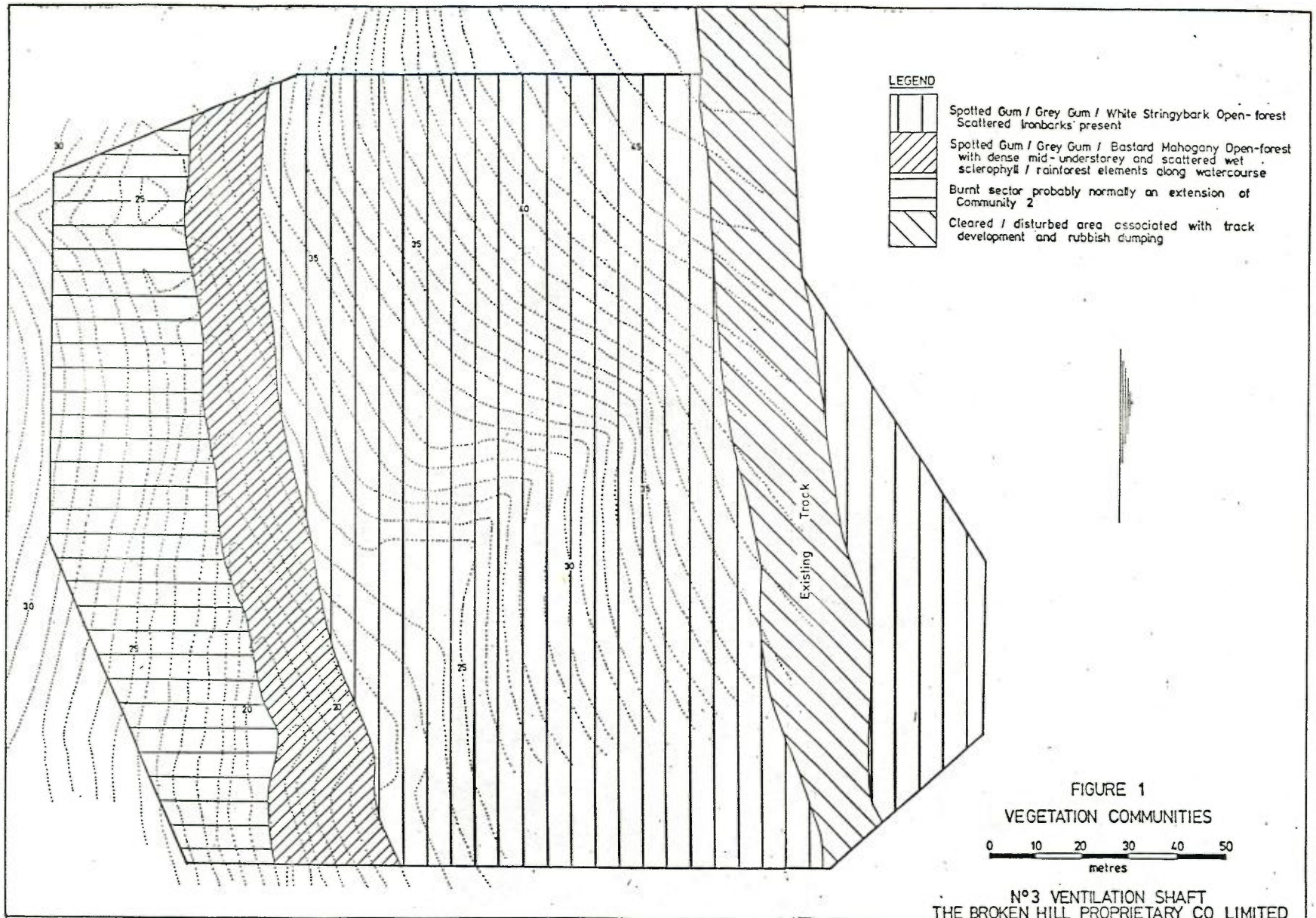

FIGURE 1
VEGETATION COMMUNITIES

N°3 VENTILATION SHAFT
THE BROKEN HILL PROPRIETARY CO LIMITED

TABLE 1

PLANT SPECIES OCCURRING IN THE STUDY AREA

Scientific Name	Common Name	Status
PTERIDOPHYTES		
ADIANTACEAE		
Adiantum aethiopicum L.	Common Maidenhair	P
?A. hispidulum Sw.		P
?Cheilanthes sieberi Kze.	Rock Fern	
GYMOSPERMAE		
ZAMIACEAE		
Macrozamia pauli-guilielmii W. Hill et F.Muel. ssp flexuosa (C. Moore) L.A.S. Johnson		
ANGIOSPERMAE		
MONOCOTYLEDONAE		
CYPERACEAE		
Lepidosperma laterale R. Br.		
LILIACEAE		
Dianella sp.		
ORCHIDACEAE		
Acianthus spp.		P
Pterostylis nutans R.Br.		P
PHILESIACEAE		
Eustrephus latifolius R.Br.	Wombat Berry	
POACEAE		
*Andropogon virginicus L.	Whiskey Grass	
Cymbopogon refractus (R.Br.) A. Camus	Barbwire Grass	
Cynodon dactylon (L) Pers	Couch	
Echinopogon sp.	a Hedgehog Grass	
Entolasia sp.		
Imperata cylindrica (L.) Beauv.var. major (Nees) C.E. Hubbard	Blady Grass	
Oplismenus imbecillis (R.Br) Roem + Schult.		
Themeda australis (R.Br.) Stapf.	Kangaroo Grass	
SMILACACEAE		
**Smilax glyciphylla Sm.		
XANTHORRHOEACEAE		
Lomandra longifolia Labill.		
L. obliqua (Thunb.) Macbride		
Lomandra Labill. sp.		
Xanthorrhoea sp.	a Grass Tree	

DICOTYLEDONAE

ARALIACEAE
Polyscias sambucifolia (Sieber ex DC) Harms

ASTERACEAE
*Chrysanthemoides monilifera (L)
T. Norlindh — Bitou Bush
Senecio lautus Forst. f. ex Willd.

BIGNONIACEAE
**Pandorea pandorana (Andr.) Steenis — Wonga Wonga Vine

CASUARINACEAE
**Casuarina torulosa Ait. — Forest Oak

DILLENIACEAE
**Hibbertia sp.

DROSERACEAE
Drosera sp.

EUPHORBIACEAE
**Breynia oblongifolia Muell. Arg. — Dwarf's Apples
Phyllanthus thymoides Muell. Arg.

FABACEAE
Davisia ulicifolia Andr.
Glycine tabacina (Labill.) Benth.
Gompholobium minus Sm
**Hardenbergia violacea (Schneev) Stearn — False Sarsparilla
Oxylobium ilicifolium (Andr.) Domin.
Pultenaea villosa Willd.

HALORAGACEAE
Gonocarpus teucrioides DC.

LOBELIACEAE
Pratia purpurascens (R.Br.) E. Wimmer.

MIMOSACEAE
**Acacia myrtifolia (Sm.) Willd.
?A. brownei (Poir.)Steud. ex DC
**A. terminalis (Salisb.) Macbride — Sunshine Wattle
A. ulicifolia (Salisb.) Court. — Prickly Moses
A. sp.

MYRSINACEAE
Rapanea variabilis (R.Br.) Mez

MYRTACEAE
**Angophora costata (Gaertn.) J. Britt.
**Eucalyptpus crebra. F. Muell. — Narrow-leaved Ironbark
**E. globoidea Blakely. — White Stringbark
**E. gummifera (Graertn.) Hochr. — Red Bloodwood

**E. maculata Hook.	Spotted Gum
**E. paniculata Sm	Northern Grey Ironbark
**E. punctata DC	Grey Gum
OLEACEAE	
?Notelaea venosa F. Muell.	
PITTOSPORACEAE	
**Billardiera scandens Sm.	Dumplings
Bursaria spinosa Cav.	Blackthorn
PROTEACEAE	
**?Persoonia linearis Andr.	Narrow-leaved Geebung
RUBIACEAE	
Pomax umbellata (Gaertn.) Soland. ex A. Rich	
SANTALACEAE	
Exocarpus cupressiformis Labill.	Native Cherry
SAPINDACEAE	
**Dodonaea triquetra Wendl.	Hop Bush
VERBENACEAE	
*Lantana camara L.	Lantana
Verbena sp.	

NOTE: Nomenclature from Jacobs and Pickard (1981) and Beadle et al (1982).

* indicates an introduced species.
? indicates a tentative identification.
** indicates a species suitable for rehabilitation.

A small number of specimens are being sent to the National Herbarium to be identified.

TABLE 2
VEGETATION COMMUNITIES ON THE SITE

COMMUNITY	TREES COMMON SPECIES	HT	%CVR	TALL SHRUBS COMMON SPECIES	HT	%CVR	LOW SHRUBS COMMON SPECIES	HT	%CVR	HERBS/GROUND COVER COMMON SPECIES	HT	%CVR	OVERALL STRUCTURE	COMMENTS
1 Spotted Gum/ Grey Gum/ White Stringybark Open-forest	Eucalyptus maculata E. punctata E. globoidea Occasional E. crebra, ?E. paniculata Casuarina torulosa	13- 17	30- 50	Juvenile eucalypts Persoonia linearis Occasional Pittosporum revolutum	2-3	10	Oxylobium ilicifolium Notalaea sp, Hibbertia sp. Daviesia ulicifolia	1- 1.5	10- 20	Themeda australis Dianella sp. Xanthorrhoea sp. Hardenbergia violacea, Macrozamia pauli-guilielmii	1	50	Open -forest	Trees generally immature. Understorey low in species numbers.
2 Spotted Gum/ Grey Gum/ Bastard Mahogany Open-forest	E. maculata E. punctata, E. umbra, Occasional Casuarina torulosa to 10m		20- 50	Bursaria spinulosa Acacia terminalis, Dodonaea triquetra, Occasional Persoonia linearis, Pultenaea villosa, Acacia longifolia, Notalaea sp, Lantana camara* Rapanea variabilis	1.5 3	50- 70	Dodonaea triquetra, Pultenaea villosa, Polyscias sambucifolia, Rapanea variabilis	1	50	Lomandra obliqua, L. longifolia, Grass spp. Pratia purpurescens Macrozamia pauli-guilielmii Hardenbergia violacea, Adiantum aethiopicum, A. hispidulum? Eustrephus latifolius, Cheilanthes sieberi, Dianella sp, Smilax glicyphylla, Pandorea pandorana.			Variation of Community 1 associated with presence of gully. Water flowing down drainage course at time of survey (after prolonged rain).
3 Probably burnt form of Community 2	As for 2.			Badly burnt			Badly burnt			Adiantum aethiopicum, Drosera sp.				

A small number of protected plant species were recorded on the site and are marked in **Table 1.** No rare or endangered flora species were found or would be expected to occur.

The Spotted Gum Community is generally not well conserved in the State **(National Parks and Wildlife Service, pers. comm.)** but its representation on the site would not be regarded as highly significant considering the degree of disturbance.

The main significance of the site is in its present status as an integral part of the remnant vegetation strip along the shore of Lake Macquarie. Such a remnant is a diminishing resource, particularly in the northern sectors of the lake.

4.0 FAUNA

4.1 METHODS

No detailed fauna surveys were conducted on the site. However, all observations of species and signs of animals' presence were recorded during the two day field study period.

Local records and knowledge of local fauna were used to compile lists of birds, mammals and reptiles known or likely to occur on the site.

4.2 FAUNA HABITATS

The site may be considered as one dry sclerophyll forest habitat with the small gully forming a microhabitat for some species. However, most of this habitat is in relatively poor condition owing to the effects of fire, logging, rubbish dumping and track development.

At the time of survey, there was little ground cover available for such animals as bandicoots, although recolonisation of the site would occur if regeneration processes were allowed to continue.

4.3 OCCURRENCE OF FAUNA SPECIES

A small number of avifauna species were observed on the site during the field survey and these are listed, together with species likely to occur, in **Table 3. Tables 4** and 5 list mammal and reptile species likely to occur on the site.

The site would not be expected to support a large or diverse fauna population given its present state of disturbance and its size. No signs of ground fauna were observed but scratch marks on trees indicate the likely presence of possums. The proximity of the area to urbanisation and the probable heavy predation by feral cats would help account for the lack of ground species.

TABLE 3
AVIFAUNA SPECIES RECORDED OR LIKELY TO OCCUR ON THE PROPOSED VENTILATION SHAFT SITE

SCIENTIFIC NAME	COMMON NAME	STATUS OF RECORD	STATUS IN NSW
Haliastur sphenurus	Whistling kite	E	U
Haliaeetus leucogaster	White-bellied Sea-eagle	X	U
Streptopelia chinensis*	Spotted Turtle-dove	E	A
Ocyphaps lophotes	Crested Pigeon	E	A
Cacatua galerita	Sulphur-crested Cockatoo	x(o)	C
Platycercus eximius	Eastern Rosella	E	A
Cuculus pallidus	Pallid Cuckoo	E	C
C. variolosus	Brush Cuckoo	E	MC
C. pyrrhophanus	Fan-tailed Cuckoo	x	C?
Eudynamis scolopacea	Common Koel	E	A
Ninox novaeseelandiae	Southern Boobook	E	A
Podargus strigoides	Tawny Frogmouth	E	MC
Dacelo novaeguinea	Laughing Kookaburra	E	A
Eurystomus orientalis	Dollarbird	E	A
Hirundo neoxena	Welcome Swallow	E	A
Coracina novaehollandiae	Black-faced Cuckoo-shrike	x	A
Eopsaltria australis	Eastern Yellow Robin	E	A
Pachycephala pectoralis	Golden Whistler	E	A
P. rufiventris	Rufous Whistler	x	A
Colluricinda harmonica	Grey Shrike-thrush	x	A
Rhipidura fuliginosa	Grey Fantail	x	A
Malurus cyaneus	Superb Fairy-wren	E	A
Sericornis frontalis	White-browed Scrubwren	E	A
Acanthiza pusilla	Brown Thornbill	x?	A
A. nana	Yellow Thornbill	E	A
A. lineata	Striated Thornbill	x	A
Daphaenositta chrysoptera	Varied Sitella	E	A
Lichenostomus chrysops	Yellow-faced Honeyeater	x	C
Melithreptus lunatus	White-naped Honeyeater	E	A
Phylldomyris nigra	White-cheeked Honeyeater	x	A
Acanthorhynchus tenuirostris	Eastern Spinebill	E	A
Pardalotus punctatus	Spotted Pardelote	E	A
Emblema temporalis	Red-browed Firetail	E	A
Gracticus torquatus	Grey Butcherbird	E	A
Gymnorhina tibicens	Australian Magpie	E	A
Corvus coronoides	Australian Raven	x	A

x - Recorded on site during survey period
(o) - Flying Overhead
E - Expected to utilise the site to some degree, particularly when western part of site and adjacent bushland has recovered from recent fire.
* Introduced Species.
U - Uncommon
C - Common
MC - Moderately common
A - Abundant

Nomenclature according to Schodde(1975) and Schodde et al (1978). Status in NSW according to Morris et al(1981).

TABLE 4
MAMMAL SPECIES LIKELY TO OCCUR ON OR UTILISE
THE PROPOSED VENTILATION SHAFT SITE

SCIENTIFIC NAME	COMMON NAME	STATUS OF RECORD
Trichosurus vulpecula	Common Brushtail Possum	E(s)?
Isoodon macrourus	Northern Brown Bandicoot	E
Rattus rattus*	Black Rat	E
Mus musculus*	House Mouse	E
Canis familiaris*	Domestic Dog	E
Felis catus*	Feral cat	E

E - Expected to occur on the site when habitats have regenerated after fire
(s)? - Possible signs of this species presence (scratch marks on larger trees).
* Introduced species

Nomenclature according to Strahan(Ed)(1983).

TABLE 5
REPTILE SPECIES LIKELY TO OCCUR ON THE
PROPOSED VENTILATION SHAFT SITE

SCIENTIFIC NAME	COMMON NAME
Amphibolurus barbatus	Bearded Dragon
A. muricatus	Jacky Lizard
Lialis burtonis	Burton's Snake-lizard
Cryptoblepharus sp.	
Ctenotus robustus	Striped Skink
Leiolopisma sp.	
Tiliqua scincoides	Eastern Blue-tongued Lizard
Demansia psammophis	Yellow-faced Whip Snake
Dendrelaphis punctulatus	Common Tree Snake
Furina diadema	Red-naped Snake
Pseudechis porphyriacus	Red-bellied Black Snake
Pseudonaja textilis	Eastern Brown Snake

* Based on records for the Newcastle/Lake Macquarie area.

4.4 CONSERVATION STATUS OF FAUNA SPECIES AND HABITATS

No rare or endangered fauna species, or species of any 'special concern' or significance were recorded on the site and none would be expected to occur.

5.0 ASSESSMENT OF SENSITIVITY OF BIOLOGICAL COMPONENTS TO DISTURBANCE

Most of the site's biological components may be considered moderately sensitive to disturbance and this can be extended to adjacent bushland areas. This sensitivity rating means that areas adjacent to clearing activities would only suffer adverse impacts through 'edge effects', probably with increased incidence of weed infestation.

The species and habitat most sensitive to disturbance would be the minor rainforest elements and gully vegetation in the western sector of the site. These components would be sensitive to any impacts on drainage and increase in siltation at the head of the gully and would be more subject to weed infestation if ground cover is disturbed.

No fauna species of particular sensitivity to disturbance would be likely to remain in the vicinity of the site given its present degree of disturbance.

6.0 CONCLUSIONS AND RECOMMENDATIONS

The following conclusions can be made concerning the flora and fauna of the proposed ventilation shaft site:

1. The site is directly linked with a strip of vegetation along the western foreshore of Lake Macquarie, but is separated from large tracts of bushland to the west by the Bolton Point-Marmong Point Road.

2. There have been numerous disturbances to the site resulting in a somewhat degraded bushland habitat.

3. The site retains a natural dry sclerophyll forest cover typical of the Lake Macquarie area. Most of the bushland comprises a Spotted Gum/Grey Gum/White Stringybark community. There is a minor rainforest/wet sclerophyll element along the small gully in the west of the site.

4. Sixty one plant species were recorded on the site; the small number being attributable to both degradation of the vegetation through frequent fires and the small size of the site.

5. The site does not provide high quality habitat for fauna species in general but would still support a small number of animals, particularly avifauna and reptiles.

6. No flora and fauna species of particular conservation significance occur or would be expected to occur on the site.

7. The main vegetation community is not well reserved within the State but the site does not support a particularly good example of this vegetation type.

8. The main conservation significance of the site is in its location within a continuous strip of bushland along the shore of Lake Macquarie.

9. The wet sclerophyll/rainforest elements and gully community would be the most sensitive to adjacent disturbances.

The following recommendations are made to assist in minimising impacts on flora and fauna on the site and in adjacent areas:

1. Clearing be restricted particularly in areas adjacent to the head of the gully to minimise erosion from slopes and sedimentation in the gully.

2. Bare areas are rehabilitated as soon as practicable to minimise the potential for weed infestations, particularly in the vicinity of the gully. Species suitable for rehabilitation are indicated in **Table 1.**

3. Sedimentation controls be implemented to restrict sedimentation of the gully below the site.

4. Consideration be given in construction works if possible to restriction of access which could facilitate further dumping of rubbish in the vicinity of the site.e.g., fencing of the site.

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APPENDIX 5

ARCHAEOLOGICAL SURVEY

ARCHAEOLOGICAL SURVEY FOR PROPOSED PACIFIC COLLIERY NO. 3 VENTILATION SHAFT AND ASSOCIATED WORKS AT BOLTON POINT, NSW.

July, 1986

Report prepared for
BHP Central Engineering

by

Josephine McDonald

CONTENTS

Illustrations

1. INTRODUCTION

This report details the archaeological survey undertaken at the site of the proposed Pacific Colliery No. 3 ventilation shaft and associated works. The survey was commissioned by BHP Australia, and was conducted by the consultant on the 23rd of July, 1986.

No archaeological sites were located within the study area.

2. THE STUDY AREA

The proposed development is to be located in a tributary creek gully between Marmong and Bolton Points (see Figure 2). Two hundred metres below the proposed development, there is a creek junction from which this creekline flows into Lake Macquarie.

The construction site is to be located wholly within the gully, covering an area of approximately 4000 m^2 (0.4 ha). Access from the north-eastern ridge will be achieved partially along an existing access track, with an additional connecting loop (see Figure 2) joining the ridge with the gully. It is estimated that the additional access will disturb an area of approximately 200 m by 30 m (max.).

2.1 Environmental Context

The geology of the study area is Triassic Narrabeen (tuff, claystone, sandstone, conglomerate and coal) of the Clifton Sub-Group, overlying the Permian Newcastle Coal Measures (conglomerate, sandstone, tuff, shale and coal : Newcastle 1:250,000 Geological Series, SI 56-2).

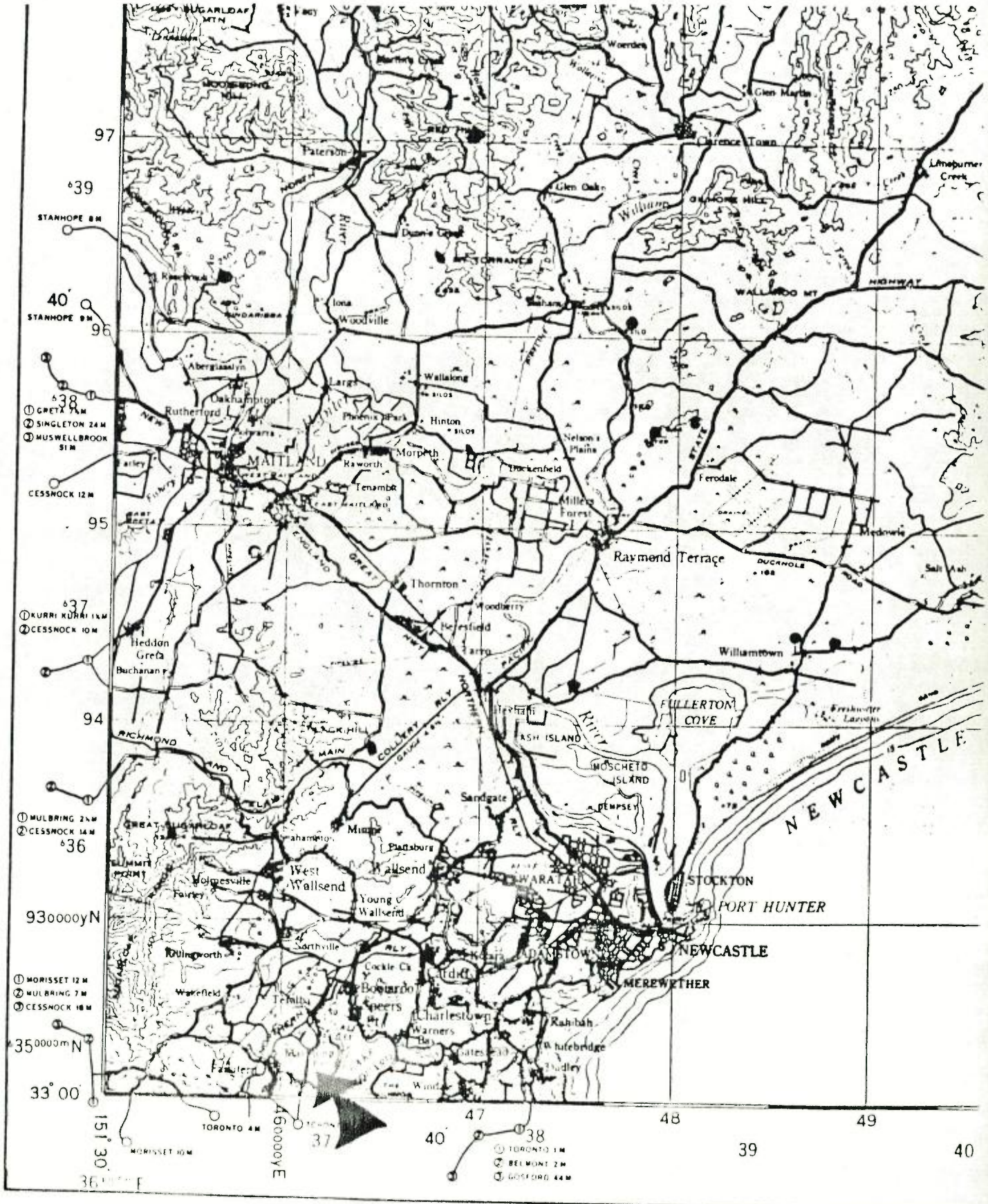

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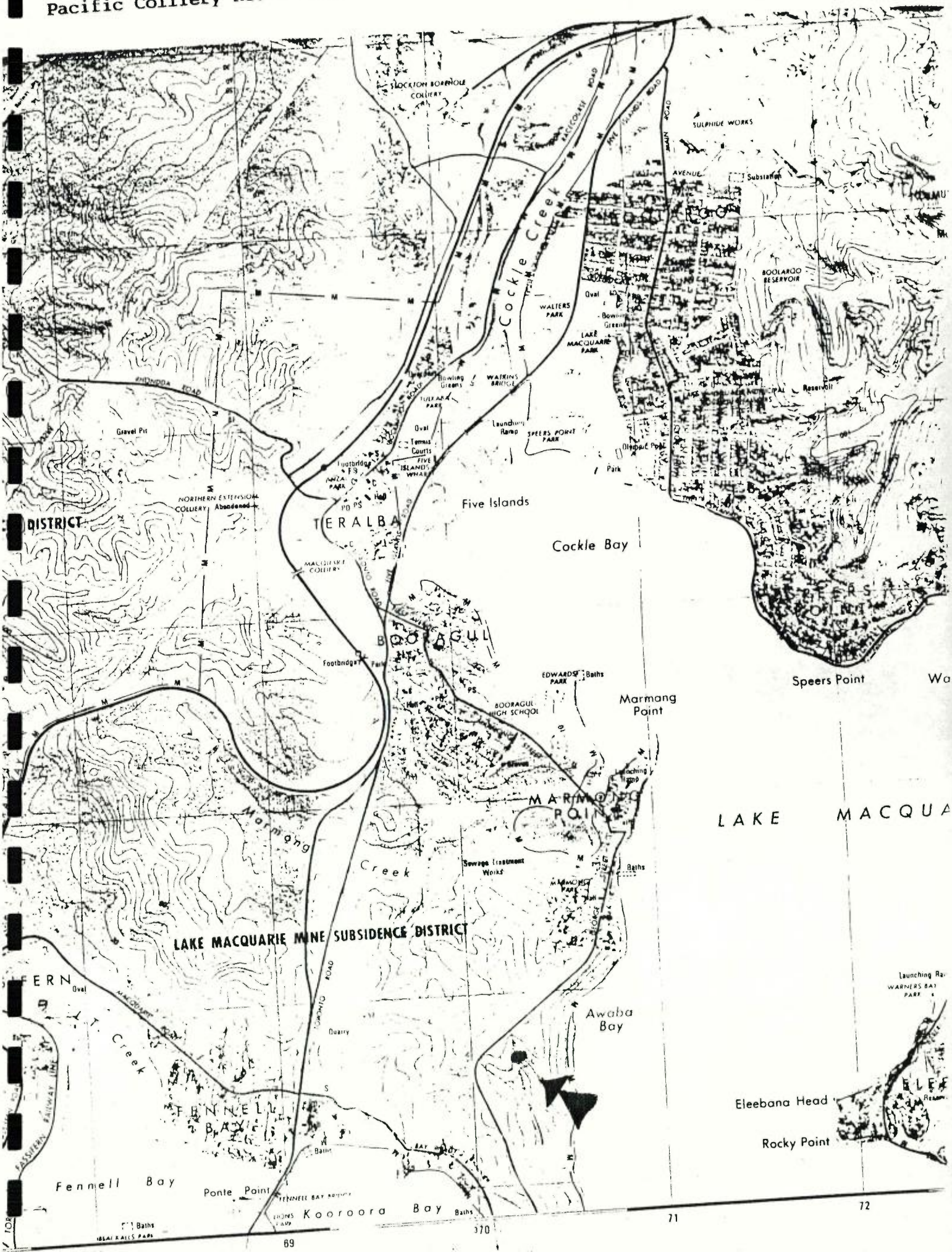
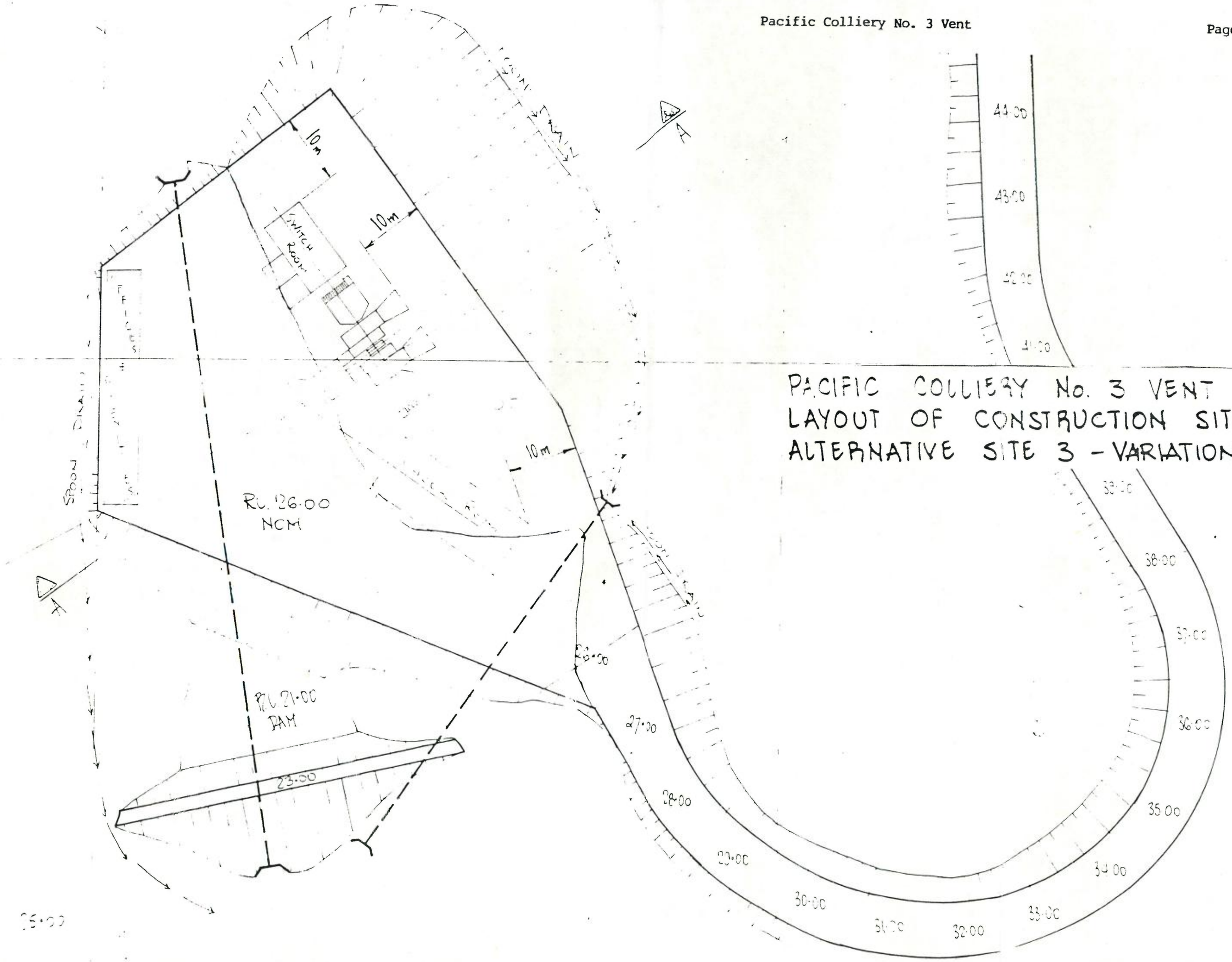
Fig. 1: Newcastle 1:250,000

Pacific Colliery No. 3 Vent





PACIFIC COLLIERY No. 3 VENT
LAYOUT OF CONSTRUCTION SITE
ALTERNATIVE SITE 3 - VARIATION 2

Where the development is proposed, the creekline is approximately 20 m in elevation below the north-eastern ridge. At this point, the creekline is also 20 m in elevation above Lake Macquarie. The slopes in the vicinity of the development are steep, and the creekline is quite deeply incised. There are no flat areas adjacent to the creek banks (see photos).

Along the creekline, both above and below the study area, there are exposed slabs of sandstone and conglomerate. The surface texture of these rocks is extremely rough. No other exposures of bedrock were observed.

The vegetation in the area is open forest/woodland. Predominant species include Eucalyptus haemostoma (scribbly gum) and E. punctata (grey gum), and some Angophora costata (smooth barked Sydney Apple). Acacia spp. (wattles), Persoonia spp. (geebung) and Casuarina sp. contribute to the shrub layer.

For the majority of the creek gully the understory is dense, and there is a thick ground cover of leaflitter and small ferns. On the south-western slopes of the creek gully, a recent fire has cleared much of the understory and leaf litter. On this slope there is considerable regrowth of ferns, particularly maiden-hair.

Besides the north-eastern ridgeline, where there has been much dumping of rubbish and cars, the area is undisturbed.

3. ARCHAEOLOGICAL CONTEXT

Over the past five years several archaeological surveys have been carried out in the Lake Macquarie region prior to development (Bell 1982, Brayshaw 1983, Dallas 1983, 1986, Dyall 1981). On the basis of the results of these surveys it is possible to predict the range of Aboriginal site types to be expected in this area. These sites include:-

i) **Surface campsites** - archaeological remains in the form of stone artefacts and sometimes hearths. Such sites usually occur as surface scatters of artefacts in areas where ground surface is exposed because of lack of vegetation, or where is has

been lowered by erosion or physical disturbance (i.e. ploughing or vehicular traffic;

ii) **Axe grinding grooves** - which are produced during the manufacture of edge ground artefacts and occur on flat areas of sandstone. These are usually located in association with watercourse, since water is essential to the grinding process;

iii) **Scarred trees** - where the scar is the result of the removal of bark for the production of shields, water containers, canoes or shelter roofing. Scars may also be in the form of toe holes, an artefact of the Aborigines foraging for possums and wild honey;

iv) **Midden deposit** - in the form of shell and other food remains resulting from the habitual camping and exploiting of food resources, such as oysters and fresh water mussels. Stone artefacts often are found in these deposit, which are usually found on the coast and on the shorelines os estuaries, lakes and inland rivers. They have also sometimes been recorded on ridgetops, though rarely are these deposits extensive.

Less common but potential site types in the region (Dyall 1972, Threkeld 1855) are:-

v) **Ceremonial grounds** - used by the Aborigines for tribal meetings and ceremonies. These usually take the form of raised earth-mound circles, and are located only very rarely due to their fragile nature and European land use patterns; and,

vi) **Burials** - which can occur anywhere but are generally in soft sandy sediments. These are usually only located by accidental exposure.

4. ABORIGINAL CONSULTATION

The appropriate Aboriginal community for consultation, in the local area is the Koompahtu Local Aboriginal Land Council. Prior to and during the survey, repeated efforts were made to contact this Land Council at their office in Toronto. Unfortunately, this was to no avail, and no representative of the Land Council took part in the survey.

After the survey, further efforts were made to contact the office of the Land Council. This included checking the telephone number with Aiden Ridgeway (Ministry of Aboriginal Affairs). Again repeated efforts failed to raise an answer from the Land Council.

Since no archaeological sites were located in the study area, it is considered that no further attempts to reach the Land Council were necessary prior to development. It is recommended (see below) that a copy of this report should be sent to the Land Council for their archives and interest.

5. FIELDWORK PROCEDURE

The survey was carried out by the consultant on Wednesday the 23rd of July, 1986. The study area was covered entirely on foot. All bedrock exposures on the creeklines were inspected closely, as were areas where ground visibility was good (i.e. especially on the south-western slopes). Given the size and presumed age of the large trees in the study area, the likelihood of scarred trees was considered low. Larger trees, however, were inspected for possible scarring.

6. CONCLUSIONS AND RECOMMENDATIONS

No archaeological site or relic is located within the study area. There is no archaeological constraint to the proposed development and associated works in the study area.

The following recommendations are made on the basis of:-

1. A fully comprehensive surface survey; and,

2. The legislative requirements of the National Parks & Wildlife Act (1974) (as amended), in which it is stated that it is illegal to knowingly deface, damage or destroy an Aboriginal relic in N.S.W., without the prior written consent of the Director of the National Parks and Wildlife Service (N.S.W.).

It is recommended that:-

1. No further archaeological work in the study area is necessary.

2. 4 copies of this report be sent to:-

   the Regional Archaeologist,
   Central Region, N.P.W.S.
   P.O. Box 95, Parramatta, N.S.W.

3. A copy of this report be forwarded to:-

   the Secretary,
   Koompahtu Local Aboriginal Land Council,
   19 Nicholson Street, Toronto West, N.S.W.

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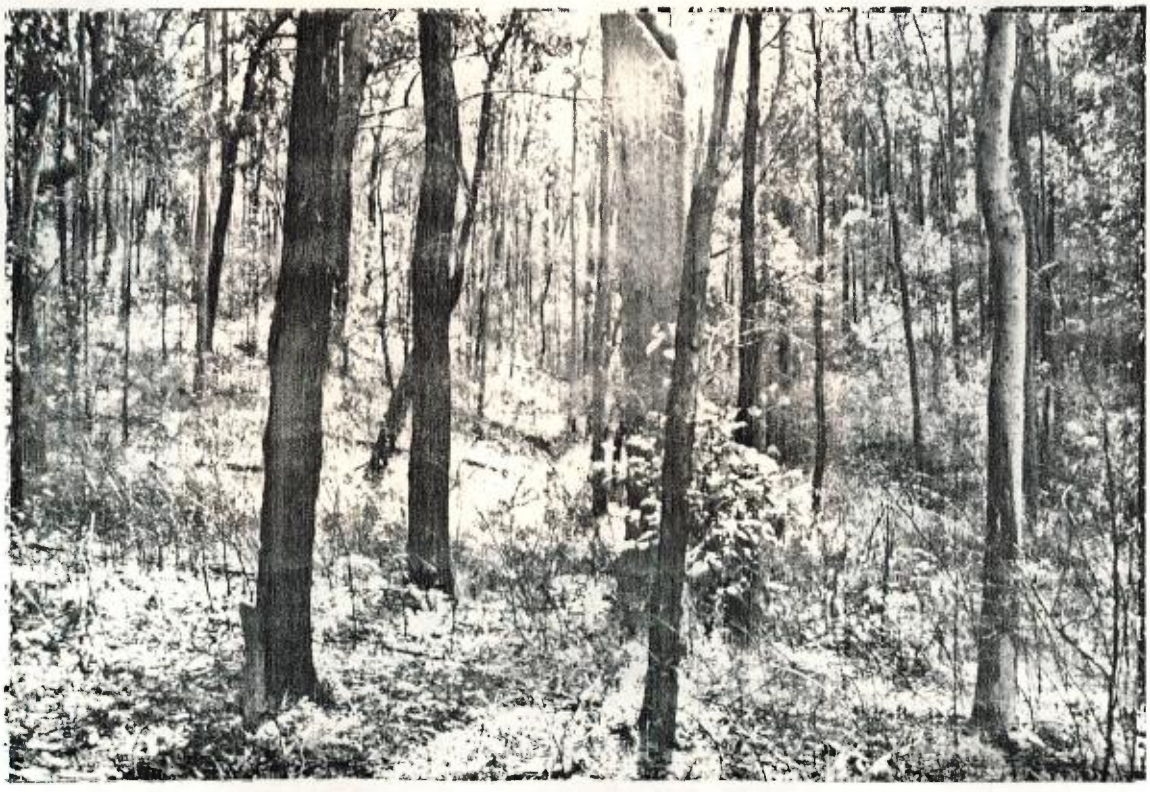
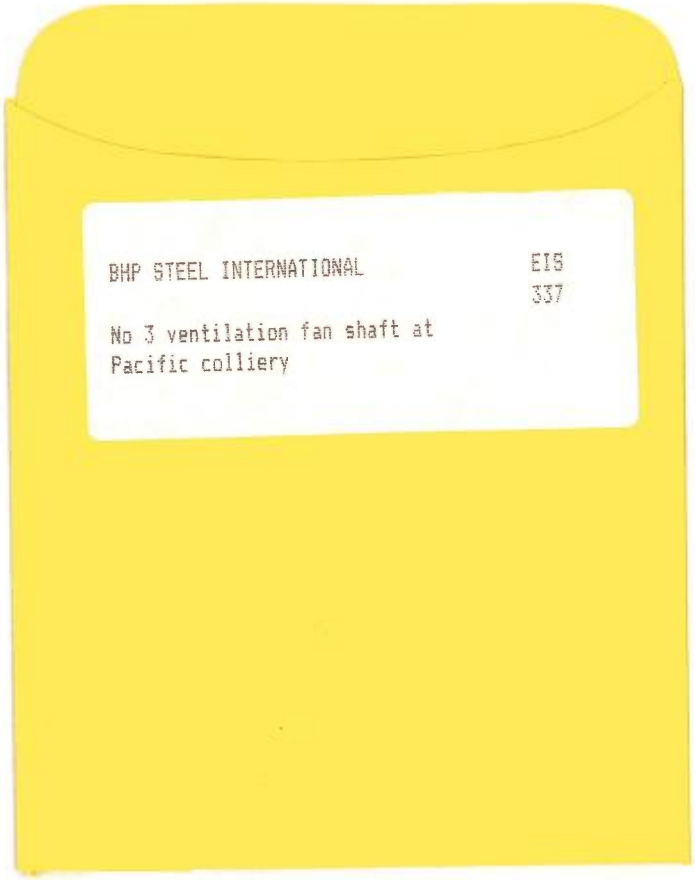
Looking along the surveyed line through the centre of the study area. From the southern slopes looking north-east.



Looking north-west-north up the main creek line from the centre of the study area. Note the burnt out undergrowth and resultant visibility.


BHP STEEL INTERNATIONAL
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No 3 ventilation fan shaft at
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