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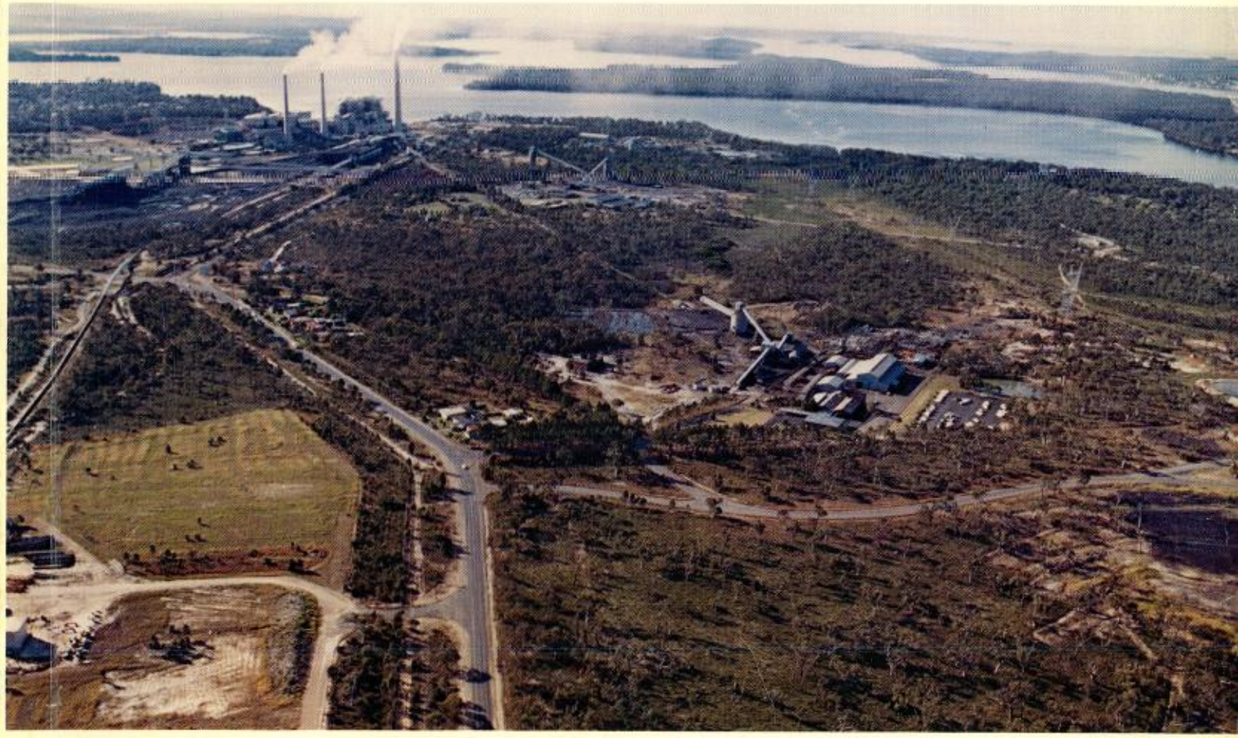
Environmental impact statement for upgrading the surface facilities at Wyee State Coal Mine

ENVIRONMENTAL IMPACT STATEMENT FOR UPGRADING THE SURFACE FACILITIES AT WYEE STATE COAL MINE — ELCOM COLLIERIES PTY LTD

ELCOM COLLIERIES PTY LTD



ENVIRONMENTAL IMPACT STATEMENT
FOR
UPGRADING THE SURFACE FACILITIES
AT
WYEE STATE COAL MINE

PREPARED BY
CROFT & ASSOCIATES

ELCOM COLLIERIES PTY LTD

ENVIRONMENTAL IMPACT STATEMENT
FOR
UPGRADING THE SURFACE FACILITIES
AT
WYEE STATE COAL MINE

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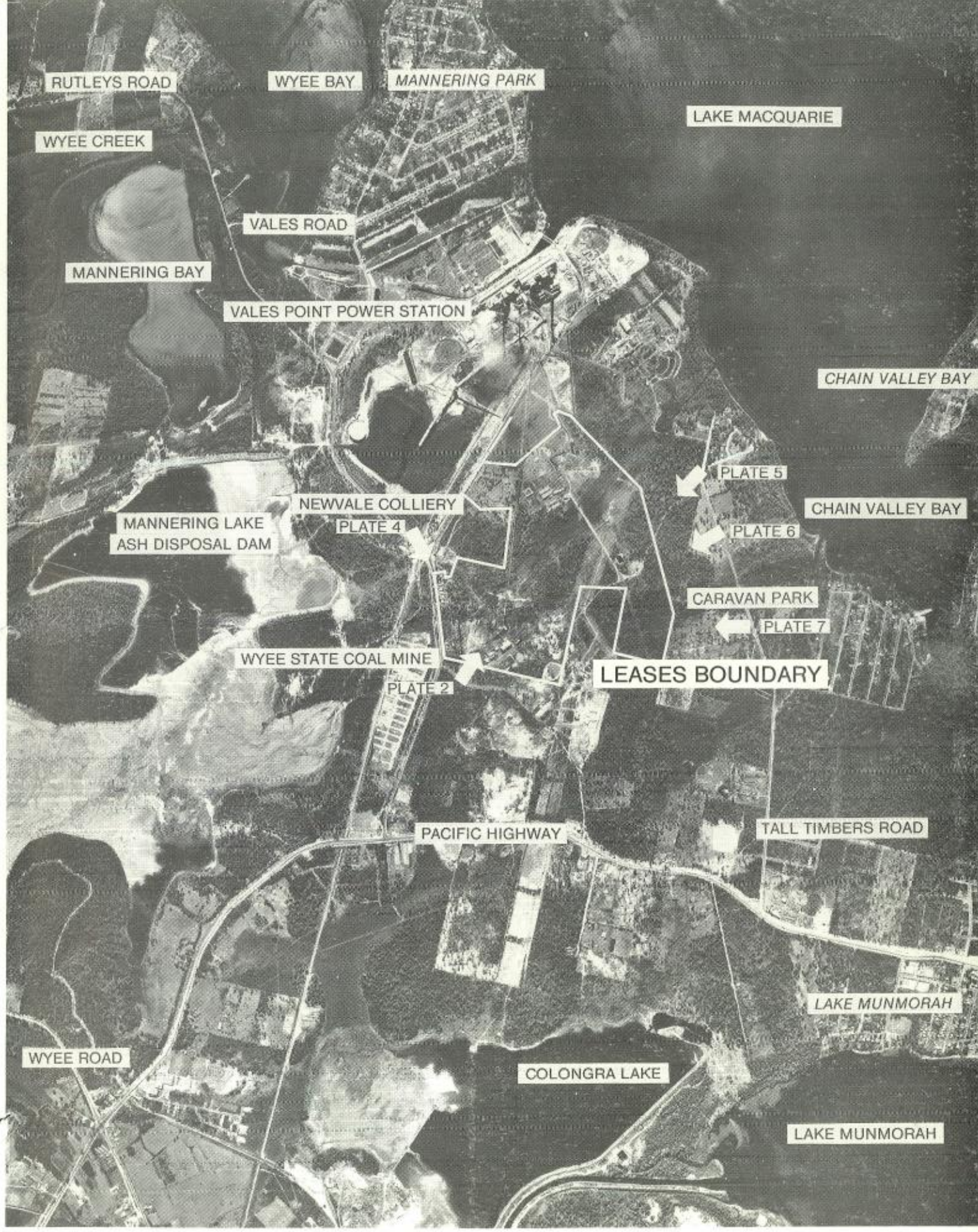

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Scale 1: 25 000

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PLATE 1

EXISTING AND PROPOSED MINING PURPOSES LEASES, WYEE STATE COAL MINE AND NEWVALE COLLIERY.

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SUMMARY AND OVERVIEW

THE PROPOSAL

Elcom Collieries Pty. Ltd. proposes to construct a 700 tph jig washing plant at Wyee State Coal Mine to reduce the ash content of product coal in the light of the increasing levels of ash in run-of-mine production.

Coal is currently produced at Wyee from underground workings at an average rate of 6000 tonnes per day, and screened and crushed before conveyor transfer to Vales Point Power Station. Existing surface facilities include a rotary breaker, a screen and crushing house, a storage bin and emergency stackout area, two entry portals, an upcast ventilation shaft, bath house and office accommodation and store and workshop buildings.

In addition to the washing module, the proposal includes the establishment of a reject handling system, the modification of existing coal transfer and storage capabilities, and the construction of a surface runoff storage dam. It is expected the facility will have an operating life in excess of 20 years.

There will be no change in manning levels at Wyee as a result of the upgrading.

Construction is planned for a 14 month period, employing an average of 44 persons. Capital expenditure will be $18.3M (1982 prices).

SETTING

Wyee State Coal Mine is on the southern margin of Lake Macquarie, approximately 5 kilometres east of Wyee. It is one of three major suppliers of coal to the adjacent Vales Point Power Station.

The area has been extensively modified by past and continuing mining and power generation activities, and by the spread of residential developments. The latter is concentrated at Mannering Park, 2.5 kilometres to the north, and Lake Munmorah, 3.5 kilometres to the southeast. Further development is proceeding on the shores of Lake Macquarie to the east.

Small areas have been cleared along the edges of many of the roads in the area and used for grazing, market gardening, orcharding and chicken farming

as well as hobby farming.

Transmission line easements from Vales Point Power Station cross the area in southerly, southwesterly, westerly and northwesterly directions. Coal conveyor easements connect the collieries and the Wyee rail loop to the power station.

Munmorah and Vales Point Power Stations are also linked by conveyor. The Main Northern Railway Line lies to the west and the Pacific Highway to the south of the site.

IMPACT ASSESSMENT

As the proposed upgrading of the Wyee State Coal Mine is relatively small in size, involves no changes to manning levels, and is in an area already considerably altered by mining and power generation activities, impacts will generally be slight and localised.

Due to the industrial development in the area, background noise levels are considerably above normal rural readings. As a result, the incremental increase in sound pressure levels related to the project will cause no impact during either daylight or night time hours in surrounding areas. The Macquarie Shores Caravan Park and the residential area along Tall Timbers Road to the north of the site will experience maximum sound pressure level increases of 2.5 dB and 1 dB respectively, both well below the increase which could cause noise nuisance.

Under normal conditions, there will be no discharge of water from the site. Runoff to Lake Macquarie will occur only in times of high rainfall, and will then consist only of water which has undergone sedimentation treatment. Process water for the site will where possible be sourced from the planned adjacent Mannering Park Sewage Treatment Plant, and will thus not compromise existing or possible future water users.

Washery rejects will be placed in the Mannering Lake ash disposal area. The quality of the outflow water will be only minimally changed, without affecting aquatic biota downstream.

There will be some emissions of dust from the site caused by wind erosion of coal stockpiles. Background dust deposition levels in the area are highly variable,

and are likely to mask any increases arising from the development. As a result, annual average deposition rate increases are not expected to be significant, and will not lead to a deterioration of residential amenity in the area. Variation from annual average conditions will be of short duration and small magnitude.

There will be some changes to the flora and fauna of the areas of land actually developed, and to an existing drainage line downstream of the proposed surface storage dam. No rare or endangered species will be affected, and the scale of the alterations is small.

Existing land use in the area is a combination of rural residential and power generation/coal mining. The development at Wyee is restricted to an existing Colliery Holding, and an adjacent area, and is an extension of operations on that site. No changes are required to the zoning of land actually involved in the project or that which is adjacent. The impact on overall land use in the area will not be significant.

Visual impact will not be of major proportions, as most viewing points will be shielded and screened by existing or proposed planting.

Socio-economic impacts will be confined largely to the construction stage, and because of its short duration will be unlikely to include induced effects. There will be a benefit to the Region as a result of the expenditure on capital items and on wages and salaries, plus a generation of job opportunities over a 14 month period. As it is likely the construction workforce will largely be locally sourced, there is expected to be no adverse impact on the level of community services or accommodation.

SECTION ONE

INTRODUCTION

1.1 THE COMPANY

Elcom Collieries Pty. Ltd. is a private company wholly owned by the Electricity Commission of New South Wales. It supplies steaming coal to the Commission for electric power generation, and markets a coking coal fraction. The Company holds the leases and other mining titles associated with its operations.

Prior to the Company's formation in 1973, State controlled coal mines were operated by both the State Mines Control Authority and by the Electricity Commission.

Wyee, Munmorah, Liddell and Awaba State coal mines were operated by the Authority and Huntley, Newcom, Newstan, Newvale and Newvale No.2 Collieries were operated by the Commission through wholly owned private companies.

The Authority was originally formed to provide coal to the State Railways and for gas and electricity production. With the decline in the demand for coal for the use of railways and gas production, the mines operated by the Authority were brought under the control of the Electricity Commission in July 1973.

Elcom Collieries Pty. Ltd. was formed to provide a single operating company for mines previously run by both Newstan Collieries Pty. Ltd. and the State Mines Control Authority.

It now operates seven underground mines on the northern coalfields - Liddell, Awaba, Wyee and Munmorah State Coal Mines and Newstan, Newvale and Newvale No.2 Collieries.

1.2 WYEE STATE COAL MINE

Wyee State Coal Mine is located immediately south of Lake Macquarie as indicated in Figure 1. Other colliery holdings in the vicinity are shown in Figure 2.

Wyee State Coal Mine was originally developed by the State Mines Control Authority in 1961, simultaneously with Newstan Colliery Pty. Ltd.'s Newvale Colliery, and Coal & Allied Operations Pty. Limited's Chain Valley Colliery. The former two mines were brought under the control of Elcom Collieries Pty. Ltd. in 1973. Wyee and Newvale mines began producing coal from the Great Northern Seam in 1963 to supply the boilers of Vales Point Power Station which commenced operation in that year. Initial production was about 3000 tpd from each mine.

In 1966, Munmorah Power Station was completed and a belt conveyor was constructed from Vales Point to Munmorah. This allowed coal from Wyee and Newvale mines to be transferred to either power station. Munmorah Power Station was also supplied with coal from the Munmorah State Coal Mine and Newvale No.2 Colliery.

In the 20 years since its commencement, Wyee mine has increased production rates to an average of 6000 tpd.

1.3 THE COMPANY'S OBJECTIVES

The ash content of coal won from Wyee State Coal Mine has been increasing over the past years, and this trend is expected to continue.

Production from Wyee State Coal Mine is required to maintain adequate coal supplies for Vales Point Power Station. It will be necessary to reduce the ash content of run-of-mine coal.

The Company thus proposes to construct a coal beneficiation plant to ensure that existing reserves at Wyee can be mined and processed to a quality suitable for use in the Power Station.

1.4 LAND INVOLVED IN THE PROPOSAL

The surface development will extend over the present boundary separating

the Wyee State Coal Mine Colliery Holding and the Newvale Colliery Holding.

The land involved in the proposal is owned by the Electricity Commission of N.S.W. It is Elcom Collieries Pty. Ltd.'s intention to apply for a Mining Purposes Lease to include all affected property. Land tenure and that proposed in the area is indicated in Figure 3.

1.5 FORMAT OF THE EIS

This document is divided into the following sections:

SUMMARY AND OVERVIEW

SECTION 1 - INTRODUCTION

SECTION 2 - DESCRIPTION OF THE PROPOSAL
A detailed explanation of the Company's plans, including a description of pollution control safeguards incorporated in the design and operation.

SECTION 3 - IMPACT ASSESSMENT
A review of the likely impact of the proposal on the biophysical, cultural and socio-economic environments. The section provides a discussion of the characteristics of the existing environment, divided into its major components, followed in each case by the assessment of impact.

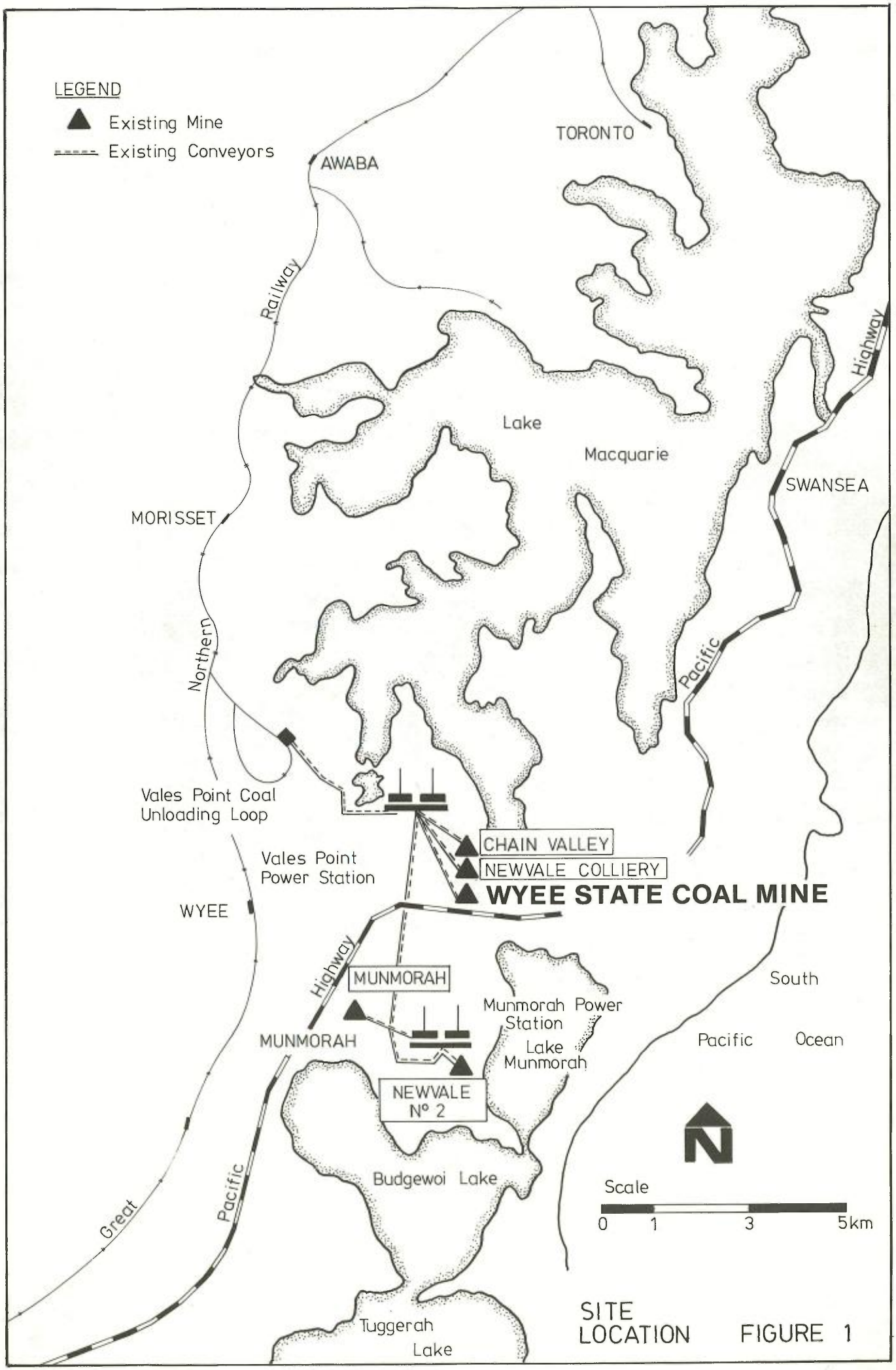
APPENDICES
Technical information of a detailed nature is provided in appendices.

FIGURES
Illustrated figures are provided at the conclusion of Sections 1, 2 and 3.

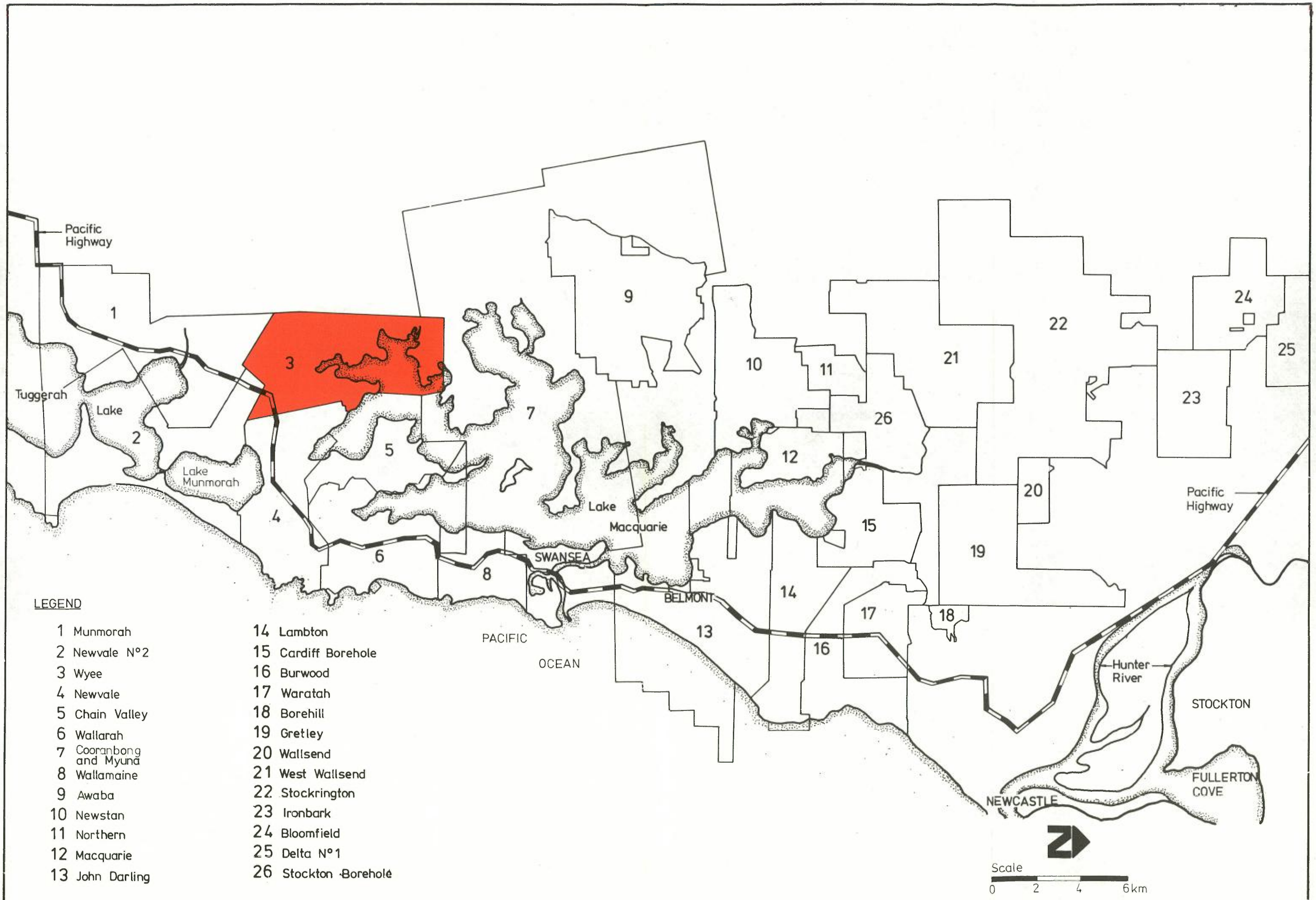
1.6 ENVIRONMENTAL INVESTIGATIONS

Environmental investigations were conducted on behalf of Elcom Pty. Ltd. by Croft & Associates Pty. Limited. The study team was as follows:

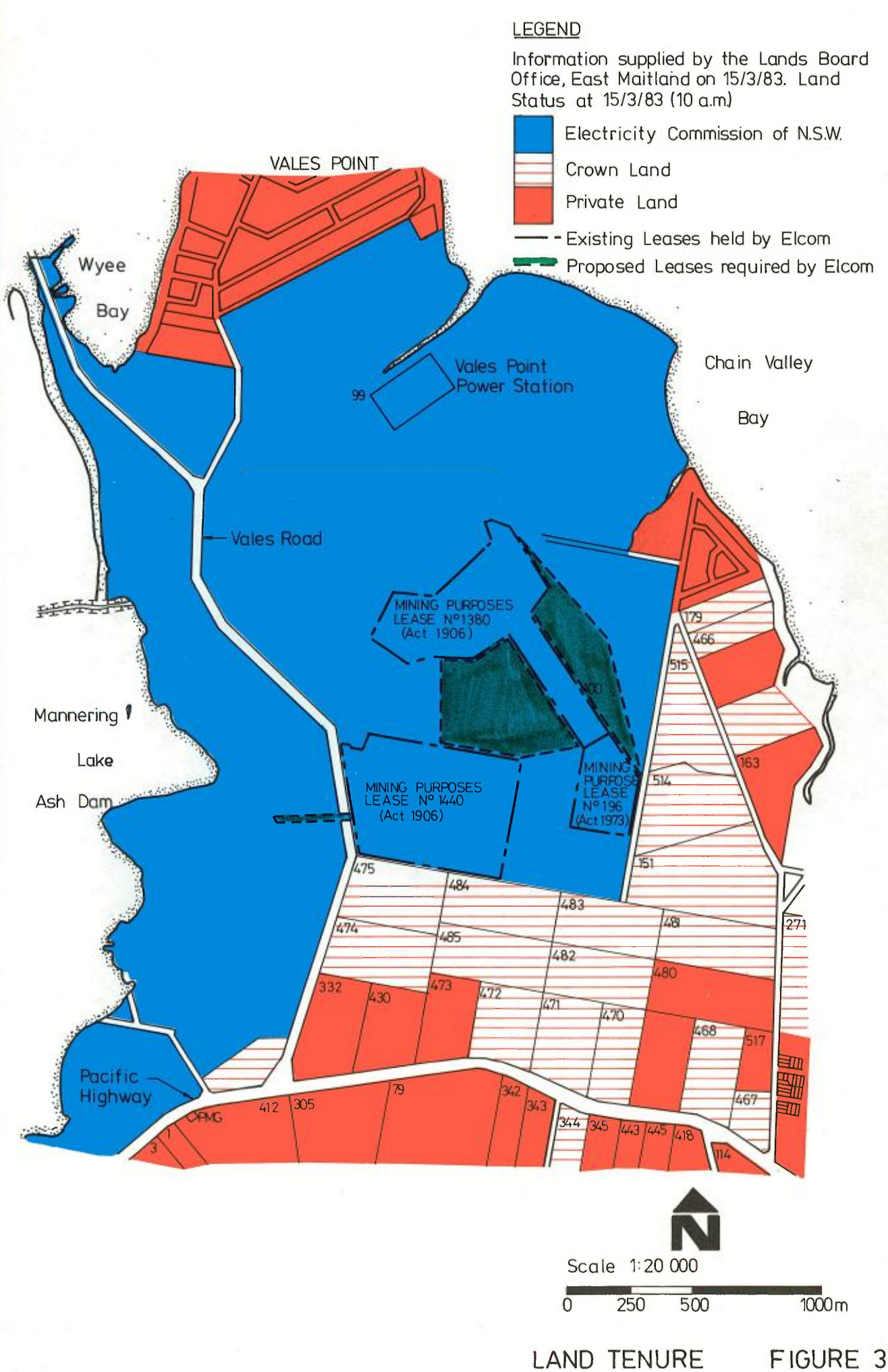
F. HELLEMAN, B.E.	Project Manager
P. RAY, B.E.	Water Management
P. ZIB, M.E., Ph.D. M. MORRIS, B.Nat.Res.	Air Quality Determinations
A. KONTOPOULOS, B.E., M.Sc.,	Noise Studies
M. POLLINGTON, B.Sc. (Hons.) G. BARTRIM, B.Sc., Dip.Ed.	Biophysical Investigations
J. WIGGERS, B.A., Dip.Ed.	Socio-economic Impacts
A. SANDS, B.Appl.Sc. (Landscape Design), Grad. Dip.Res. Man.	Visual and Landscaping Aspects
B. WILSON, B.Appl.Sc.	Laboratory Co-ordination.



SITE LOCATION FIGURE 1



ADJACENT COLLIERY HOLDINGS FIGURE 2



LAND TENURE FIGURE 3

SECTION TWO

DESCRIPTION OF THE PROPOSAL

2.1 SCOPE

Elcom Collieries Pty. Ltd. proposes to construct a 700 tph jig washing plant at Wyee State Coal Mine to reduce the ash content of product coal in the light of the increasing levels of ash in run-of-mine production.

Coal currently produced at the mine is screened and crushed before conveyor transfer to the Vales Point Power Station.

In addition to the washing module, the proposal includes the establishment of a reject handling system, the modification of existing coal transfer and storage capabilities, and the construction of a surface runoff storage dam. It is expected the facility will have an operating life in excess of 20 years.

There will be no change in manning levels at Wyee as a result of the upgrading.

Construction is planned for a 14 month period, employing an average of 44 persons. Capital expenditure will be $18.3M (1982 prices).

2.2 SETTING

2.2.1 General

Wyee State Coal Mine is on the southern margin of Lake Macquarie, approximately 5 km east of Wyee. It is one of three major suppliers of coal to the adjacent Vales Point Power Station.

The surface facilities site generally slopes at less than four degrees, and is drained by intermittent watercourses which discharge into Lake Macquarie.

The area has been extensively modified by past and continuing mining and power generation activities, and by the spread of residential development. The latter is concentrated at Mannering Park, 2.5 km to the north, and Lake Munmorah, 3.5 km to the southeast. Further residential development is proceeding on the shores of Lake Macquarie to the east. Land use in the area is detailed in Figure 4.

Although significant clearing and construction works have taken place in the vicinity of the site, its common vegetation communities appear to be adequately reserved in the region.

The scenic status of the site is considered to be low. It is not visually prominent when viewed from adjacent roads and nearby houses.

2.2.2 The Resource

(i) Site Geology

A description of the regional geology is provided in Section 3.1.2.

The site is located on the eastern limb of the Macquarie Syncline.

The Munmorah Conglomerate, the basal unit of the Narrabeen Group, outcrops over the site. This unit consists essentially of conglomerate with interbedded sandstone and siltstone bands and is approximately 150 m thick at Wyee. The conglomerate is grey in colour and contains well-sorted pebbles of quartz and rock fragments in a matrix of quartz, mica and clay minerals. The fine-medium grained sandstone is light grey in colour when fresh but weathers to a rusty brown colour. Locally, the strata dip at approximately four degrees to the southwest and are intersected by major faults and dykes trending northwest-southeast.

(ii) Coal Quality

Exploration has been undertaken on the Company's Holding over a period of approximately 20 years and has investigated the extent and quality of the uppermost seams of the Newcastle Coal Measures.

The seams intersected on the Wyee State Coal Mine Holding are as follows:

WALLARAH SEAM: The Wallarah Seam is characteristically a dull, hard, massive steam coal with an inherent ash content of 10 to 15 per cent.

This seam thins and becomes very dirty to the north of Wyee. As a result it is not a viable proposition to mine at this site.

GREAT NORTHERN SEAM: The Great Northern Seam is the main source of supply for Vales Point and Munmorah Power Stations. It is characteristically a hard, dull steam coal with an inherent ash content of 15 to 26 per cent. Its run-of-mine (ROM) ash ranges from 18 to 30 per cent. The seam is relatively free from stone bands, although mudstone, siltstone and claystone partings occur.

This seam is currently being worked at Wyee, where it varies from 2 to 3 m in thickness.

FASSIFERN SEAM: The Fassifern Seam is characteristically a medium to poor quality high ash steam coal. It has an inherent ash content of 19 to 25 per cent, and a ROM content of 20 to 30 per cent at Wyee. This seam is very variable in thickness and split extensively, containing numerous stone and clay bands. At Wyee the seam measures range in thickness up to 7 m but thin out to the south, where the seam splits.

Results of analyses of typical samples from the Great Northern and Fassifern Seams are provided in Table 1.

2.3 EXISTING OPERATIONS

2.3.1 Mining

The layout of existing surface operations on the Wyee site is illustrated in Figure 5 and Plate 2.

Wyee State Coal Mine currently produces an average of 6000 tpd from the Great Northern and Fassifern Seams, the majority from the former. Peak production levels of up to 9000 tpd occur from time to time.

Coal is won using continuous miner units supported by shuttle cars.

TABLE 1

TYPICAL ANALYSES OF GREAT NORTHERN AND FASSIFERN SEAM WORKING SECTIONS

Property	Great Northern Seam		Fassifern Seam	
	Geological	'As mined'	Geological	'As mined'
	%	%	%	%
Moisture (Air Dry)	2.8	2.8	2.8	2.8
Ash	26.5	28.1	22.0	25.2
Volatile Matter	29.6	28.2	27.5	26.1
Fixed Carbon	43.9	42.7	47.9	48.7
Total Sulphur	0.31	0.31	0.37	0.37
Specific Energy (ML/kg)	24.0	23.40	25.65	24.55
Crucible Swell Number	1	1	1	1

Source: Elcom Collieries Pty. Ltd.

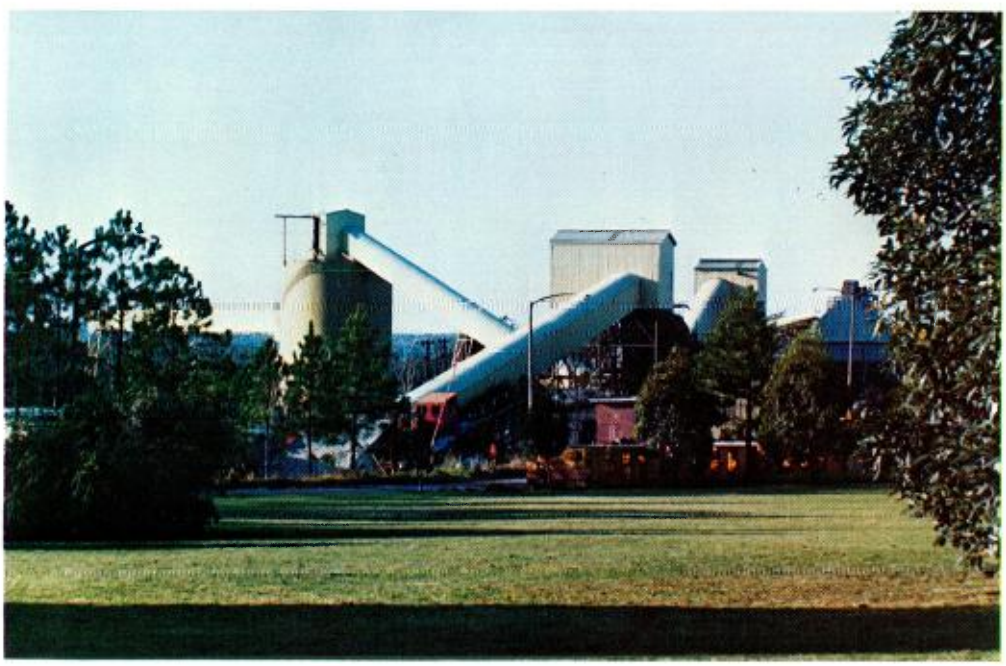


PLATE 2. View to Surface Facilities from Mine Access Road.

Photograph References on Plate 1

These feed onto panel and trunk conveyor systems leading to an underground storage bin of approximately 1000 t capacity. Coal from this bin is distributed by vibratory feeders onto the main slope 1060 mm wide conveyor belt for transfer to the surface at the rate of 800 tph.

2.3.2 Raw Coal Handling

The main slope conveyor feeds a rotary breaker, and thence the screen and crushing house, where the product is reduced to its final -32 mm size by three sets of screens and flextooth crushers.

Coal from the crushing house is fed to a 1000 tonne storage bin provided with an emergency overhead tripper stackout area of approximately 10000 tonnes capacity. Coal from the bin and stackout area is reclaimed by a 1060 mm conveyor system which runs directly to Vales Point Power Station.

2.3.3 Mine Access and Ventilation

Two portals each of dimensions 3.7m x 2.7m are provided for access to the mine, one for the main slope conveyor and the other for men and materials handling.

The portals and drifts leading to the seams are inclined at 1 in 3.5.

A manually operated men and materials winch is housed adjacent to the men and materials drift, and the main slope conveyor drive is housed adjacent to the conveyor drift. A service inspection winch is also provided next to the slope conveyor.

A 5.2 m diameter upcast shaft with twin centrifugal, variable speed fans and motor room are provided for the ventilation requirements of the mine. Current operation of the fan installation is 210 m^3/sec at 1.2 kPa.

2.3.4 Surface Buildings and Facilities

(i) Bath House and Office Accommodation

The bath house has capacity for 384 men and consists of clean and dirty change areas and showering facilities.

The office for management and administration staff is attached.

Level sealed car parking areas are provided for 110 vehicles.

(ii) Store and Workshop Buildings

A workshop with approximate dimensions of 24m x 54m is provided with an overhead crane of 15 t capacity for routine repairs and servicing and welding requirements of the underground mining and other equipment.

Attached to the workshop is a stores area with approximate dimensions of 7m x 35m for storage of mine consumable items.

A separate bulk store building and enclosed compound is provided for the storage of more bulky items.

A diesel servicing bay and battery charging building, with approximate dimensions of 12.5m x 37m, is located adjacent to the workshop/stores building. A steam cleaning bay and servicing pit are also provided.

(iii) Company Cottages

Nine cottages are established on the site adjoining Vales Road for use by Company personnel.

2.3.5 Services

(i) Power

Power is supplied at 11000 V from the Vales Point Substation via aerial transmission lines to a switch-house and transformer compound adjoining

the crushing plant.

(ii) Water

Potable water is purchased from Wyong Shire Council.

Process water requirements are met from minewater generated onsite. Minewater is pumped via the upcast shaft from the underground sumps at a rate of up to 273000 L/d and discharged directly into water storage tanks for immediate re-use underground. Three tanks are provided for firefighting and dust suppression requirements, with capacities of 1.3 ML (two) and 0.9 ML.

Any deficits in process water are met from the potable supply.

(iii) Sewage

Sewage is treated in septic tanks served by a transpiration area adjacent to the mine switchroom.

(iv) Site Access

Access to the mine site is effected from Vales Road, as indicated in Figure 6.

2.3.6 Workforce and Hours of Operation

The mine workforce totals 360 employees.

Coal production is on a two-shift basis between the hours of 7 a.m. and 9 p.m. Occasionally production continues outside these hours.

Maintenance is undertaken between 9 p.m. and 7 a.m. each night and on Saturdays.

2.4 PROPOSED UPGRADING

2.4.1 Mining

Underground operations will basically be a continuation of existing extraction of the Great Northern and Fassifern Seams.

2.4.2 Raw Coal Handling

The layout of the proposed additions to the surface facilities is indicated in Figures 5 and 6, and Plate 3.

The existing rotary breaker will be refurbished and internal plates will be replaced to provide for the breaking of coal to -150 mm size.

Coal from beneath the rotary breaker will be transferred at ground level through the existing crushing plant, which will become redundant, by a 1600 mm conveyor belt to the top of a new 3000 t raw coal storage bin. The bin construction will be of concrete with a steel cone base. Dust suppression sprays will be incorporated at the top of the bin.

An emergency/stackout reclaim facility is to be provided with a capacity for approximately 15000 t of coal. A conical stockpile will be initiated from a rill tower, with coal reclaimed by vibratory feeders into a concrete tunnel. The reclaim tunnel will be positively ventilated and be provided with escape and washdown facilities. It will be graded to a collection sump. A level area adjacent to the emergency stackout would allow temporary storage of up to 50000 t of raw coal should a major breakdown occur to the washing plant. Water sprays will be fitted at the top of the rill tower and around the perimeter of the stockpiles.

All elevated conveyor gantries will be of an enclosed type with washdown facilities leading to clean out sumps at ground level. Sumps will be cleaned using a front-end loader, with overflows being pumped to the washery or draining to the primary settling pond.

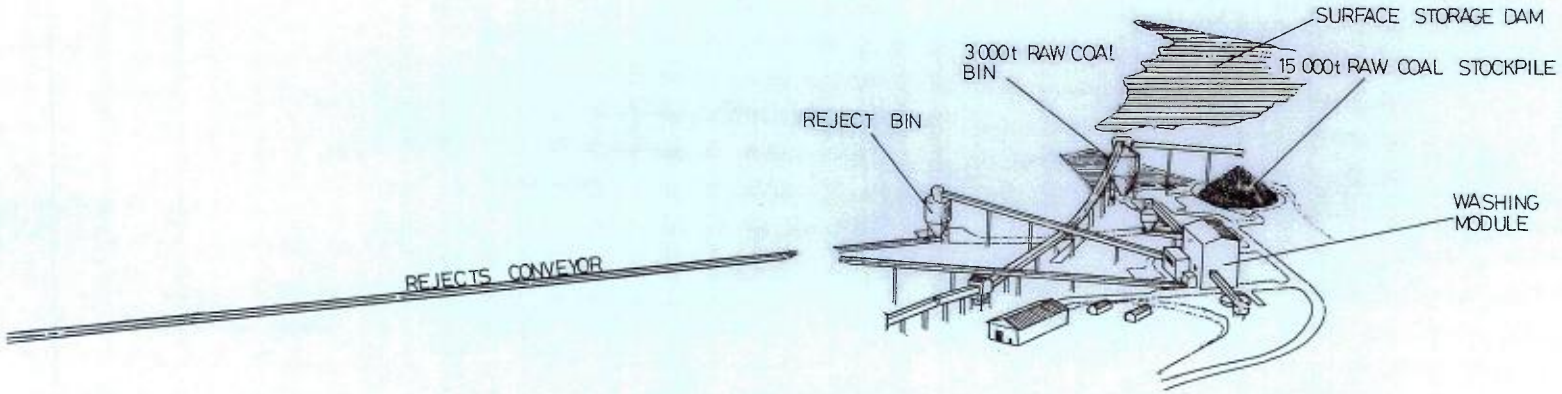


PLATE 3 ARTISTS IMPRESSION OF THE DEVELOPMENT

PLATE 8 ARTISTS IMPRESSION OF THE DEVELOPMENT

2.4.3 Coal Preparation Plant

A 700 tph jig washing module will be constructed. Typical plans and elevations are provided in Figure 7. A process flowsheet is provided in Figure 8.

Coal ex the rotary breaker is prescreened to -19 mm, the oversize fraction flowing directly to a jig for washing whilst the undersize passes to a set of four rotary probability screens. The -6 mm fraction from these screens passes directly to product, the +6 mm being fed to the jig.

Product from the jig is dewatered on static and dewatering screens before being reduced to -32 mm, and transferred to the product storage conveyor. The -6 mm fraction is sized in classifying cyclones, and the -6 x 0.1mm stream dewatered on screens and by centrifuge prior to direction to product conveyor.

The -0.1 mm overflow feeds to a high rate thickener with underflow from the thickener being pumped to a tailings disposal dam to be constructed within the confines of the Mannering Lake Ash Disposal Area. The effluent from the centrifuge will be recycled to the cyclone circuit.

Provision has been made in the plant to add a solid bowl centrifuge or similar processing unit in the future to dewater the thickener underflow and transfer it to either product or reject conveyors.

Clear supernatant water from the tailings dam will be pumped back to the washery water circuit. The building will be clad in olive green steel profile sheeting, with a maximum of 5 per cent of its roof and wall area covered with translucent material.

Provision has been made in the design for the possible future addition of a further 700 tph washing module. Should this eventuate the relevant environmental approvals will be sought at that time.

2.4.4 Product Handling

Product from the washing module will be conveyed directly to the existing 1000 tonne storage bin and stackout facility for subsequent reclaiming and transfer on the existing Electricity Commission conveyor to Vales Point Power Station.

The expected characteristics of the washed product are nominated in Table 2.

TABLE 2

PREDICTED WASHED PRODUCT CHARACTERISTICS

Property	50/50 Mix Great Northern/Fassifern	
	Feed (%)	Product (%)
Moisture	5.0	6.4
Ash (Air dry basis)	26.7	18.7
Recovery ($^{w}/_{o}$)	100.0	85.9
Specific Energy (Air dry basis)	23.95 MJ/kg	26.90 MJ/kg
Energy Recovery	100.0	96.50

Source: Elcom Collieries Pty. Ltd.

2.4.5 Rejects Handling and Disposal

(i) Quantity and Composition

Rejects may be generated at the maximum rate of approximately 20 per cent of raw coal depending on the feed to the washing module. This assumes disposal of a thickener underflow in the tailings dam - in this case, the proportion of coarse to fine rejects is approximately 6:1 on a dry basis.

The expected characteristics of the reject material are listed in Table 3.

TABLE 3
COMPOSITION OF REJECTS

Property	Rejects (%)
Moisture	6.4
Ash (Air dry basis)	75.4
Recovery ($^{W}/_{O}$)	14.1
Specific Energy (Air dry basis)	6.0 MJ/kg
Energy Recovery	3.5

Source: Elcom Collieries Pty. Ltd.

(ii) Disposal

Coarse reject from the jig operation is dewatered and transferred by conveyor to a 1000 t storage bin.

A vibrating feeder at the base of the bin distributes reject onto a 900 mm wide overland conveyor which crosses beneath Vales Road to a 250 t bin located adjacent to Vales Point Power Station ash dam. Truckout facilities will be provided to allow the transfer of the reject material for use in increasing the height of the ash dam wall, or for disposal elsewhere in the dam.

Thickener underflow will be pumped to a tailings dam constructed in the ash dam. Clear supernatant water from the pond will be collected and recycled to the washery.

2.5 SUPPORT FACILITIES

With the exception of service roads and drainage control structures (which are detailed in Section 2.8), the majority of the facilities onsite will be unchanged.

Existing bath house, workshop, office and storage space will be retained without the need for expansion.

The increased electrical loading will be supplied from a new substation being constructed by Sydney County Council. A new mine switchroom will be constructed adjacent to the fan installation with power being reticulated to the washery by aerial lines.

2.6 NOISE CONTROLS

The washing module and associated surface equipment have been designed to minimise noise generation and transmission. The following specific noise controls will be incorporated.

i. The washery wall sheeting will extend to ground level.

ii. Translucent sheeting will only be used in thin strips, amounting to approximately 5 per cent of the total surface area.

iii. Intermediate levels in the washery will be of concrete construction.

iv. Silencers will be fitted to the washbox rotary air valves and the washbox blower.

v. The blower and plant air compressor will be housed in a separate insulated enclosure.

vi. Classifying screens will use polyurethane decks.

vii. Elevated conveyor gantries will be totally enclosed.

As a result, the following sound power emission levels are anticipated:

Preparation Plant - 95 dB(A)
Conveyors - 88 dB(A)
Transfer Points - 95 dB(A).

2.7 AIR QUALITY CONTROLS

The opportunities for dust generation on the site will be very limited, and confined entirely to wind action on stockpiles.

Elevated conveyor gantries will be fully enclosed, restricting any lift off of particulates. Conveyors will be fitted with scrapers to remove adherent coal, and thus minimise spillage and subsequent dust generation. The coal beneficiation process is wet, preventing dust emissions from the plant itself, and from either the coarse or fine rejects while being transferred to the ash dam for disposal.

Both raw coal and product will be preferentially stored in enclosed bins. The raw coal emergency stackout system incorporates rill tower stockpile initiation, and complete coverage of the exposed surface by water sprays. The additional temporary storage area will be used only in the case of major plant breakdown, and will also be provided with water sprays.

2.8 WATER MANAGEMENT

2.8.1 Objectives

A site water management plan has been developed with the following objectives:

i. the preferential use onsite of the most saline and/or most turbid water.

ii. the minimisation of requirements for externally sourced non-potable water.

iii. the displacement of treated excess water when receiving waters are best able to assimilate the discharges.

To this end the following principles have been adopted:

a. Runoff from all disturbed areas including roads, hardstands and stockpiles will be collected by a system of surface drains and clarified using sedimentation facilities.

b. Runoff from undisturbed areas will be directed around surface developments by a system of diversion banks and collected in a large earth dam for subsequent onsite use. Clarified runoff from disturbed areas may also flow to this dam during storm events.

c. Groundwater generated by the underground mining operations will be collected and pumped to surface storage tanks. It will then be gravity fed to the workings for dust suppression at the mining face.

d. Potable water and process makeup will be purchased from Wyong Shire Council, the latter as far as possible in the form of treated effluent from the proposed adjacent sewage treatment plant.

e. All sewage will be disposed of by the existing septic tank transpiration trench system.

2.8.2 Design Details

The proposed surface drainage controls are shown in Figure 9. All have been designed to handle 1 in 20 year return period storms.

Drainage channels will have the capacity to accommodate runoff from the time of concentration storms. The diversion banks will be wide shallow channels, grassed to prevent scouring.

Four grit arrestors each of 22.5 m^3 capacity will be provided to remove large solids from disturbed area runoff. Mine washdown waste water will be treated in an oil arrestor before sedimentation in the primary pond.

The primary pond volume is equivalent to the runoff generated during a 1 in 20, 1 hour duration storm, with a silt allowance of 1 m. Any water displaced during storms of greater intensity will flow via the overflow weir and existing channels to the surface storage dam.

The storage dam will be created by the construction of an earthen dam across a natural depression immediately south of the existing Newvale Colliery.

The dam will be founded on alluvium and weathered sedimentary rocks and will be constructed of suitable clay and rock materials excavated from the storage area and supplemented if necessary by imported earth and rock materials.

A spillway channel on the right abutment of the dam will be excavated in weathered rock and will provide a non-erodible control to discharge flood waters from natural catchment runoff. Concrete crest control, invert lining and dissipator works will be provided where necessary to protect adjacent structures and control erosion and siltation downstream.

The details of the dam and spillway will be developed during the design stage and will require geotechnical investigation of foundation, abutments and borrow areas. The stability, flood capacity and impermeability of the dam and associated works will conform to recognised procedures and requirements approved to the current Dam Safety Legislation in New South Wales.

The dam will have the following features subject to changes required by detailed design.

Embankment length	450 m
Crest Level	RL 13
Height of Dam	6.5 m
Crest Width	6 m
Full Supply Level	RL 11.5
Embankment Volume	50000 m^3
Total Storage to FSL	145 ML
Catchment Area	94 ha
Slope Protection - Upstream	Rock fill or grassing
- Downstream	Grassing
Spillway Capacity	48 cumecs
Diversion During Construction	Bypass pipe plus closure section
Outlet Works	Pump to Colliery.

A preliminary hydrological study indicates that the probable maximum precipitation flood could be handled with a maximum flood level of RL 12.5 and a spillway with crest length of approximately 30 metres.

2.9 MANNING AND HOURS OF OPERATION

There will be no change in the total number of employees at Wyee. There will be some redistribution of tasks to provide the necessary personnel to man the coal preparation plant.

A 24 hour operation is proposed for the washing module. The hours actually worked will vary dependent on power station coal requirements and peak production levels.

2.10 SERVICES

The arrangements for the provision of electrical power to the site were outlined in Section 2.5. The increased power requirement amounts to an average of 1.5 MVA split between the washing module and coal handling plant (1.1) and the upgraded conveyor (0.4).

Water for potable uses will be purchased from Wyong Shire Council at the same rate as at present.

Process water supplies will be purchased from the same source. The major portion of the nonpotable requirement will be obtained from the planned adjacent Mannering Park Sewage Treatment Works. This plant is expected to come onstream in mid 1987 and within one year will be able to provide an average of 0.4 ML of treated effluent per day. By the middle of 1989, this quantity will rise to about 0.6 ML/d.

The expected quality of the effluent is as indicated in Table 4.

TABLE 4

TREATED EFFLUENT QUALITY

Parameter	Maximum Value Under Normal Conditions
Faecal coliform Counts /100 mL	10
Suspended Solids mg/L	20
B.O.D. mg/L	20
Nitrogen mg/L	30
Phosphorus mg/L	8
Surfactants mg/L	1

Source: Department of Public Works.

2.11 LANDSCAPING

Planting proposed for the project area is shown in Figure 10. It is designed to minimise the visual prominence of the development and to improve the scenic quality within the site.

The following landscape principles have been adopted.

i. The reduction of prominent views to plant areas by the introduction of planting and/or mounding at strategic points along approach roads.

ii. The reduction of the visual impact of construction affected areas by appropriate planting or revegetative treatment.

iii. The preservation and reinforcement where possible of existing vegetation on minor ridges surrounding the plant areas.

iv. The introduction of new planting to soften and create a pleasant landscape character around office and administration areas.

v. The provision of additional planting along the entry road to further define and extend the existing entry character.

vi. The reduction of the scale and visual impact of the car park by additional screen planting where appropriate around the perimeter.

Indigenous native tree and scrub species will be used throughout, with a selection made from the species nominated in Table 5, depending on availability.

Particular care will be taken during plant construction to retain as many mature trees as is possible.

TABLE 5

PRELIMINARY PLANTING LIST

Scientific Name		Common Name
Casuarina littoralis	Salisb.	
C. glauca	Sieb. ex Spreng	Swamp Oak
Glochidion ferdinandi	(J.Muell.)F.M.Bailey	Cheese Tree
Acacia botrycephala	(Vent.) Desf.	Sunshine Wattle
A. suaveolens	(Sm.) Willd	
Angophora costata	(Gaertn.) Druce	Rusty Gum
Callistemon citrinus	(Curtis) Skeels	Lemon Bottlebrush
C. linearis	DC	
Eucalyptus amplifolia	Naudin	Cabbage Gum
E. capitellata	Sm.	Brown Stringybark
E. gummifera	(Gaertn.) Hochr	Red Bloodwood
E. haemastoma	Sm.	Scribbly Gum
E. racemosa-haemastoma	intergrade	Scribbly Gum
E. robusta	Sm.	Swamp Mahogany
Leptospermum attenuatum	Sm.	
L. juniperinum	Sm.	
M. linariifolia	Sm.	Snow in Summer
M. sieberi	Schau. in Walp	
M. thymifolia	Sm.	
M. quinquenervia	(Cav.) S.T. Blake	Broad-leaved Paperbark
Hardenbergia violaceae	(Schneev.) Stearn	
Kennedia rubicunda	Vent.	
Banksia aspleniifolia	Salisb.	
B. collina	R.Br.	
B. robur	Cav.	
B. serrata	L.f.	
Hakea bakerana	F.Muell.etc. Maiden	
H. dactyloides	(Gaertn.) Cav.	
H. teretifolia	(Salisb.) J. Britten	

2.12 CONSTRUCTION

Construction of the proposed surface developments will extend over a period of 14 months, employing a maximum of 65 people and an average of 44. A capital expenditure of $18.3 M (1982 prices) is proposed.

There will be no need to construct temporary accommodation facilities for this workforce.

2.13 MONITORING

The Company will monitor the performance of the pollution control safeguards and the resultant emission levels as determined necessary by the relevant regulatory authorities.

2.14 ALTERNATIVES

2.14.1 Introduction

A series of alternatives to the project itself, and to components of the larger development, were examined in an effort to find an optimum solution to the question of supplying suitable coal for power generation at Vales Point. Economic, environmental and technical factors were assessed. A summary of the major options investigated is provided below.

2.14.2 The Non-development Option

The implications of not proceeding with the construction of a washing module at Wyee are as follows:

i. continue production at the same level, producing an increasingly higher ash coal with probable detrimental affects on the reliability of steam raising at Vales Point, and on maintenance costs.

ii. selectively mine low ash coal at Wyee, reducing the overall production rates and efficiency, and effectively sterilising significant reserves of potentially valuable coal.

iii. supplement supplies to the power station from other sources, incurring increased transportation charges and possible impacts on the environment.

It is considered that none of the above options is acceptable - if coal supplies to Vales Point are to remain at the current levels in terms of quality and quantity and remain viable economically, the construction of a washing module to serve the Wyee State Mine is seen to be essential.

2.14.3 Site Options

The opportunities for alternative plant siting within the Wyee State Coal Mine Colliery Holding are limited by the following factors:

i. existing and fixed coal supply (incline drift) and coal delivery points (Vales Point Power Station Conveyor)

ii. existing residential development in the area.

iii. the possibility of future linkage to the Newvale Mine.

iv. the desire to limit the area of new land disturbance.

The chosen site is the optimum choice in respect of points (i) and (iii), and limits the requirements for additional coal conveying with the attendant economic and environmental costs.

Construction of the plant to the west, between Vales Road and the Mannering Lake ash disposal area, would increase the separation distance from occupied residences. However, the cost penalties involved were not considered to balance the minimal reduction in impacts likely to be perceived by residences to the south and east.

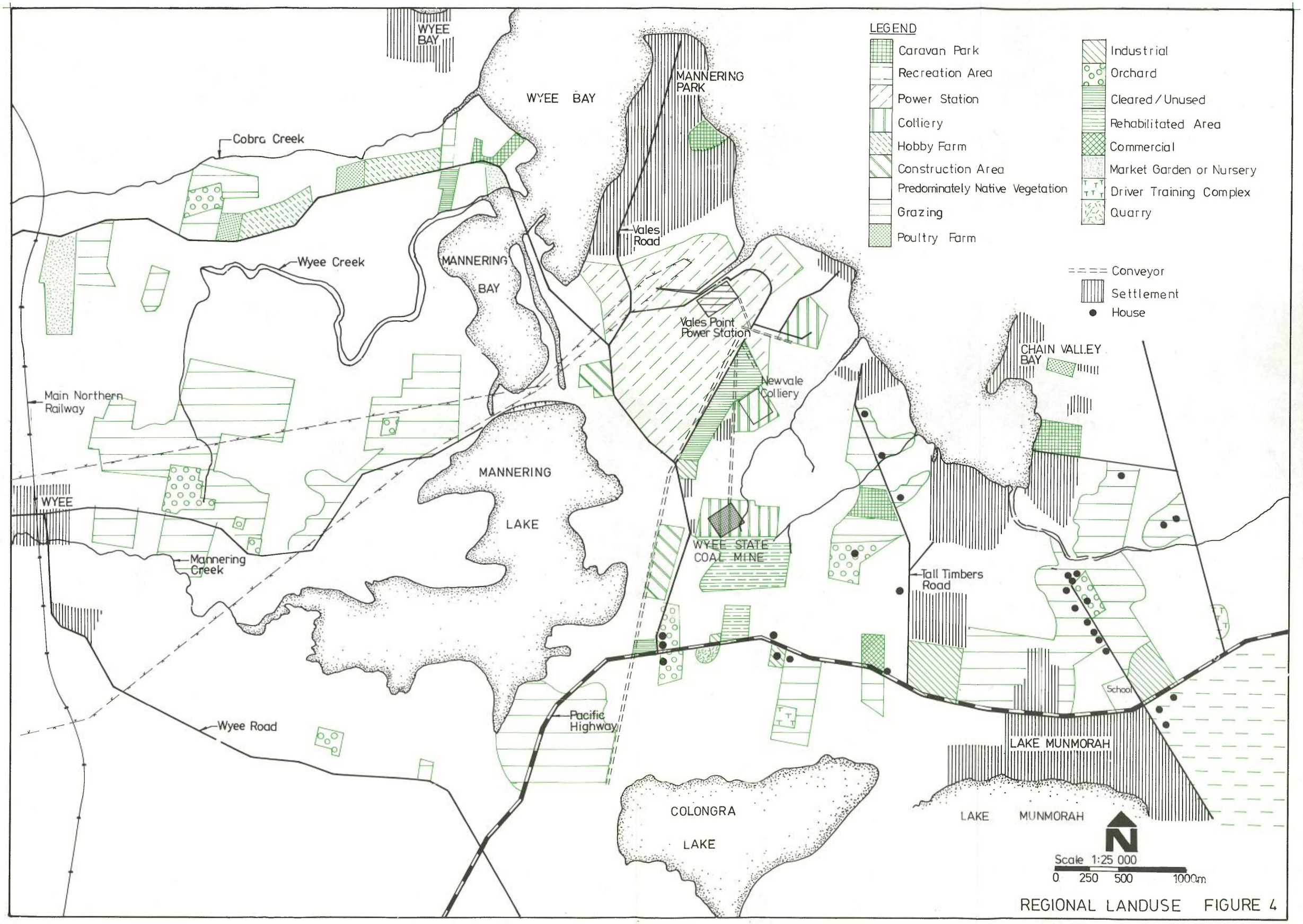
As run-of-mine coal from Wyee will require ash reduction at a much earlier stage than that mined from Newvale, construction of a washing plant at the Newvale site in preference to Wyee would involve additional unnecessary costs and is a less logical location.

2.14.4 Process Options

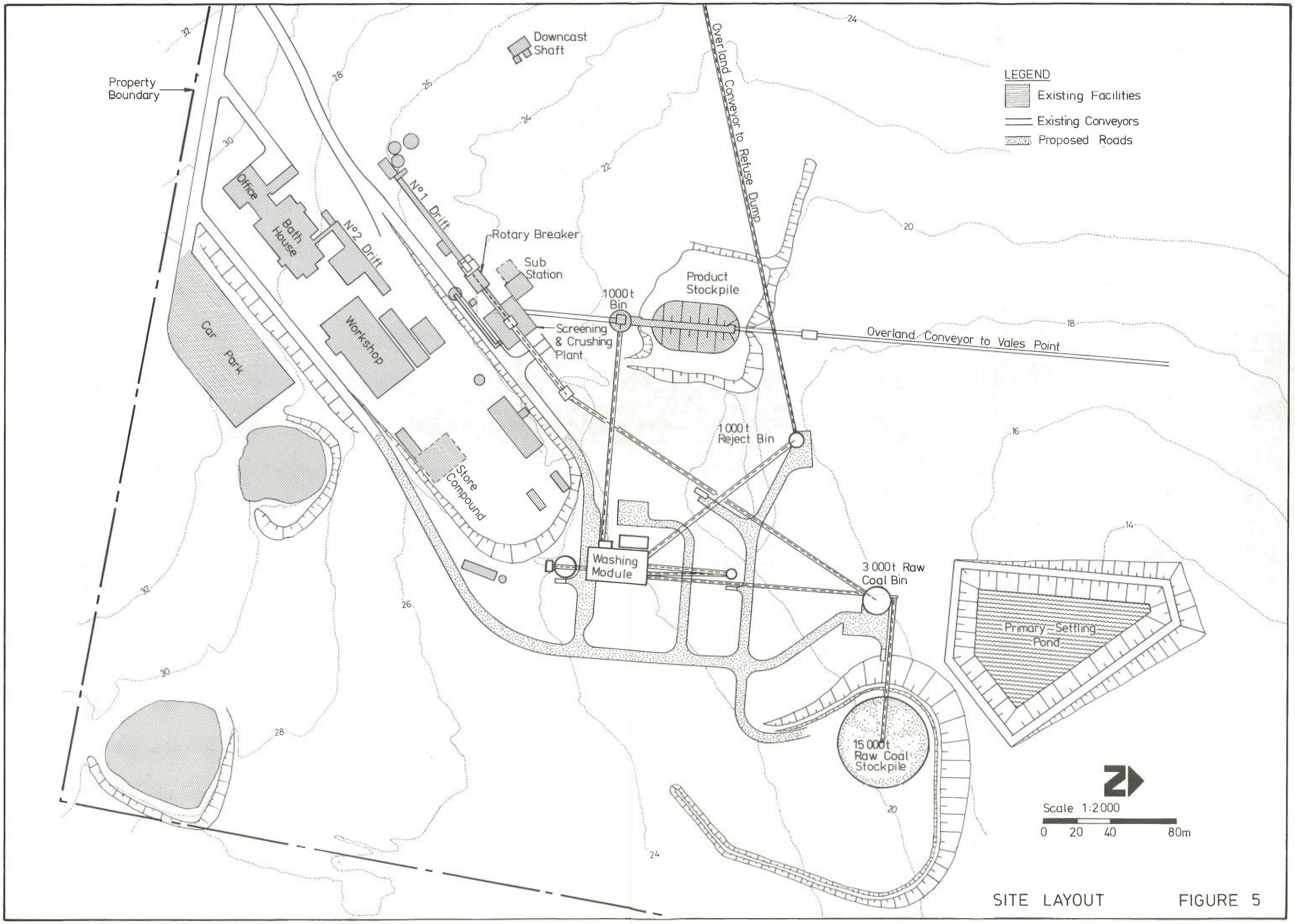
Jig washing and heavy media separation are the most commonly adopted processes for the beneficiation of coal.

As a result of sampling and testing of Great Northern and Fassifern Seams coal from both Newvale Colliery and Wyee State Coal Mine, consultants in the field of washery design have recommended a process involving a Baum jig with feed coal prescreened of fine materials to minimise the attendant technical and environmental problems associated with the dewatering of fine materials. The process is simple, less expensive to install and operate, and is suited to the production of a single steaming coal product as at Wyee. The process meets the Company's objective of not only removing as much ash as possible but also minimising the loss of coal.

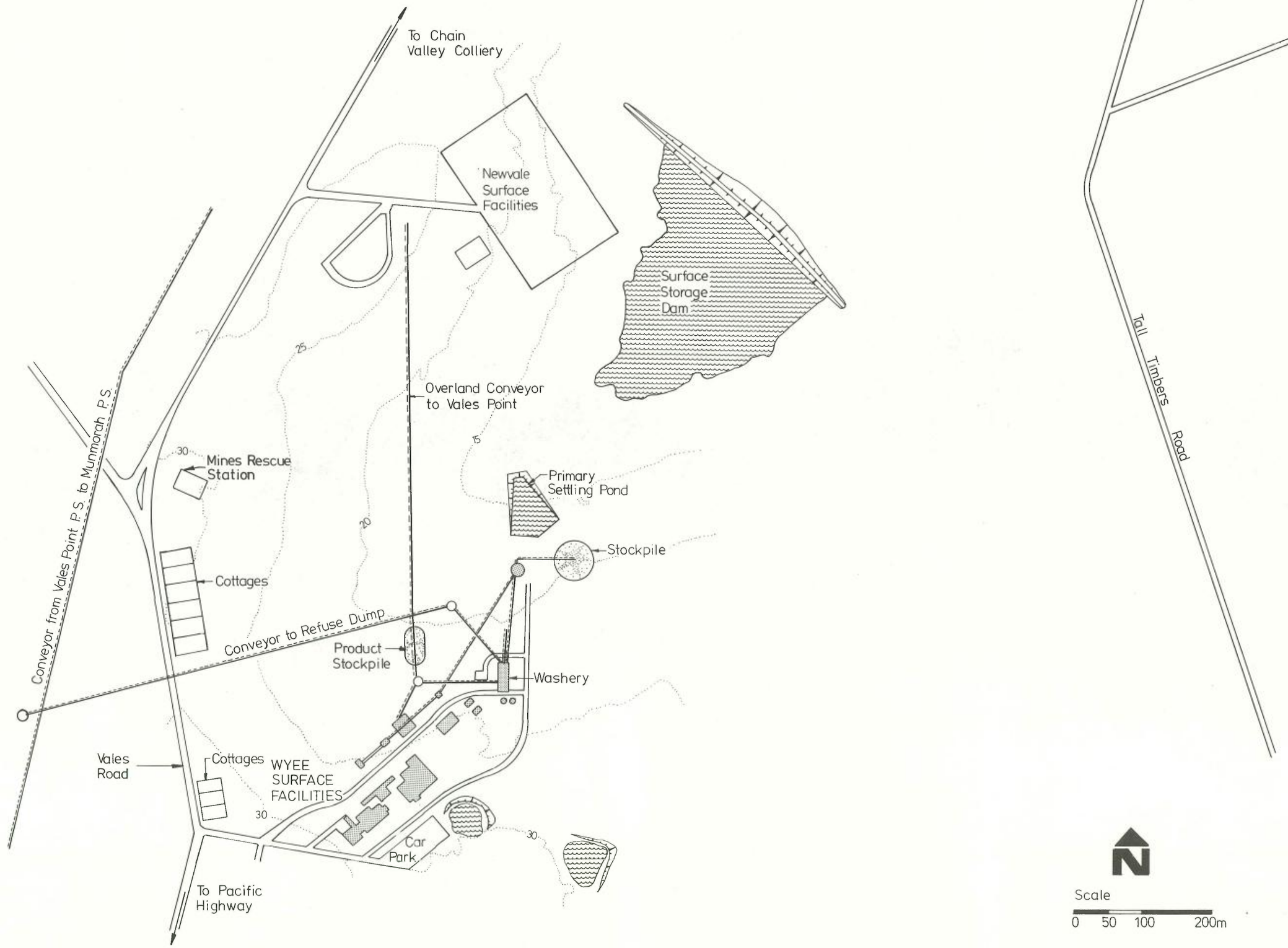
Heavy media processes have the potential to operate more efficiently when a cleaner product is required from a relatively low specific gravity of separation. In the Wyee application, any improvement in efficiency, which would be offset by higher operational costs and difficulties associated with the handling of magnetite, is not considered justified.



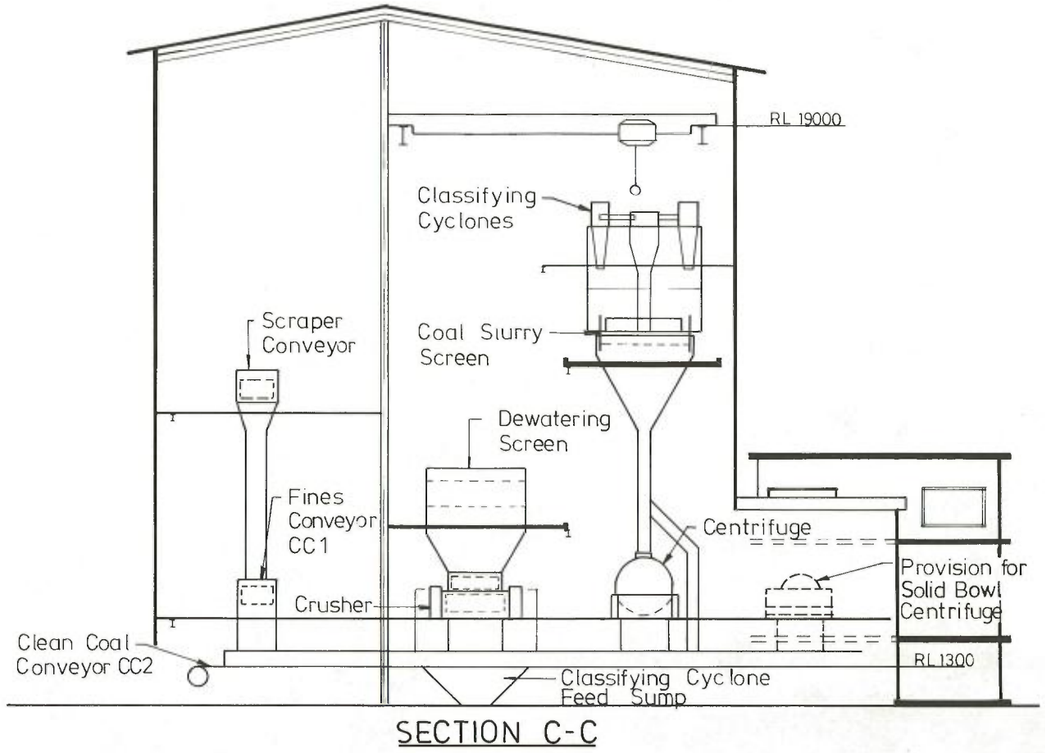
REGIONAL LANDUSE FIGURE 4



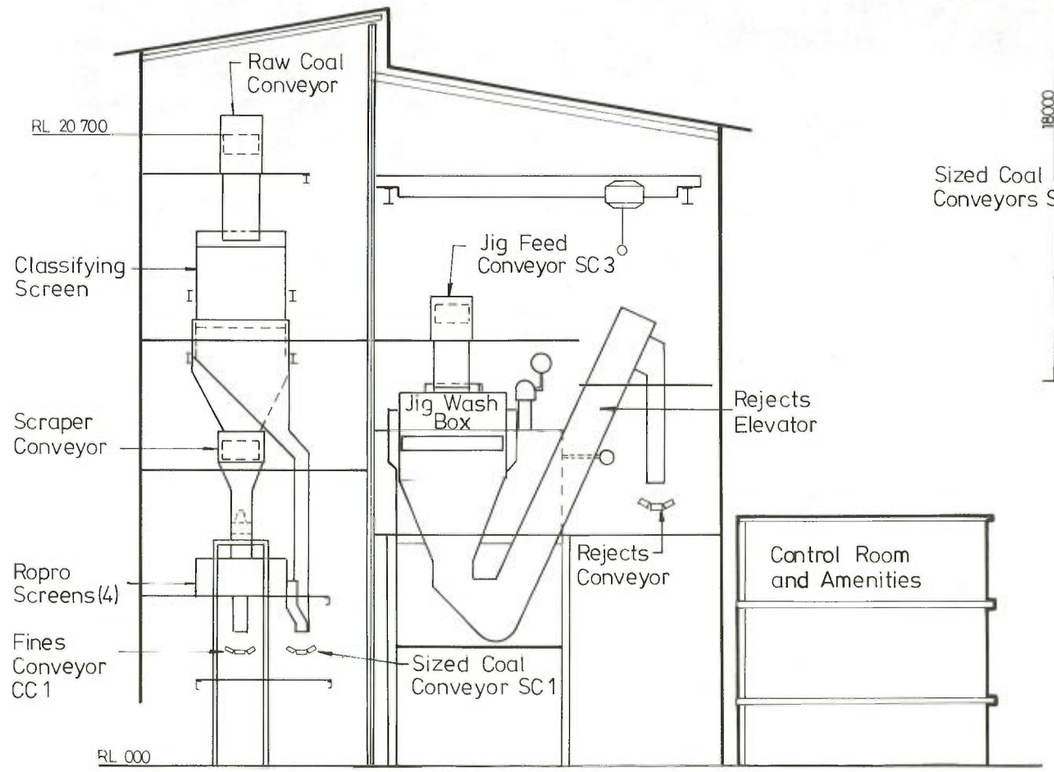
SITE LAYOUT FIGURE 5



SITE CONTEXT FIGURE 6



SECTION C-C



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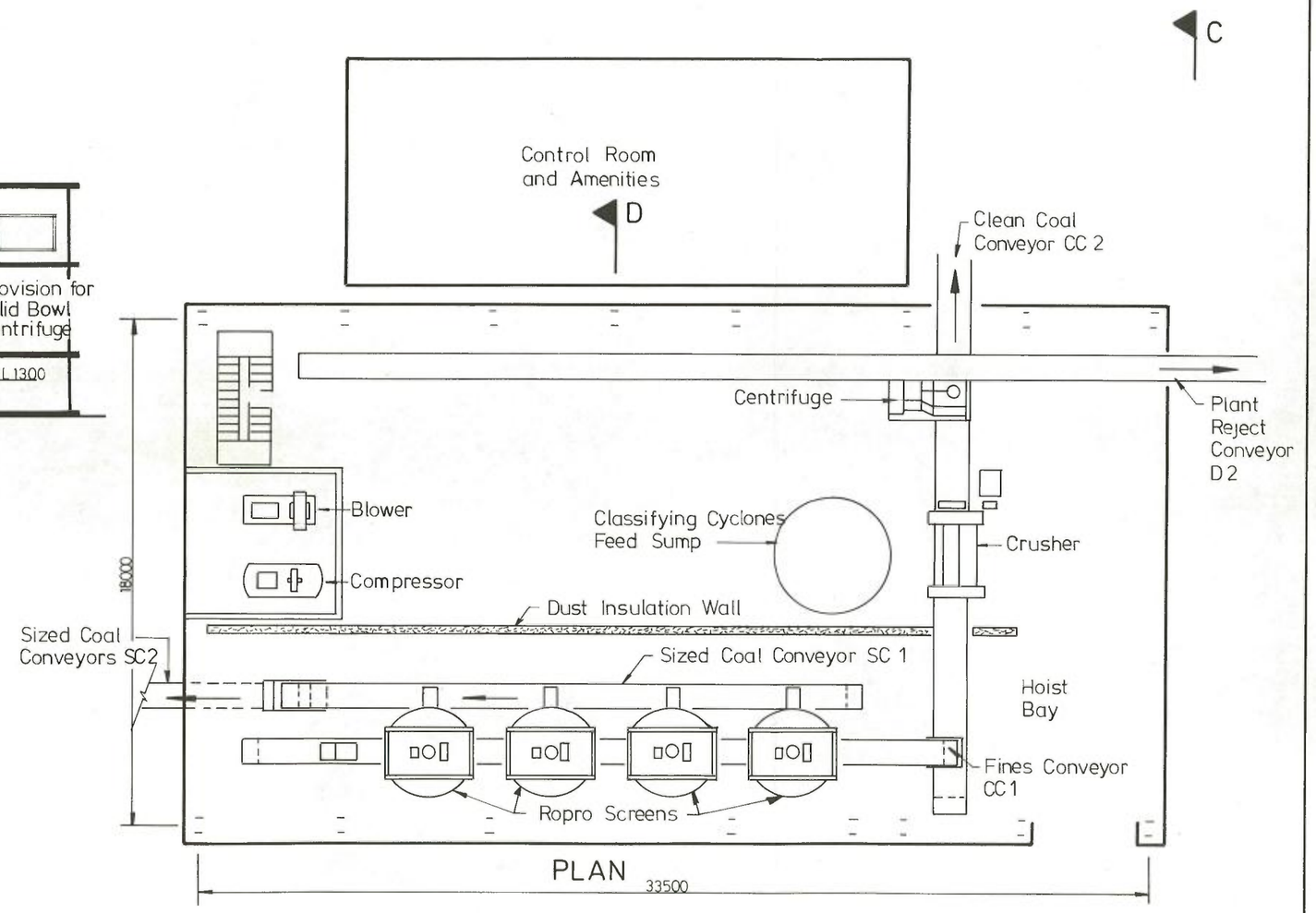
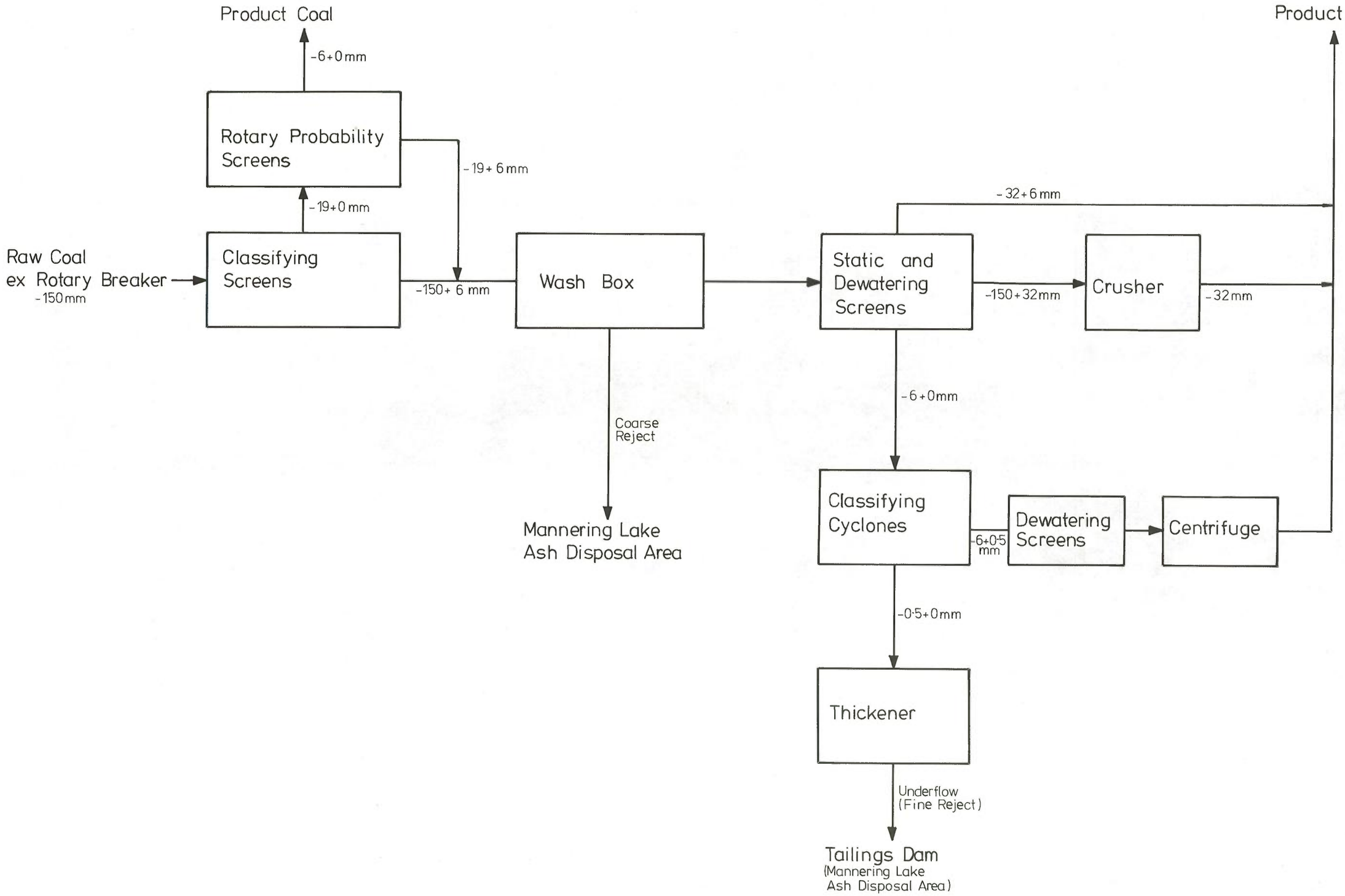


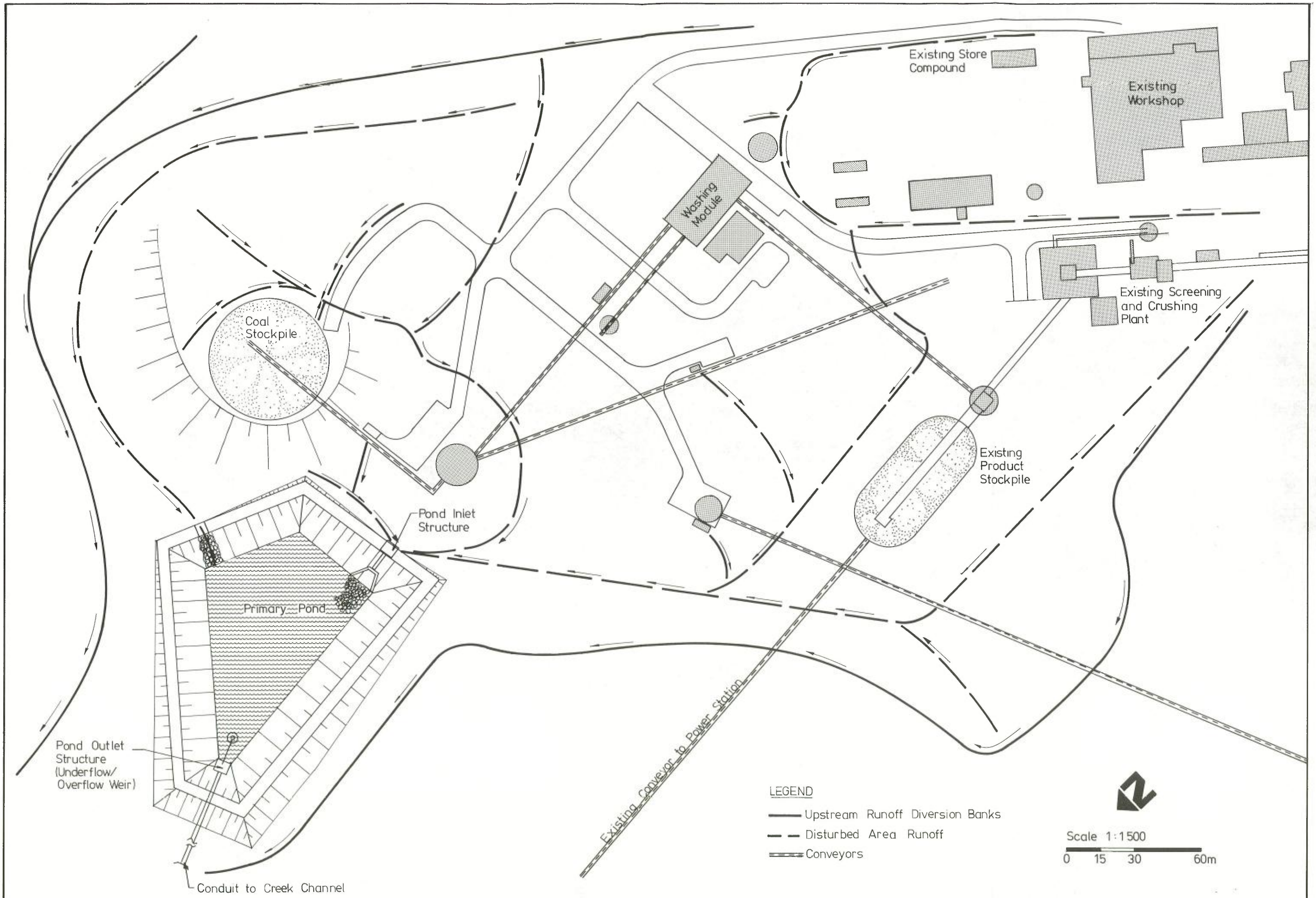
PLAN

Scale
0 2 4 8m

WASHING MODULE
PLAN & ELEVATIONS FIGURE 7



PROCESS FLOWSHEET FIGURE 8



DRAINAGE CONTROLS FIGURE 9

Planting & Mounding to Screen Views to Plant Areas Beyond

Additional Planting around Car Park

Revegetation & Rehabilitation of Banks & Construction Affected Areas

Reinforcement of Vegetation on Ridge Lines to Screen Plant Areas

Screen Planting around New Construction Works

Area Subject to Future Rehabilitation

Downcast Shaft

Ridge Line

Overland Conveyor to Refuse Dump

Overland Conveyor to Vales Point

Office

Bath House

No 2 Drift

Workshop

Car Park

Store Compound

Primary Settling Pond

Stockpile

Ridge Line

32 30 28 26 24 22 20 18 16 14

Scale 1:2 000

0 20 40 80m

LANDSCAPING FIGURE 10

SECTION THREE

IMPACT ASSESSMENT

3.1 PHYSIOGRAPHY

THE EXISTING ENVIRONMENT

3.1.1 Topography

The proposal is located at the southern end of Lake Macquarie on undulating coastal lowlands. Topography is shown in Figure 11.

There is little variation in relief over the site. A maximum height of 30 m above sea level is attained immediately south of the Wyee surface facilities. The surface slopes gently to the northeast. Slopes are less than four degrees over the site, with the exception of a few small localised areas.

Two broad, shallow valleys trend northeast to Chain Valley Bay. A similar north trending valley immediately west of the site is occupied by the Mannering Lake ash disposal area.

3.1.2 Geology and Soils

(i) Regional Geology

The strata cropping out over this region are the Permian Newcastle Coal Measures and the Triassic Narrabeen Group. The geology of these rocks has been described by Robinson & Shiels (1975), McKenzie & Britten (1969) and McElroy (1969).

The Newcastle Coal Measures consist of a sequence of conglomerates, sandstones, mudstones, shales, claystones, tuffs and coal seams, attaining a maximum thickness of approximately 400 m in the Swansea area. These measures occupy a shallow southerly dipping synclinal structure, the Macquarie Syncline. This syncline, which is a structural element of the Sydney Basin, has a general northeast-southwest regional trend and contains the main coal producing areas of New South Wales. Igneous rocks, mainly in the form of dolerite dykes, intersect the

measures and in places sill out in the coal seams.

The Narrabeen Group, which conformably overlies the Newcastle Coal Measures, consists of a sequence of conglomerates, sandstones and shales. It attains a maximum thickness of approximately 700 m near Wyong.

(ii) Soil Types

The distribution of soil types over the site and surrounding areas is shown in Figure 11. Uniform profile type soils occur in the floors of the broad valleys. Duplex profile type soils occur over the remainder of the site.

The soils vary in thickness and in general, have a low organic content. A thin cover of ironstone gravel occurs on the surface in some areas. In many areas the soils have been disturbed by the establishment of mine surface facilities.

The uniform soils are coarse, dark grey loamy sands that have developed on alluvial material in the main creeks. They range in depth up to 1.5 m.

The duplex soils have a yellow grey sand to sandy loam A horizon ranging up to 400 mm in depth. There is a fairly rapid transition to an orange-fawn partially mottled sandy clay B horizon, averaging about 500 mm in depth. The sandy clay grades down to a whitish clay above the parent rock. Depth to parent rock is up to 2 m. A nodular pistolitic ironstone layer occurs in the base of the A and the top of the B horizons. In some areas the top of the A horizon has been removed by erosion, leaving a hard surface covered with ironstone gravel.

(iii) Erosion Potential

Sheet erosion has occurred over the site where there is a lack of complete vegetative cover. Bushfires through the area have probably accelerated this process in the past.

Although the soils are potentially highly erodible, erosion will not be a serious problem because of the very gentle slopes over most of the site.

IMPACT ASSESSMENT

3.1.3 Topography

The impacts of the project on the topography of the area will be minimal, with earthworks being restricted to minor filling operations at the surface facilities site.

The creation of a dam covering approximately 7 ha of swamp area to the northeast of the pithead represents the major surface alteration. The resultant impact on the ecology of the site is described in Section 3.5.

3.1.4 Soils and Erosion

There may be a minor and short term increase in erosion during the construction of the dam and the surface facilities. This possibility will be removed as vegetation and runoff control structures are established.

3.2 NOISE CLIMATE

THE EXISTING ENVIRONMENT

3.2.1 Acoustic Environment

The Wyee State Coal Mine is established in an area of considerable industrial and residential development. The existing acoustic environment reflects these factors.

The power station can be considered as the base source contributing to the background noise level. Noise emanates in the form of machinery noise from the main building, and coal handling activities from the large stockpile area.

The Wyee, Newvale and Chain Valley Collieries contribute to the background by virtue of the operation of rotary breakers, screening and crushing plants, elevated conveyors, bin vibrators, air compressors, electric drives, ventilation fans and extensive conveyor runs feeding the Power Station.

Residential and industrial sites in the area are serviced by Vales Road and Tall Timbers Road. As a result of the shift wise operation of the mines and power station, peak traffic flows occur on several occasions during a 24 hour period. It is considered that the most appropriate neighbourhood description as defined by AS1055-1978 is the R3 category, which provides for background sound pressure levels of from 40 to 50 dB(A), dependent on the time of day.

3.2.2 Background Sound Pressure Levels

Ambient sound pressure levels were measured at the sites indicated in Figure 12. The methods employed are detailed in Appendix 1.

The conditions under which measurements were taken and the results of the statistical analysis of the recorded levels are provided in Table 6.

Monitoring sites S1, S2, S3, S6 and P3 have been considered to represent residential areas, whilst the remainder are classed as being part of or adjacent to an industrial complex.

Sites S1 to S5 were monitored on a Sunday when the three mines are inoperative. They can thus be viewed as a conservatively low assessment of general background conditions.

Measurements were undertaken at P1 to P3 while mines were operational (until 9 p.m.) and thereafter. In the case of P3, the higher recording

after 9 p.m. reflects the operation of a water treatment plant associated with the adjacent Macquarie Shores Caravan Park. This plant operates for several hours at night in response to a variable demand.

An octave band frequency spectrum was established at Site P1 when the mine ventilation fan was the only operational source. It is provided in Table 7. The steady noise level of 50 dB(A) can be compared with an average level of 64 dB(A) at the same point when the rotary breaker and screening and crushing plant was operational.

IMPACT ASSESSMENT

3.2.3 Predicted Sound Pressure Levels

For noise assessment purposes, the proposed development comprises the following basic components:

- a site preparation and construction phase
- coal washing operations
- conveyor transfer of coal.

The site preparation and construction phase will extend over a period of 14 months, with activity limited to daylight hours. Construction noise will range from 90 to 110 dB(A), the higher levels being intermittent in nature. The general construction broadband noise will be approximately 90 dB(A).

The washing module and conveyors will for the purposes of far field sound pressure level prediction also emit a fairly steady broadband noise. The following sound power emission levels have been assumed:

95 dB(A) from washery building
95 dB(A) from transfer points
88 dB(A) from conveyor systems.

On these bases, and using the propagation predictions described in

TABLE 6

BACKGROUND NOISE CLIMATE

Location	Date Time 13.2.83	Cloud Cover %	Temperature °C	Wind Speed m/sec	Wind Direction	L_{10} dB(A)	L_{90} dB(A)
S1	2.00 pm	30	26	1	-	-	44
	4.45 pm	60	25	2	S.S.E.	-	45
S2	3.30 pm	30	27	-	-	-	42
	6.00 pm	90	22	1	-	-	40
S3	3.10 pm	30	27	-	-	-	40
	5.45 pm	90	22	1	-	-	40
S4	2.30 pm	30	27	1	-	-	46
	5.15 pm	80	25	2	S.E.	-	47
S5	2.15 pm	30	27	1	-	-	47
	5.00 pm	60	25	2	S.E.	-	46
	14.2.83						
S2*	10.45 pm	-	20	1	-	-	42-44
S6	10.55 pm	-	20	1	-	-	47-48
P1	7.40 pm	-	20	2-3	N.E.	63	60
	9.10 pm	-	20	2-3	N.E.	54	50.5
	9.30 pm	-	20	2-3	N.E.	-	50
P2	8.00 pm	-	20	2-3	N.E.	45.5	44
	10.00 pm	-	20	1-2	N.E.	44	42
P3	8.30 pm	-	20	2-3	N.E.	48	45
	10.30 pm	-	20	2-3	N.E.	-	48

* Check reading only - five minute sample

TABLE 7

OCTAVE BAND FREQUENCY ANALYSIS
OF MINE VENTILATION FANS

Site P1, Time 9.30 pm									
Octave Band Hz	31.5	63	125	250	500	1K	2K	4K	8K
S.P.L. dB	70	65	57	52	43	40	40	40	25
S.P.L. dB(A) 50									

Appendix 1, the noise levels generated by the proposed development are as indicated in Figure 13. The contours have been computed without taking into account any excess attenuation, given the relatively short propagation distances involved.

The predicted sound pressure level at the Macquarie Shores Caravan Park due to the operation of the washery and associated facilities is 42.5 dB(A). The predicted value at Site S2, the residential area with the lowest background and separated from the development by about 1100 m, is 40 dB(A).

3.2.4 Conclusions

The construction and operation of upgraded surface facilities at Wyee State Coal Mine will have no detectable impact on the acoustic environment of the surrounding area, as a result of existing elevated levels.

The two areas of potential impact are the Macquarie Shores Caravan Park to the east of the development, and residential settlement near the end of Tall Timbers Road to the north. During the normal mine operating hours, the proposed washery will increase noise levels by only 1 dB(A) at these points. This increase will not be detectable.

After 9 p.m., with mining operations ceased, the washery may become the dominant source at the caravan park, increasing background levels by 2.5 dB(A). This falls well within the increment of 5 dB normally considered to constitute a noise nuisance. It only would apply in periods when the water treatment plant is inoperative.

As a result of the extensive areas of trees remaining in the area, both between the proposed site and potential receivers and within residential areas, wind assisted propagation of sound is expected to be masked by wind generated noise. Consequently downwind effects are not predicted to increase the level of noise nuisance.

3.3 WATER MANAGEMENT

THE EXISTING ENVIRONMENT

3.3.1 Surface Water

The stream pattern and catchments for the proposal area are shown in Figure 11.

The surface facilities site is drained by intermittent creeks that flow northeast into Lake Macquarie via Chain Valley Bay. Drainage to the south of the site is into Colongra Lake and then Lake Munmorah. Swamps occur along these drainage lines. To the west of the site, drainage flows into the Mannering Lake ash dam and then into Lake Macquarie via Mannering Bay.

No flows were recorded in the creeks draining the proposed site during the study period, and the swamp areas were dry. The creeks flow only for short periods directly following rainfall.

3.3.2 Groundwater

The Company's existing workings at Wyee produce a groundwater inflow of approximately 3500 m^3/mth. This rate is reasonably constant and is independent of rainfall as a result of the seam depths at this point.

The quality of groundwater derived from each seam is indicated in Table 8.

3.3.3 Lake Macquarie and Mannering Lake Ash Disposal Area

The Vales Point Power Station currently draws water from Lake Macquarie for mixture with collected boiler ash and subsequent pumping to the Mannering Lake ash disposal area. Clear supernatant from the ash dam overflows via a spillway back into Lake Macquarie. The ash slurry

inflow rate is approximately 70 ML/d, at 6 per cent solids.

TABLE 8

GROUNDWATER QUALITY

	Great Northern Seam	Fassifern Seam
pH	6.0	7.5
Total Alkalinity (mg/L)	530	15
Hardness (mg/L)	720	62
Soluble Salts (mg/L)	6542	2346
Conductivity (µmhos/cm at 25°C)	10430	3750
Chloride (mg/L)	3698	500
Sulphate (mg/L)	229	91

Source: Croft & Associates Pty. Limited.

The levels of dissolved salts in both Mannering Lake and Lake Macquarie vary considerably in response to climatic conditions, particularly rainfall, in the latter case as a result of the low level of tidal interchange. The results of analyses conducted in August and December 1982 and January 1983 are provided in Table 9.

TABLE 9

WATER QUALITY RESULTS

	Power Station Inlet		Ash Dam Outlet	
Date:	August'82*	January'83#	December'82*	January'83#
pH	8.0	8.1	8.6	8.7
Conductivity (µmhos/cm)	45000	53000	40500	51000
Soluble Salts (mg/L)	25000	n/a	40400	n/a
Chloride (mg/L)	18000	23300	19500	22700
Sulphate (mg/L)	2600	2000	2600	1640

Source: * Croft & Associates Pty. Limited
Vales Point Power Station

Fresh water runoff feeds Mannering Lake via Mannering Creek and a series of intermittent streams around its shores. It has been the experience of the Electricity Commission that the conductivity of water overflowing the ash dam wall is lower than the inlet supplies to the Vales Point Power Station. The pH of the water is normally increased as a result of the alkaline nature of the boiler flyash.

IMPACT ASSESSMENT

3.3.4 Water Balance

Figure 14 shows a monthly site water balance based on average annual meteorological conditions. To analyse the implications of extreme weather, seven water balances were performed ranging from the driest month in a one in ten year drought through to the wettest month in a one in ten peak rainfall year. The results of these analyses are given in Table 10.

TABLE 10

WATER MAKEUP REQUIREMENTS UNDER VARIOUS RAINFALL CONDITIONS

Rainfall Condition		Total Makeup (m^3/mth)	Required Makeup Following Use of Treated Effluent (m^3/mth)			
Monthly Rainfall	Return Period		Effluent Plant-Year of Operation			
			1	2	3	4
Maximum Rainfall Month	1in10 year wet	-20976	Nil	Nil	Nil	Nil
	Annual Average	-10095	Nil	Nil	Nil	Nil
Average Monthly Rainfall	1in10 year wet	-3747	Nil	Nil	Nil	Nil
	Annual Average	+2600	Nil	Nil	Nil	Nil
	1in10 year dry	8947	3947	Nil	Nil	Nil
Minimum Rainfall Month	Annual Average	12937	7937	2937	Nil	Nil
	1in10 year dry	16745	11745	6745	Nil	Nil

Notes: 1. Effluent volumes are based on average daily volumes used on 20 days per month.
Source: Public Works Department, New South Wales.

2. Negative makeup indicates a site water excess which where possible would be stored for subsequent use on-site.

The table indicates that in periods of rainfall equal to or less than the annual average monthly rainfall there will be a deficit of water on site. It should be noted that this analysis is performed on a month to month basis, and assumes no residual supply in the storage dam at the beginning of each new month. Hence for instance the maximum required makeup of 16745 m^3 could be in part sourced from this dam.

Should external supplies be required, they will where possible be drawn from the adjacent Mannering Park Sewage Treatment Works. Sewage will undergo physical and biological treatment at this facility, and will be held in maturation ponds for at least 15 days before being pumped to the coal preparation plant. Effluent will only be drawn when required for coal beneficiation, and will not be used for any other purposes on site. During the early years of operation of the treatment works, sufficient treated effluent may not be available. Water will be purchased from Wyong Shire Council to make good short term deficits. Potable water will continue to be purchased from Council in the same quantities as at present.

There will be no dry weather discharge from the site. The water balance indicates that there will be a monthly site water surplus only in some periods of a one in ten peak wet year. This does not necessarily imply a site discharge however, due to the substantial buffer capacity afforded by the surface storage dam. A monthly surplus of about 5500 m^3 represents about 3.8 per cent of the dam's active storage. Even in such extreme weather conditions, a water surplus does not persist throughout the year. For a discharge to occur, the peak rainfall would have to coincide with full storage conditions in the surface storage dam. In these circumstances, overflows through the dam spillway would consist of clarified runoff from disturbed areas and uncontaminated runoff from undisturbed portions of the dam catchment.

Over the period of the Christmas shutdown, approximately 3000 m^3 of minewater will be pumped to the surface storage dam. As this represents only 2 per cent of the dam's active storage, it is most unlikely to result in any discharge. Should any occur however, the minewater will be diluted at a ratio of approximately 50:1 by runoff - the resultant discharge would have no adverse impact on the existing

watercourse downstream.

3.3.5 Rejects Disposal

It is proposed that rejects from the washing process be disposed of in the Mannering Lake ash disposal area. Underflow from the thickener will be pumped to a specially constructed tailings dam, and clear supernatant recycled to the washing module. Coarse rejects will be used either to increase the height of the ash dam wall, or will be placed within the general ash dam area.

A methodology for predicting the quality of leachate generated by the action of water on coal rejects or overburden is not fully developed. To date, saturation extract or 1:5 extract analyses have been applied, the amount of material being leached obviously increasing with the volume of extractant used. In both cases, however, the reject or overburden material is crushed to -2 mm, and thus provides greater opportunity for salt extraction as compared with the generally larger sized material actually encountered in practice.

As an upper limit to the production of leachate, it has been suggested that overburden material in the Hunter Valley (and reject material, which generally has similar chemical characteristics) has an extractable salt content equivalent to 0.125 per cent by weight (based on information put forward by the State Pollution Control Commission during the Glendell Coal Mine Commission of Inquiry).

To determine the possible effects of the rejects on the quality of the overflow from the ash dam, both of the above techniques were applied. Saturation extracts were conducted on samples of similar material, using deionized water and a sample of water drawn from the existing ash dam. The results of the analyses are listed in Table 11.

The tests indicate that the rejects have the potential to generate an increase in the soluble salts level of the extractant of up to a maximum of about 3000 mg/L, and a tendency to reduce the pH of a highly alkaline extractant. (The increase in pH of deionized water

as compared to decrease in the case of dam water is probably explained by precipitation product being formed in the latter case.)

TABLE 11

SATURATION EXTRACTS, REJECT MATERIAL

	Dam Water	Saturated Extracts	
		Dam Water	Deionized Water
pH	8.6	7.5	8.0
Conductivity (μmhos/cm)	42000	43000	1100
Soluble Salts (mg/L)	40000	42800	820
Chloride (mg/L)	18500	20100	240
Sulphate (mg/L)	3100	2900	250

Using dam water, the saturation moisture content of the reject sample was 30.7 per cent. On this basis, the total amount of soluble salts available for leaching from the rejects can be calculated as follows:

$$\text{Maximum daily reject production} = \text{reject \% of raw feed} \times \text{peak daily production rate}$$

$$= \frac{16}{100} \times 9000$$

$$= 1440 \text{ tonnes.}$$

$$\therefore \text{Total amount of soluble salts available for leaching} = \text{reject production} \times \text{saturation moisture content} \times \text{ppm soluble salts in extract}$$

$$= 1440000 \times \frac{30.7}{100} \times \frac{3000}{1000000} \text{kg}$$

$$= 1326 \text{ kg}$$

The daily flow into the ash dam is 70 ML of slurry, at about 6 per cent solids. Assuming only enough runoff into the dam to balance evaporative losses, the daily discharge from the ash dam is thus approximately 65 ML.

In the case of all salts available for saturation extraction being leached in this manner, the increase in salinity of the discharge

is given by:

$$\frac{1326}{65000000} \times 10^6 \text{ ppm} \simeq 20 \text{ ppm.}$$

On the basis that a maximum of 0.125 per cent of the reject material is extractable salt, the increase in the salinity of the ash dam overflow becomes

$$1440000 \times \frac{0.125}{100} \times \frac{1}{65} \text{ ppm} \simeq 28 \text{ ppm.}$$

3.3.6 Conclusion

The construction of a washing module at Wyee State Coal Mine will have minimal or no adverse effects on the quality of water bodies surrounding the site, notably Lake Macquarie.

There will be no dry weather discharge from the site. Because of the large capacity of the proposed storage dam, for a discharge to occur, the peak rainfall would have to coincide with full storage conditions. In these circumstances, overflows from the spillway would consist of clarified runoff from disturbed areas and uncontaminated runoff from undisturbed portions of the catchment. There will be no opportunity for runoff to contain treated effluent. As a result, little or no impact is expected on the waters of Lake Macquarie.

The surface drainage network surrounding the site will be largely unchanged. The one exception to this will be the intermittent stream currently draining in a northeasterly direction to Chain Valley Bay. The construction of the 145 ML storage dam will limit flow downstream to cases of extreme wet weather. Consequently, there may be some change to the vegetation in that area as further described in Section 3.5.5. There will also be a minor overall reduction in the freshwater inflow to Lake Macquarie.

The provision of water to the site from external sources is unlikely

to disadvantage current or future consumers. The quantity required for potable uses will be unchanged. The process water required will, where possible, consist of treated effluent from the planned adjacent sewage treatment plant. The original plans for this effluent called for its pumping and discharge to the ocean at Norah Head. Under the proposed scheme to supply the washing plant, it will by late 1987 be able to supply 100 per cent of the total annual average external requirement.

In approximately the first three years of operation, before the sewage treatment plant becomes operational, up to 16745 m^3 of water may have to be supplied from the Wyong reticulation system in the case of the minimum rainfall month of a one in ten year drought. Again this assumes no residual supply in the surface storage dam. Existing headworks are available to meet this demand.

The placement of reject material in Mannering Lake ash disposal area will have no measurable impact.

Assuming worst case conditions, in which all available salt contained within the reject material is leached out on a daily basis, the salinity of the Mannering Lake ash dam overflow could increase by up to 28 ppm. This represents an increase of less than 0.1 per cent on existing levels, which is well within naturally occurring variation and not expected to cause any impact on aquatic biota downstream. It should be stressed that this is very much a worst case - it is proposed that the initial production of the reject material will be used in the construction of the ash dam wall, and in most circumstances remain dry. This proportion would therefore not contribute to the production of leachate.

The pH of the extractant is not favourable to the solution of trace metals. There is expected to be no detectable increase in trace metal content of the water leaving the ash dam as a result of the reject disposal operation.

There may be a slight downward modification of the ash dam overflow pH level. If this were the case, the pH would more closely resemble that of Lake Macquarie.

3.4 AIR QUALITY

THE EXISTING ENVIRONMENT

3.4.1 Background Dust Levels

The Electricity Commission of New South Wales maintains a series of dust deposition gauges in the Central Coast area.

Three gauges are located within a 1.5 km radius of the existing Wyee surface facilities, between the mine and Chain Valley Bay. The results of monitoring over the years 1977-1980 inclusive indicate a range in the annual geometric means of monthly results of from 1.4 $g/m^2.mth$ to 2.7 $g/m^2.mth$, (for total dust; individual gauges) with the levels predominantly in the range 2.0 to 2.5 $g/m^2.mth$.

Individual results indicate considerable variation about the mean, but insufficient data are available to explain such excursions. Results have been recorded greater than an order of magnitude in excess of the mean.

3.4.2 Wind Data

Wind speed and direction are the meteorological variables of critical importance to the dispersion of dust.

Frequency distributions of wind speed and direction were prepared from hourly average values recorded at Munmorah Power Station, 4 km to the south of the site, by the Electricity Commission over the period 1966 to 1981.

Annual average, summer and winter wind roses for Munmorah Power Station are shown in Figure 15.

The annual wind rose indicates a fairly uniform frequency distribution of wind speed and direction, with a higher frequency of southerlies and southwesterlies at higher speeds.

The wind rose for summer winds shows a dominance of easterlies and southerlies. Northeasterlies dominate at low speeds and southerlies at higher wind speeds.

Winter winds are dominated by northwesterlies, westerlies and southwesterlies.

IMPACT ASSESSMENT

3.4.3 Dust Dispersion

The development of additional surface facilities at Wyee State Coal Mine will lead to an incremental increase in fugitive dust emissions from the site. The methods employed to determine the level of increase are explained in Appendix 2.

Figures 16 to 21 show isopleths of predicted increases in dust deposition and concentration arising from the development under annual average, summer and winter conditions. Dust levels under these conditions at nearby residences (or groups of residences) are listed in Table 12. Their locations are marked on the figures.

Dust dispersion under annual average wind conditions occurs fairly uniformly about the source, reflecting the uniform frequency distribution of annual average winds. The Company owned residences within the Colliery Holding will receive increases in dust deposition of approximately 0.5 $g/m^2.mth$, with a predicted increase in dust concentration of between 5 and 10 $\mu g/m^3$. The Macquarie Shores Caravan Park on Tall Timbers Road approximately 0.75 km to the east of the site will experience an increase in dust deposition of 0.1 to 0.5 $g/m^2.mth$ with an increase in concentration of 5 to 10 $\mu g/m^3$. Private residences along the Pacific Highway will receive increases of about 0.05 $g/m^2.mth$ and 1 to 5 $\mu g/m^3$ in dust deposition and concentration respectively, whilst residences along Tall Timbers Road may experience deposition increases in the range of 0.1 to 0.5 $g/m^2.mth$ and concentration increases of 5 $\mu g/m^3$.

TABLE 12

DUST LEVELS AT RESIDENCES IN PROXIMITY TO THE PROPOSAL

		Annual Average		Summer		Winter	
		Deposition $g/m^2.mth$	Concentration $\mu g/m^3$	Deposition $g/m^2.mth$	Concentration $\mu g/m^3$	Deposition $g/m^2.mth$	Concentration $\mu g/m^3$
1	Elcom Collieries - Residences	0.5	5 - 10	0.5 - 1	10	0.1 - 0.5	5
2		0.1 - 0.5	10	0.5 - 1	10 - 15	0.1 - 0.5	5
3		0.5	10	0.5 - 1	10 - 15	0.1 - 0.5	5
4	Private Residence	0.05	1 - 5	0.05 - 0.1	1 - 5	0.01 - 0.05	1
5		0.05	1 - 5	0.05 - 0.1	1 - 5	0.01 - 0.05	1
6		0.05	1 - 5	0.01 - 0.05	1	0.05 - 0.1	1 - 5
7		0.05	1 - 5	0.01 - 0.05	1	0.05 - 0.1	1 - 5
8		0.05	1 - 5	0.01 - 0.05	1	0.05 - 0.1	1 - 5
9		0.05	1 - 5	0.01 - 0.05	<1	0.05 - 0.1	1 - 5
10		0.05	1 - 5	0.01 - 0.05	<1	0.1	1 - 5
11		0.1 - 0.5	5	0.05	1 - 5	0.1 - 0.5	10
12		0.1 - 0.5	5	0.05 - 0.1	1 - 5	0.1 - 0.5	5 - 10
13		0.1 - 0.5	5	0.05 - 0.1	1 - 5	0.1 - 0.5	5 - 10
14		0.1 - 0.5	1 - 5	0.1 - 0.5	1 - 5	0.1 - 0.5	5
15	Urban Area	0.05 - 0.1	1 - 5	0.05 - 0.1	1 - 5	0.1	1 - 5
16		0.05 - 0.1	1 - 5	0.01 - 0.05	1	0.1	1 - 5
17		0.01 - 0.05	1 - 5	<0.01	<1	0.05	1 - 5
18	Caravan Park	0.1 - 0.5	5 - 10	0.05 - 0.5	1 - 5	0.1 - 1	15 - 20

During summer, under the influence of northeasterly and southerly winds, levels of increase will be higher at the Elcom owned residences and lower at the remainder as compared with annual average conditions.

The reverse applies in winter, with for instance deposition rates at the Elcom residences increasing from 0.1 to 0.5 $g/m^2.mth$, while the corresponding range at the caravan park will be from 0.1 to 1 $g/m^2.mth$.

The above increases refer to average dust levels expressed over a period of one month as compared to existing measured levels. Short term variations in the fallout rate or concentration may be experienced when the wind is blowing persistently from the direction of the stockpile facility or when the wind is blowing with a higher than the normal velocity. The frequency of the variations during the time covered by the wind observations was included in the wind matrixes used in the estimates of the monthly values. It is not possible to determine the magnitude of the short term dust levels with precision. It is estimated however, that the short term increase in the dust deposition rate will not exceed the monthly rate by more than a factor of 10 and will not last for longer than a few hours.

Short term variations will generally be at a level less than 10 times the monthly rate.

3.4.4 Conclusions

On the basis of existing background dust deposition levels in the range of 2.0 to 2.5 $g/m^2.mth$, and assuming a conservatively high usage rate of stockpiles at the upgraded Wyee surface facilities, dust deposition rates under some conditions may increase by up to 1.0 $g/m^2.mth$ at the Elcom owned cottages and at the Macquarie Shores Caravan Park. In all other cases, the maximum increase will not exceed 0.5 $g/m^2.mth$.

While the increase at the Park and the Company owned cottages is inherently measurable, it is likely to be masked by the existing

high degree of variability in background readings.

It is thus probable that the development at Wyee will not be directly linked with any change in air quality in the area.

There will be no instances where on a long term basis the monthly deposition rate will increase to 4 $g/m^2.mth$. This value has been suggested by the State Pollution Control Commission as representing the limit of deposition above which air quality is inconsistent with the amenity of rural areas of the Hunter Valley. In other words, air quality in the Vales Point area, even allowing for the proposed development, will remain very acceptable for rural residential development.

The increases in concentration levels are not significant, and will cause no impact on residential amenity or health.

3.5 ECOLOGY

THE EXISTING ENVIRONMENT

3.5.1 Flora

i. Field Investigations

A period of four days was spent in the field assessing the vegetation of the site and locality. Vegetation structure and floristics were the two major facets examined. The structural classification was based on Specht et al (1974).

Vegetation communities were mapped with the aid of aerial photographs. All species identified are listed in Appendix 3, Table A3.1.

ii. Vegetation Communities

The distribution of vegetation units in the study area is shown in Figure 22.

The site and its locality have undergone considerable disturbance and change. The remaining natural vegetation consists of only a few communities but exhibits a great diversity in species composition.

The characteristics of identified communities are outlined below.

Open-forest dominated by Scribbly Gum, Red Bloodwood

The two dominant tree species of this community, Scribbly Gum (Eucalyptus haemastoma) and Red Bloodwood (Eucalyptus gummifera) are generally 10 m in height and present cover varying from 30 to 50 per cent. Occasional Rusty Gums (Angophora costata) and small clumps of the Brown Stringybark (Eucalyptus capitella) also occur.

Tall shrubs are generally sparsely distributed, the two most common ones being Black She-Oak (Casuarina littoralis) and Leptospermum attenuatum.

The shrub layer which is generally 1 m tall and variable in cover is diverse in species. Common shrubs include Myrtle Wattle (Acacia myrtifolia), Acacia suaveolens, Hakea dactyloides and Prickly Conesticks (Petrophile sessilis).

Grasses such as Kangaroo Grass (Themeda australis) make up the ground cover which is often sparse.

In parts of the community frequent burning has resulted in decreased shrub diversity. The introduced Whiskey Grass (Andropogon virginicus) is common along the margins.

The small area of Open-forest to the northwest of Wyee State Colliery is interrupted by planted Brush Box (Tristania conferta) and Slash Pine (Pinus elliottii).

Woodland dominated by Scribbly Gum, Red Bloodwood

This community although more open in structure exhibits the same floristics as the community described above. The tall shrub layer is sparse consisting predominantly of occasional immature eucalypts.

The diversity of shrubs and ground cover often merge, providing 100 per cent cover. Grass Trees (Xanthorrhoea media ssp. latifolia) occur commonly.

Parts of this community have been burned recently and the area adjacent to Mannering Lake Ash Dam has been physically disturbed.

Closed-sedgeland dominated by Leptocarpus

These areas are dominated by Leptocarpus tenax. The sedge forms a dense layer presenting almost 100 per cent cover. Scattered amongst it are Gahnia sp., Lemon Bottlebrush (Callistemon citrinus) and occasional Large-leaved Banksias (Banksia robur).

Areas of the swamplands have undergone some disturbance. Clearing has occurred along most of their boundaries and grazing has adversely affected a small area. An introduced Cumbungi (Typha sp.) is established in some areas.

Low Open-forest dominated by Sieber's Paperbark

The limited areas of this community occur adjacent to the swamps.

It is a simple community consisting predominantly of Sieber's Paperbark to a height of 7 m and presenting approximately 60 per cent cover. Juvenile Swamp Mahoganies are established amongst the Paperbarks. The low shrubs

and ground cover consist of Gahnia sp. and sedges.

Low Closed-forest dominated by Paperbark

This community occupies a small raised area in the Closed-sedgeland to the southeast of Newvale Colliery. The paperbark, probably Bracelet Honey-myrtle (Melalecua armillaris) is approximately 5 m tall and very dense, presenting 100 per cent cover. Few plants have become established under this canopy. Gahnia sp. and Lemon Bottlebrush make up the sparse shrub layer. There is no ground cover established on the channelled ground surface.

Herbfield dominated by Schoenus nitens

Overflow from a mine water storage dam has resulted in the death of the original vegetation community and its replacement by this community. The small area concerned consists of a number of herbs and sedges, the most common being Schoenus nitens.

Two other species also occurring in this community are Juncus kraussii and Fimbristylis ferruginea.

Open-forest dominated by Broad-leaved Paperbark, Swamp Oak and Swamp Mahogany

The dominant trees, Broad-leaved Paperbark (Melaleuca quinquenervia), Swamp Oak (Casuarina glauca) and Swamp Mahogany (Eucalyptus robusta) are over 15 m tall and present 50 to 60 per cent cover. Common subordinate species with uneven distribution throughout the community are Rusty Gum and Cabbage Gum (Eucalyptus amplifolia).

A variety of shrubs occur below the canopy, their distribution apparently decided by the degree of waterlogging. Shrub species observed include the Cheese Tree (Glochidion ferdinandi), Large-leaf Hop-bush (Dodonaea triquetra), Coast Wattle (Acacia longifolia), Gahnia sp. and Goodenia ovata.

Sedges and grasses make up the dense ground cover.

Open-forest dominated by Swamp Oak

These areas consist predominantly of pure Swamp Oak stands up to 15 m tall and presenting 70 per cent cover. The two main areas of this community exhibit significant differences:

i. Swamp Oak near Mannering Bay

   Most of the stands appear to be regenerating, subsequent to the construction of the ash dam

wall and other facilities.

The only tall shrub present is Ball Honey-myrtle (Melaleuca nodosa) and it occurs infrequently. The Common Reed (Phragmites australis) is growing in shallow areas. The ground cover consists of a layer of fallen oak cladodes interspersed by occasional Scaevola calendulacea.

A variety of species have become established on raised areas of fill adjacent to the Swamp Oaks. These species include Rhodes Grass (Chloris gayana), Myrtle Wattle, Large-leaf Hop-bush and Pomaderris discolor.

ii. Swamp Oak near Chain Valley Bay

These areas have not been disturbed and are much simpler than those described above. The dominant Swamp Oak is interspersed with occasional Broad-leaved Paperbarks. There are no shrubs and the ground cover is made up of Sand Couch (Sporobolus virginicus) and sedges.

iii. Mangroves and Saltmarsh

For the purposes of this study it was considered sufficient to map both vegetation types as one local community.

Along the shores of Mannering Bay and Chain Valley Bay are small stands of Grey Mangrove (Avicennia marina). The saltmarsh is dominated by Sand Couch (Sporobolus virginicus) and Juncus maritimus. These areas, particularly at Mannering Bay, have been disturbed and are of limited extent.

iv. Cleared of Native Vegetation

This area has been utilised for grazing and the establishment of coal mining facilities. The originally occurring native vegetation has been cleared or significantly degraded.

3.5.2 Fauna

(i) Field Methods

All animals observed during three days of field observation on and near the site were recorded. The sightings of Mr. and Mrs. A. Johnstone were utilised in producing the species lists presented in Appendix 3, Tables A3.2, A3.3 and A3.4.

(ii) Avifauna

Birds known to occur in the study area are shown in Appendix 3, Table A3.2. The two species most commonly observed were the Welcome Swallow (Hirundo neoxena) and White-cheeked Honeyeater (Philidonyris nigra). Both species were commonly observed in the ecotonal zone between the swampland and dry sclerophyll open-forest.

(iii) Mammals, Reptiles and Amphibians

Tables A3.3 and A3.4 list those species known to occur in the area.

It is expected that the abundance of large mammals, particularly macropods, has fallen. However a diversity of small mammals, reptiles and amphibians would inhabit those areas which remain relatively undisturbed.

3.5.3 Ecological Relationships

(i) Flora Distribution

The distribution of plant communities has been largely influenced by the infertility of the soils and the extent of waterlogging by both fresh and salt water.

The predominant Scribbly Gum and Red Bloodwood are adapted to soils of very low fertility (Anderson, 1968). The shrub species are also typical of the poor sandy soils in the district. Peas and wattles

which are common on the site are able to enhance soil fertility with the aid of nitrogen-fixing bacteria in root nodules.

The swamp areas and their associated Paperbark stands contain a variety of species, their distribution being influenced by the degree of waterlogging.

The extent of Mangrove and Saltmarsh around the bays of Lake Macquarie is determined by the available substrate and degree of tidal flooding.

A regular overflow of groundwater has significantly increased soil salinity levels resulting in salt tolerant species replacing the original vegetation in the small area southeast of Newvale Colliery.

(ii) Fauna Distribution

The study area can be divided into four broad habitat types:

a. Dry Sclerophyll Open-forest and Woodland

b. Closed-sedgeland and associated Paperbark stands.

c. Cleared and disturbed areas

d. Shoreline vegetation communities and the waters of Chain Valley Bay and Mannering Bay.

Table A3.2 shows in which habitat each of the bird species was observed. Generally speaking the greatest number of species was observed in the Dry Sclerophyll Open-forest and Woodland. This conclusion may be biased because of the fact that a proportionally greater time was spent studying this habitat than any other.

Most of the mammals and reptiles recorded for the site would occur in the Dry Sclerophyll Open-forest and Woodland habitat.

The Closed-sedgeland would contain a diversity of amphibians and possibly some bird and mammal species not recorded for the site in this study.

(iii) Status of the Site

Significant clearing and construction works have taken place in the vicinity of the site. The total area of native vegetation has been reduced and much of that remaining has been degraded.

The remaining natural vegetation consists of islands amidst a variety of land uses. The mobility of some fauna species is consequently affected and the vegetation has become prone to weed invasion. Exotic weeds, particularly Whiskey Grass, form a significant part of the site flora. Juvenile Slash Pines are becoming established in areas of native vegetation adjacent to mine facilities.

Construction works to the north of the ash dam have altered the distribution of Mangrove and Saltmarsh communities around Mannering Bay.

The only plant species observed of any particular significance was Hakea bakerana which according to the National Herbarium of New South Wales (pers. comm.) is of restricted distribution. No rare or endangered fauna are known to occur on the site. According to Bell (1978) the Suger Glider (Petaurus breviceps) has an uncertain future although there is no evidence of it being threatened at present.

The common vegetation communities of the site appear to be adequately reserved in the region. The Scribbly Gum-Red Bloodwood Associations and related communities are reserved in the nearby Munmorah State Recreation Area and North Entrance Peninsula Nature Reserve.

IMPACT ASSESSMENT

3.5.4 Surface Facilities Site

A small area of Open-forest dominated by Scribbly Gum and Red Bloodwood will require clearing to allow construction of the surface facilities. This is considered to be of minimal significance as the area involved

is very limited and already largely degraded. The existing vegetation is considered to be of very little value as fauna habitat. No Hakea bakerana specimens will require removal.

Clearing is likely to encourage the spread of weeds such as Andropogon virginicus.

3.5.5 Dam Site

The storage dam will inundate approximately 7 ha of land, disturbing areas of Low Open-forest dominated by Sieber's Paperbark, Closed-sedgeland and Open-forest dominated by Scribbly Gum and Red Bloodwood. In addition to the area actually flooded, there is likely to be some alteration to species' composition adjacent to the dam waters. Neither of these impacts is considered significant given the small scale of the disturbance and the low conservation status of the flora.

The dam will have the effect of reducing flows downstream. The area of Open-forest dominated by Broad-leaved Paperbark and Swamp Mahogany to the northeast (bordering Chain Valley Bay) may experience a longterm alteration to species' composition. As the surface drainage network will be otherwise unchanged, and as site discharges will occur only under peak rainfall conditions (and then consist only of clarified runoff from disturbed areas and uncontaminated runoff from undisturbed areas), there is expected to be no further impact on wetland communities lower in the catchment.

The disposal of washery rejects into Mannering Lake Ash Dam is not expected to cause a measurable impact on the biota of Mannering Bay (see also Section 3.3).

3.6 LAND USE AND PLANNING

THE EXISTING ENVIRONMENT

3.6.1 Land Use

Land use around the site is shown in Figure 4. Power stations and their associated facilities, colliery holdings, residential areas and bushland occupy most of the area.

Wyee State Coal Mine, Newvale Colliery and Chain Valley Colliery are located directly southeast of the Vales Point Power Station. Mannering Lake, a large area to the west and southwest, is utilised for ash disposal from the power station. Colongra Lake ash disposal area, utilised by the Munmorah Power Station, is located to the south of the site.

Substantial residential development has occurred at Mannering Park and Lake Munmorah. Lesser areas have also been established, particularly around the shores of Lake Macquarie. Housing stock in these areas is mixed ranging from small timber and iron cottages to cement board, brick veneer and large brick dwellings. There is a considerable amount of vacant land in some of these areas but infilling is occurring.

A major recreational area, the Munmorah State Recreation Area, is located to the east of Lake Munmorah.

Small areas have been cleared along the edges of many of the roads in the area and are used for grazing, market gardening, orcharding and chicken farming as well as hobby farming.

A number of small industrial areas are located along the Pacific Highway.

Transmission line easements from Vales Point Power Station cross the

area in southerly, southwesterly, westerly and northwesterly directions. Coal conveyor easements connect the collieries and the Wyee rail loop to the power station. Munmorah and Vales Point Power Stations are also linked by conveyor. The Main Northern Railway Line lies to the west and the Pacific Highway to the south of the site.

3.6.2 Regional Planning

Regional strategic plans for the Gosford-Wyong and Hunter regions have been prepared by the New South Wales Planning and Environment Commission. These plans are intended to act as guideline documents for government and private initiatives in the regions.

The Gosford-Wyong Strategy Plan allows for major urban expansion of the order of 200,000 persons in the Wyong-Wyee area.

This expansion would primarily be the development of a new town north of Wyong.

The Hunter Regional Plan allows for a population addition of 100,000 persons in the Lower Hunter Subregion by the Year 2001. The recommended strategy aims to maximise the use of existing infrastructure by infilling existing urban areas.

3.6.3 Statutory Planning

Land use in the region is currently controlled by the Northumberland County Council District Planning Scheme as amended in the Lake Macquarie Municipality. In the Wyong Shire it is controlled by the Shire of Wyong Planning Scheme Ordinance and Interim Development Order No. 58. Generalised zoning around the proposal areas is shown in Figure 23. The proposal site is located in the Wyong Shire.

A large proportion of the area has been zoned for special uses to allow for existing and future power stations and their associated facilities. The proposal sites are on the Vales Point Power Station area. The Lake Munmorah Power Station and facilities occupy the area to the south. A large area of land to the east has been set aside

for a future power station.

The northeastern margin of Lake Munmorah and the Vales Point areas have been zoned for residential purposes. A large area to the east of Lake Munmorah township has been zoned open space for recreational purposes.

Several small communities including Wyee and Chain Valley Bay have been zoned 'non urban village'.

A narrow reserve has been maintained along most of the waterfront. The area to the north of the power station reserve is a rural scenic protection area.

The area to the west of Wyee Bay has been zoned for special purposes and is occupied by the Morisset Mental Hospital.

Various rural zonings cover the remaining area.

Portion of the The Municipality of Lake Macquarie Draft Local Environmental Plan is shown in Figure 24. This scheme envisages the reallocation of a large area of the land zoned 'non urban' to the west of the site for special industrial purposes (power station facilities).

In addition, the land along the western shores of Wyee Bay would be rezoned for special business (tourist park) and public recreation purposes.

A tree preservation order covers the entire Wyong Shire.

The area is within the Swansea-North Entrance Mine Subsidence District.

IMPACT ASSESSMENT

3.6.4 Regional and Statutory Planning

The site proposed for development is zoned Special Uses-Power Station. No change will be required to allow the project to proceed. Adjacent zonings will not be compromised by the proposal.

3.6.5 Land Use

The upgrading of surface facilities at Wyee would represent an extension of existing activities in the area, and as such would not be considered as a major departure from currently land use practices.

The operations of the power station and three associated mines have influenced the air quality and background noise levels in the area, and have constrained land use accordingly. The slight further changes to the prevailing conditions arising as a result of the proposed development will impose no additional constraints on future land use, and will not significantly affect existing activities.

3.7 VISUAL ASPECTS

THE EXISTING ENVIRONMENT

3.7.1 Landscape Components

The site and its surroundings are illustrated in Plate 1. As is obvious, the area has been extensively modified by past and continuing mining activities.

Six landscape types are readily identifiable, each with different visual and structural characteristics. Details of each are provided below:

i. The surface facilities sites and their immediate surrounds are visually dominated by large structures such as workshops, crushing plant, storage bins and conveyor gantries. Rows of tree and shrub plantings, lawn areas and bitumen sealed car parks and roads surround these structures.

ii. Large areas of cleared land are located near the surface facilities. These are used as materials and machinery storage areas. The storage areas, cleared land and access tracks represent visually discordant elements.

iii. Areas of land to the south of the Wyee Colliery are covered by old washery rejects. Although regrading and rehabilitation has been undertaken the spoil remains poorly vegetated. The contrasting colours of the natural soil, coal rejects and vegetated land are major visual features of this area. There are very few upper canopy trees in this sector of the site.

iv. A network of power transmission lines passes through the site. Within the easements all upper canopy trees have been removed. The subsequent landscape has a heath-like structure delineated and visually emphasised by borders of trees.

v. Sections of the site are visually dominated by stands of upper canopy trees. The forest areas perceptually segment the site by creating a visual filter or screen between prominent features. The level of disturbance to the undergrowth varies thus influencing the effectiveness of the forest as a visual barrier.

vi. An area of Closed-sedgeland extends from the Wyee Colliery to 600 m northeast of the Newvale Colliery. The high percentage of cover and the added diversity stemming from

the vegetation structure and colour, add to the scenic quality of the area.

3.7.2 Scenic Status

The scenic status of the site is considered to be low due to the general lack of visual continuity. Substantial areas have been denuded of vegetation or disturbed through coal rejects disposal, earthworks for construction, clearing for storage areas, vehicular access tracks, water storage ponds and power line easements. These areas are perceived as visually discordant elements within the site.

There is no defined boundary between the mining operations and the surrounding forested areas. This visual aspect further detracts from the scenic status.

3.7.3 Visual Prominence

The site is not visually prominent when viewed from the adjacent roads and nearby houses. Views from Vales Road and houses in this vicinity are filtered or screened by a zone of native trees and shrubs. This vegetation effectively reduces the view potential to the site. Only taller structures can be seen above the tree canopy.

Much of the visually disturbed area is not viewed from the local transport routes. This disturbed landscape can be seen from within the site which is beyond the limits of public access.

The visual landscape of the local area is dominated by the Vales Point Power Station and its associated stockpiles and conveyor gantries. The Station's effect is to reduce the visual prominence of the Wyee surface developments by acting as the focus of attention for observers.

3.7.4 Visual Impact

As a result of the low view potential, the siting of the facilities and the extent of proposed landscaping, the development will have a low visual impact on the local and subregional landscape. Being sited within an existing disturbed and developed area, the additional structures and stockpile will be largely perceived as an extension to the existing industrial complex.

The major visual impact will occur during the construction stage when clearing, earthmoving and erection activities will be prominent. After a period of three to five years the tree planting shown on Figure 10 will begin to filter views to the structures. The major benefit will be realised after five to ten years has elapsed, during which time the planting will become both structurally compatible with the surrounding forest and effective as a visual screen or filter.

The delineation of use zones and the subsequent rehabilitation of areas and access tracks not required will increase the visual quality of land within the site.

The view from houses in close proximity, most of which are company owned, is screened by the zone of existing forest vegetation. The effectiveness of the screen is demonstrated by Plates 4 to 7 which show views to the site from the most exposed vantage points. At no other sites on either Tall Timbers Road, the Pacific Highway or Vales Road was the site visible.

It is considered that the project will not represent a major visual impact to the local residents or to users of adjacent roads.

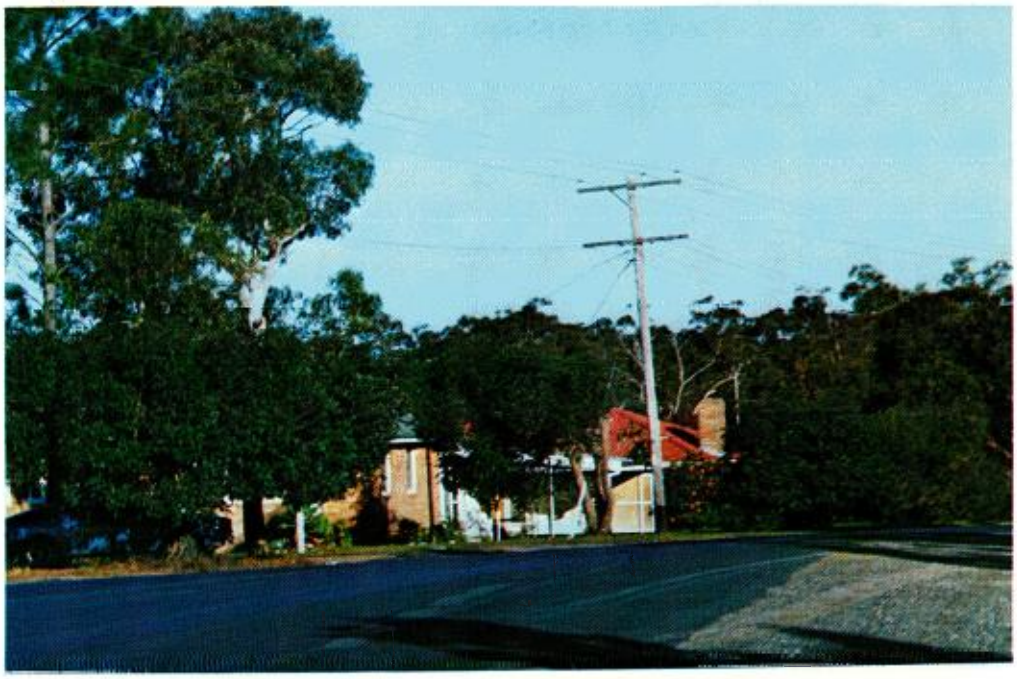


PLATE 4. View to Site from Vales Road.

PLATE 5. View to Site from Tall Timbers Road.

PLATE 6. View to Site from Tall Timbers Road.

PLATE 7. View to Site from Tall Timbers Road.

Photograph References on Plate 1

3.8 SOCIO-ECONOMIC ASPECTS

THE EXISTING ENVIRONMENT

3.8.1 The Economic Base

The Lake Macquarie, Wyong and Cessnock Local Government Areas, which for the purposes of subsequent discussion are collectively termed the Wyee Subregion, represent the economic base of the area potentially affected by the proposed Wyee upgrading. Activity in the subregion is spread over tertiary and manufacturing industry, coal mining and agricultural developments.

Employment in the tertiary sector at the 1981 Census accounted for approximately 64 per cent of total employment in the Wyee Subregion. Increased employment has occurred in recent years in electricity generation, finance, construction and community service industries, whilst employment decreased in the retail and wholesale sector.

Expansion of coal mining and electricity generation activities in the Hunter Region account for the increased significance of employment opportunities in the construction industry.

A rapidly expanding tourist industry in Wyong Shire is reflected in the gross takings from hotels and motels increasing by 88 per cent in the four years to 1979-80. The comparable figures for Cessnock and Lake Macquarie were 51 per cent and 43 per cent respectively.

The majority of the manufacturing establishments in the subregion are located in the Lake Macquarie Municipality. The most numerous industries operating in the subregion are involved in the fabrication of metal products and wood products, these industry types accounting for 44 per cent of manufacturing establishments (Garlick & Michael, 1980). The manufacturing sector employed approximately 18.3 per cent of the labourforce in the Wyee Subregion in 1981. Table 13 discloses that employment in the manufacturing industry declined by approximately

2.4 and 4.7 per cent in Lake Macquarie and Cessnock respectively between 1971 and 1981, whilst it increased by 102 per cent in Wyong over the same period.

TABLE 13

GROWTH AND CHANGE IN MANUFACTURING INDUSTRY

	1971-72*	1979-80*
Number of Establishments -		
Cessnock	44	68
Lake Macquarie	132	186
Wyong	59	145
Total subregion	235	399
	1971#	1981#
Employment -		
Cessnock	3654	3483
Lake Macquarie	12924	12619
Wyong	1324	2678
Total subregion	17902	18780

Source: * Australian Bureau of Statistics - Handbook of Local Statistics 1973, 1982.
Australian Bureau of Statistics - Census 1971, 1981.

The South Maitland and Newcastle mining districts, which together incorporate the three LGA's in the subregion, produced 1.3 Mt and 14.9 Mt of raw coal respectively in 1981-82. Coal production in the subregion has increased in the past five years, particularly in the Newcastle district which encompasses mines in Lake Macquarie and Wyong LGA's. Approximately 12.7 Mt of coal was exported through the Port of Newcastle during 1981-82.

In conjunction with the increase in production, coal mine employment in the Newcastle district has shown a 35 per cent increase to 6557 in the five years to 1982, as indicated in Table 14.

One-third of the total area of Cessnock LGA is devoted to agricultural production, mainly grape growing, beef cattle grazing and dairying. Due to factors such as urbanisation and poorer land quality, less land is used for agriculture in the Wyong and Lake Macquarie districts

(13 per cent and 4.7 per respectively).

TABLE 14

TRENDS IN COAL MINE EMPLOYMENT 1976-1982

	1977	1978	1979	1980	1981	1982
South Maitland	782	815	798	763	909	801
Newcastle	4876	4931	4921	5281	5998	6557
Total	5658	5746	5719	6044	6907	7358

Source: Joint Coal Board of N.S.W., 1982.

Poultry production both for meat and eggs is the major money earner in the subregion with vineyards in the Cessnock district and fruit production in the Wyong area also being of significance.

At the 1981 Census, 1363 persons were recorded as agricultural workers in the subregion representing 1.4 per cent of the total workforce.

3.8.2 Employment

At the 1981 Census, 95,923 were employed in the subregion. Of these, 22.7, 15.2 and 62.1 per cent resided in Wyong, Cessnock and Lake Macquarie respectively. Table 15 provides details of their distribution in the various industry categories.

Considerable differences exist in the employment structures of the three component areas, the most significant of which is the much larger proportion of Wyong residents employed in tertiary industries. The Hunter Region is characterised by a lower proportion of the population being employed in tertiary industries in response to a higher level of employment in mining and manufacturing.

The relative isolation of Wyong from the major industrial centres

is reflected in the low proportion (12.3 per cent) of its workforce employed in manufacturing. As a consequence, the mining, electricity, construction and recreation industries which do occur in its area account for a larger proportion of the workforce.

TABLE 15

EMPLOYMENT STRUCTURE BY INDUSTRY GROUP, WYEE SUBREGION AND N.S.W., 1981

(%)

Industry	Lake Macquarie	Wyong	Cessnock	N.S.W.
Primary:				
Agriculture	0.6	2.7	2.8	4.9
Mining	6.3	2.4	18.0	1.4
Total Primary	6.9	5.1	20.8	6.3
Secondary:				
Manufacturing	21.2	12.3	23.9	18.5
Tertiary:				
Gas, Electricity and Water	4.3	5.9	1.9	2.1
Construction	9.3	15.1	5.5	6.2
Retail/Wholesale	16.6	17.8	11.9	17.3
Transport	5.4	4.2	3.1	5.5
Communication	1.3	1.9	1.1	2.0
Finance	6.8	6.5	3.7	9.6
Public Administration	14.1	10.7	13.5	13.9
Recreation	4.4	7.1	4.2	5.6
Total Tertiary	64.8	73.2	47.7	67.3
Other:	7.1	9.3	7.5	7.8

Source: Australian Bureau of Statistics, Census 1981.

A similar situation occurs in Cessnock where the historical association with coal mining is reflected in 18 per cent of the workforce being employed in that industry.

The greater integration of the Lake Macquarie population into the Lower Hunter industrial area is reflected in the concentration of employment in the mining and manufacturing industries.

The number of unemployed persons in the subregion, as measured at the 1981 Census, is shown in Table 16. Analysis of the data indicates that throughout the subregion unemployment amongst females is significantly greater than that for males. Although a similar pattern is evident at the State level, it is accentuated in the subregion.

The relative lack of a broad industrial base in Wyong Shire is reflected in its having a greater unemployment rate for both males and females relative to the subregion and State.

TABLE 16

UNEMPLOYMENT IN THE SUBREGION AND N.S.W., 1981

	Lake Macquarie		Cessnock		Wyong		Total (Subregion)		N.S.W.
	No.	% of total labour-force	No.	% of total labour-force	No.	% of total labour-force	No.	% of total labour-force	%
Female	2021	9.4	419	8.1	914	11.4	3354	9.7	6.4
Male	1639	3.9	486	4.7	1280	8.0	3405	5.0	5.1
Total	3660	5.8	905	5.8	2194	9.2	6759	6.6	5.6

Source: Census 1981.

IMPACT ASSESSMENT

3.8.3 Introduction

As the proposed upgrading will not result in a change to the operational workforce numbers, and the demand for external services will be only marginally increased, it has been assumed that any socio-economic impacts will arise only as a result of the actual construction of the new facilities.

The construction phase will last for approximately 14 months, and involve a capital expenditure of about $18.3M (1982 prices). Of this

amount, it is likely that approximately 40 per cent will be expended in the Hunter Region, and a further 25 per cent in the remainder of New South Wales. Employment levels will peak at 62 and average 44.

The magnitude of the direct, indirect and induced effects of the proposal have been determined by applying input-output multipliers. The derivation of the multipliers is outlined in Appendix 4. As a result of the short-term nature of the construction period, it is unlikely that the induced effects willl be fully realised.

3.8.4 Income and Industry Output

An estimated $0.84M will be paid in wages and salaries to the direct workforce during construction. This is likely to lead to a further increase of between $0.3M and $0.8M as a result of flow-on effects to the community. It is probable that a significant proportion of this gain would accrue to the subregion, particularly in the wholesale and retail trade, financial and other business services and recreation and entertainment industries.

The expenditure of capital within the Hunter Region could increase the output value of industries by between $4.5M and $11M.

3.8.5 Employment

On the basis of input-output analysis, up to 28 direct employment positions and 46 induced positions could be created during the construction phase. However, it is very unlikely that this level of increase will be experienced, as the additional requirements have the capacity to be accommodated by existing excess capacity in the local economy or by the application of management practices other than increased staffing.

Consequently, employment impacts are likely to be confined to direct effects only. The project's construction phase is expected to provide additional employment opportunities for subregional residents in a period where such opportunities are limited. The requirements for

semi and unskilled labour may contribute to a decline in the level of unemployment in these occupational categories.

It is estimated that due to the existence of a pool of unemployed labour in the subregion and region, the majority of the unskilled construction labour requirements can be obtained from local sources. Similarly, as only a small group of key personnel will be brought to the site from outside the region, the majority of skilled labour will also be obtained from local sources.

3.8.6 Population Growth and Community Services

Population impacts resulting from the construction phase are expected to be limited to the small number of key personnel brought to the site by the contractor. As the total workforce at any one time is unlikely to exceed 65 persons, the extent of such an increase is not anticipated to be significant.

Accommodation will be provided from existing sources for employees brought to the area by the contractor. Should any additional inmigration occur as a consequence of the proposal, sufficient temporary accommodation is available in the local area to meet the demand (10 caravan parks within 7 km of the site with up to 1500 sites, and up to 100 motel units within 12 km).

3.9 ENERGY STATEMENT

3.9.1 Beneficiation

Run-of-mine coal has a specific energy of 24 MJ/kg.

Rejects will be produced at the maximum rate of 16 per cent of the ROM production, in the ratio of 6 coarse to 1 fines. Assuming energy contents of 5 MJ/kg and 10 MJ/kg respectively, the energy extraction efficiency of the washing process is 96 per cent.

3.9.2 Energy Balance

The washing plant and coal handling equipment will consume an average of 5.5 x 10^6kWh of electrical power per annum at a production rate of 6000 tonnes per day of ROM coal. Based on generation and transmission efficiency of 35 per cent, the primary energy equivalent is 57 x 10^6MJ (1 kWh = 3.6 MJ)

The washed coal will have an energy content of 27 MJ/kg, or an annual total of 37.26 x 10^9MJ.

The nett annual energy production is thus 37.2 x 10^9MJ.

3.9.3 Resource Sterilisation

The Great Northern Seam underlying the proposed surface facilities and storage dam has been worked out. The Fassifern Seam has not been mined. As a result of the surface development, support pillars will need to be retained.

Three hundred thousand tonnes of coal will be sterilised representing 7.2 x 10^9MJ of energy.

The construction of the washery will allow the recovery of significant reserves of high ash content coal which would be unusable without

beneficiation. The additional recovery will more than offset the quantities sterilised.

3.10 ARCHAEOLOGICAL ASPECTS

3.10.1 Survey

A survey of archaeological relics at Wyee State Coal Mine was made on February 24th, 1983 by Dr. Helen Brayshaw in company with Mr. Jim Wright and Mr. Percy Haslam, representatives of the Newcastle Awabakal Aboriginal Co-operative.

The survey was conducted on foot and covered all areas to be affected by the proposal. A full report of the work has been provided to the National Parks and Wildlife Service.

3.10.2 Results

No archaeological relics were located during the survey. There were no signs of scarring on trees. There were no extrusions of sandstone suitable for shelters, engravings or axe grinding grooves. No stone artefacts or midden deposits were found.

On this basis, it is considered unlikely that the development will have any impact on visual evidence of Aboriginal sites in the area.

MANNERING BAY

MANNERING LAKE

CHAIN VALLEY BAY

330kV

NEWVALE COLLIERY

WYEE STATE COAL MINE

Tall Timbers Road

Vales Road

Pacific Highway

10

20

30

LEGEND - Soils

Uniform Profile

Duplex Profile

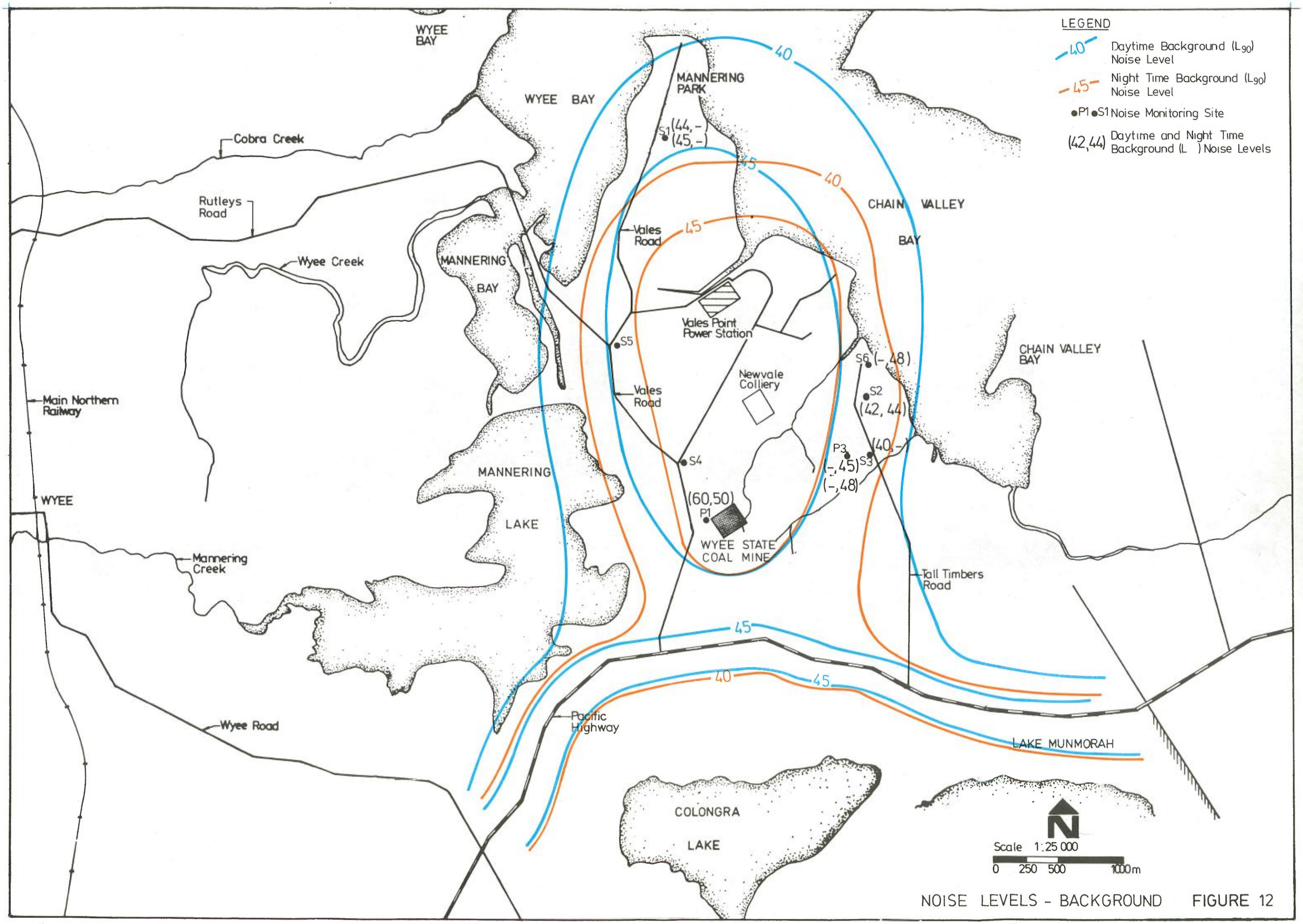
Catchment Boundary

N

Scale 1:10 000

0 100 200 400m

PHYSICAL ENVIRONMENT FIGURE 11



NOISE LEVELS - BACKGROUND FIGURE 12

LEGEND

35 — Predicted Noise Level due to Proposed Development, dB(A)

● Elcom Cottages

▲ Caravan Park

WYEE BAY

WYEE BAY

MANNERING PARK

CHAIN VALLEY BAY

Cobra Creek

Rutleys Road

Wyee Creek

MANNERING BAY

Vales Road

Vales Point Power Station

CHAIN VALLEY BAY

Main Northern Railway

Vales Road

Newvale Colliery

MANNERING

LAKE

Washery

WYEE STATE COAL MINE

45 dB(A)

40 dB(A)

35 dB(A)

Tall Timbers Road

WYEE

Mannering Creek

Wyee Road

Pacific Highway

LAKE MUNMORAH

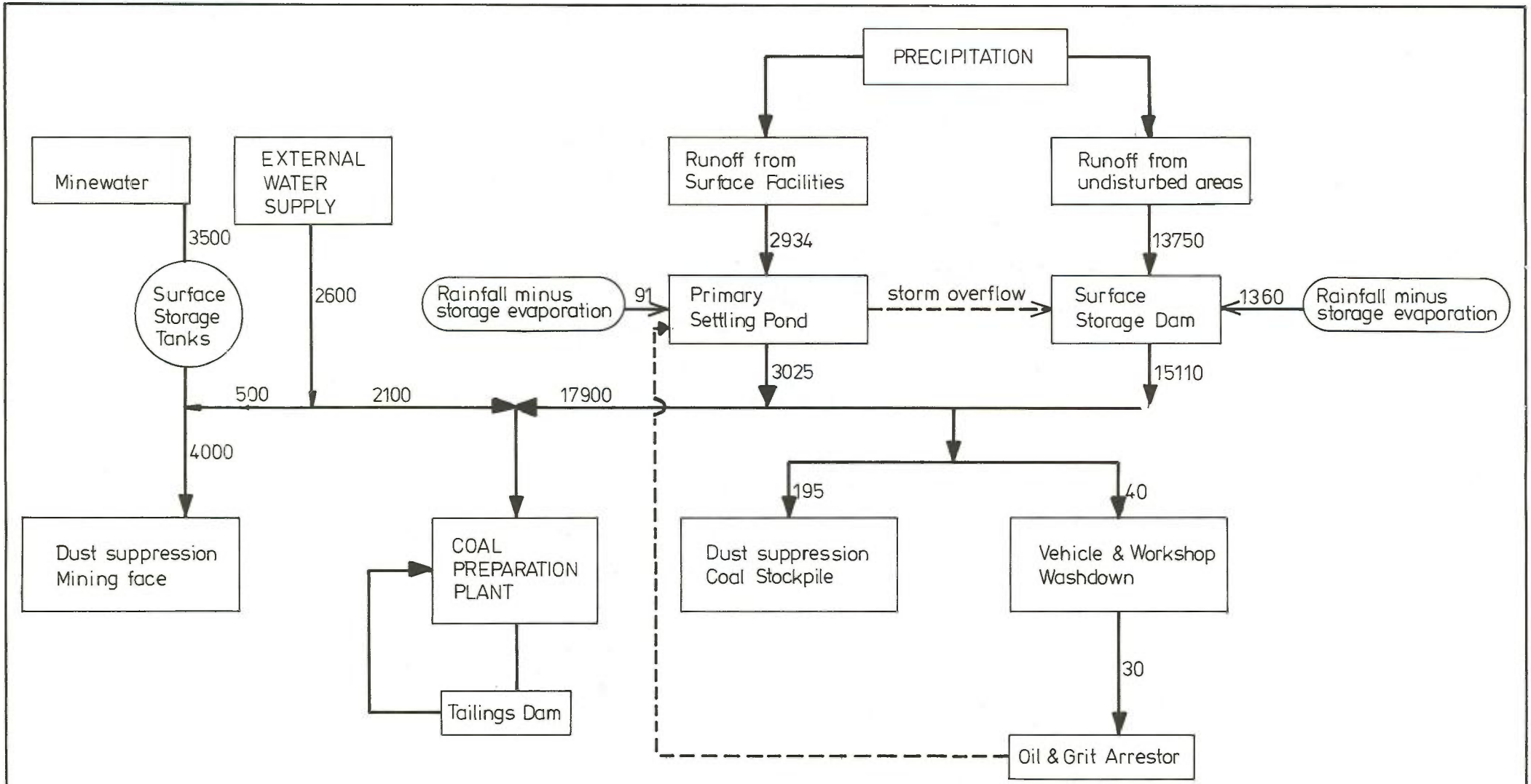
COLONGRA LAKE

N

Scale 1:25 000

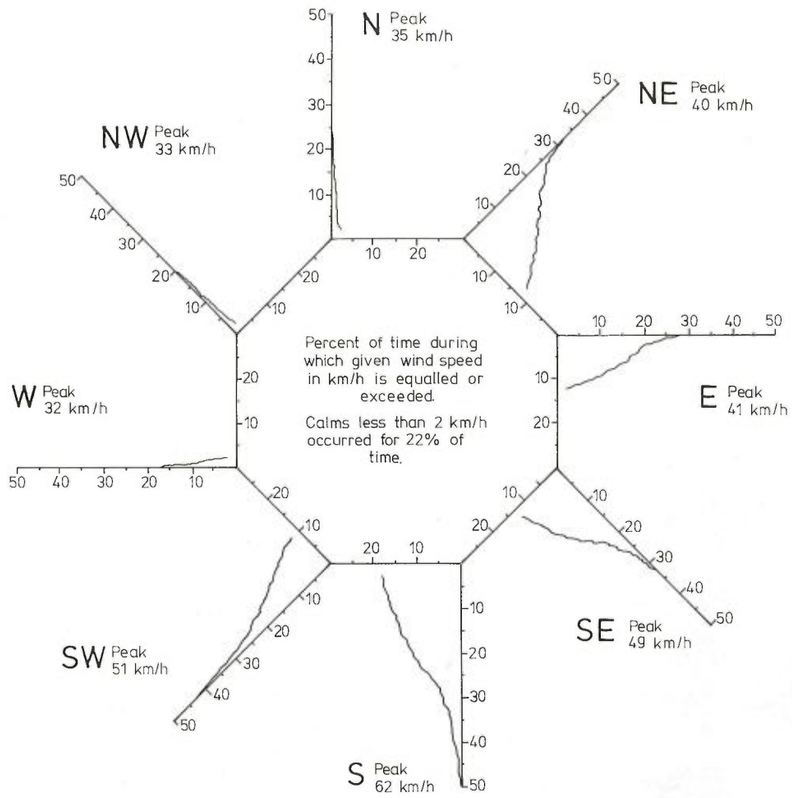
0 250 500 1000 m

NOISE LEVELS - PREDICTED FIGURE 13



All quantities in m^3/month
Assumes production rate of 9000 tpd for full month

WATER BALANCE FIGURE 14

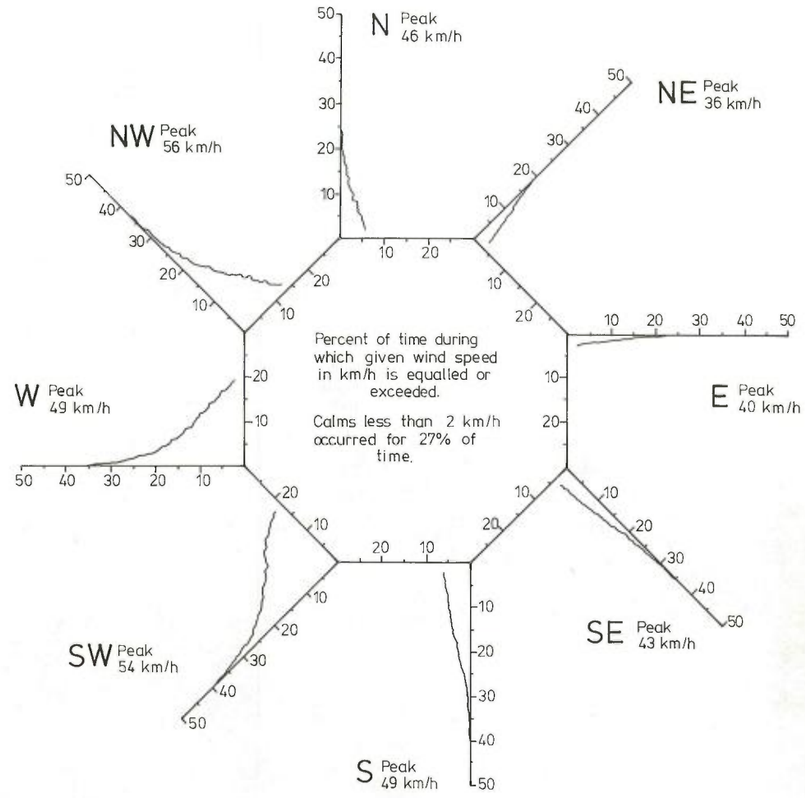


SUMMERS 1966-1974

Instruments availability 65%

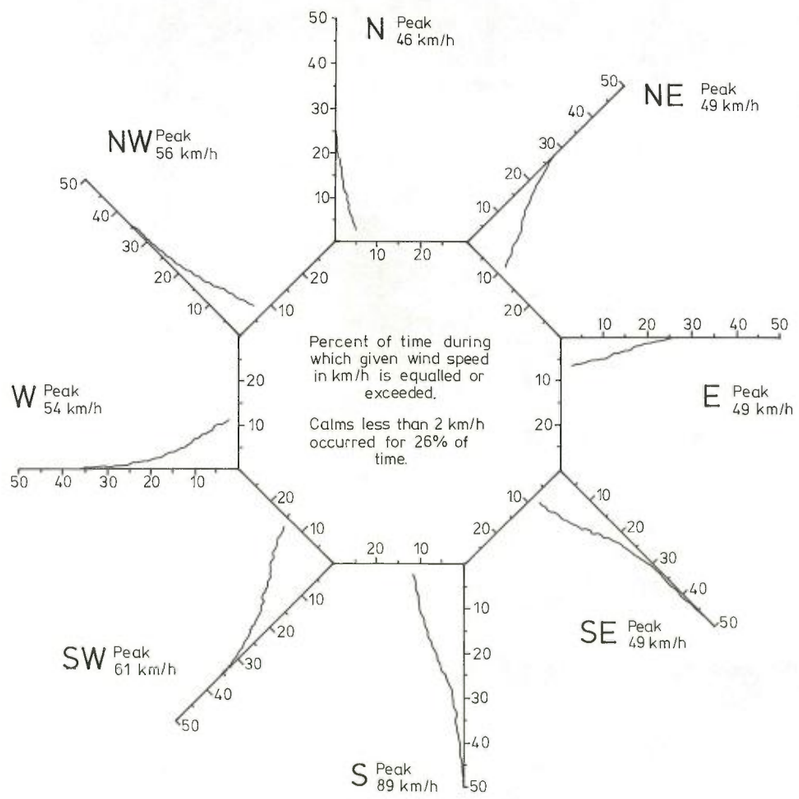
NOTE: Anenometer - Munro Cup-type
Location - Climatic Station
Height above ground - 12 m

The percentages shown are percentages of time for which records were available.



WINTERS 1966-1974

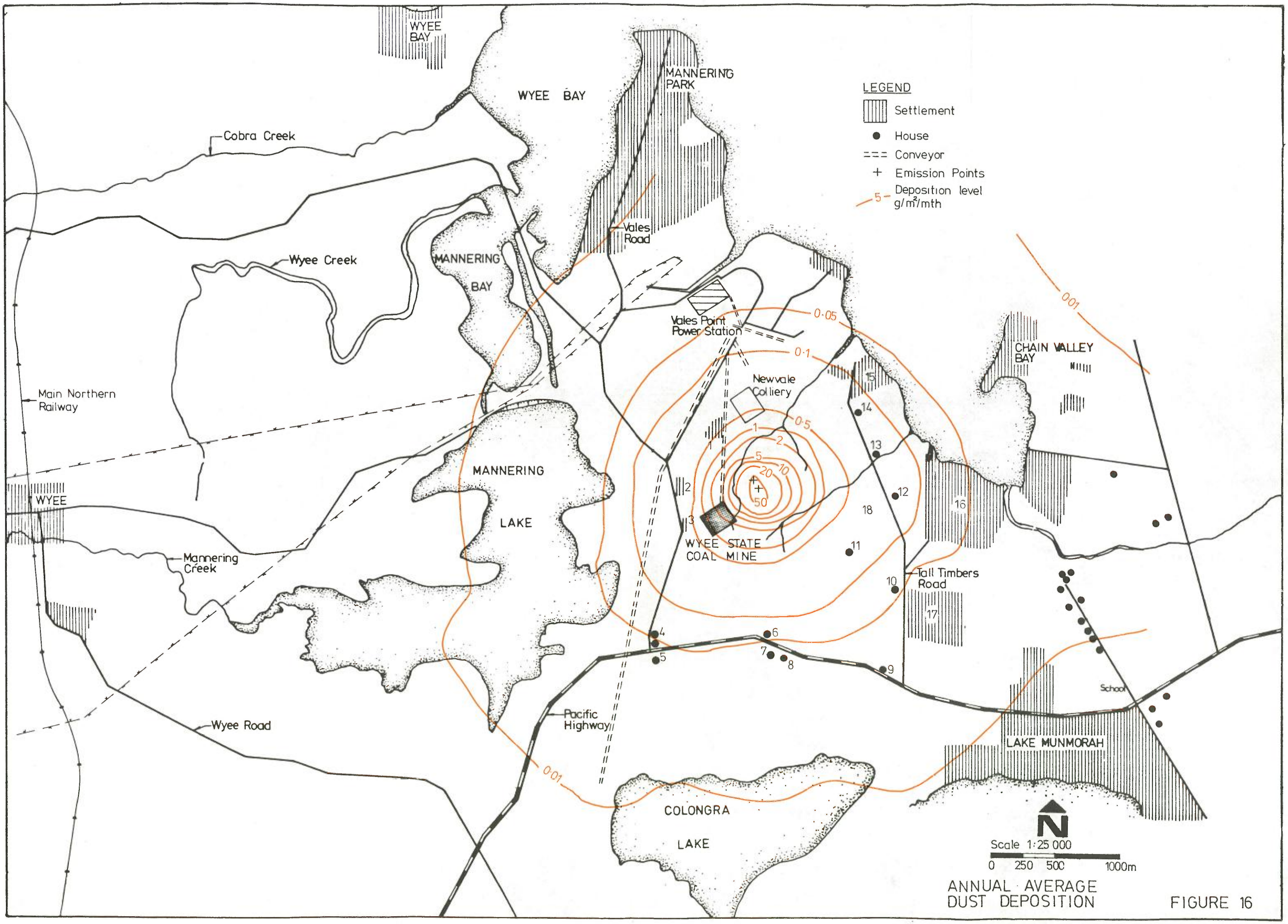
Instrument availability 92%

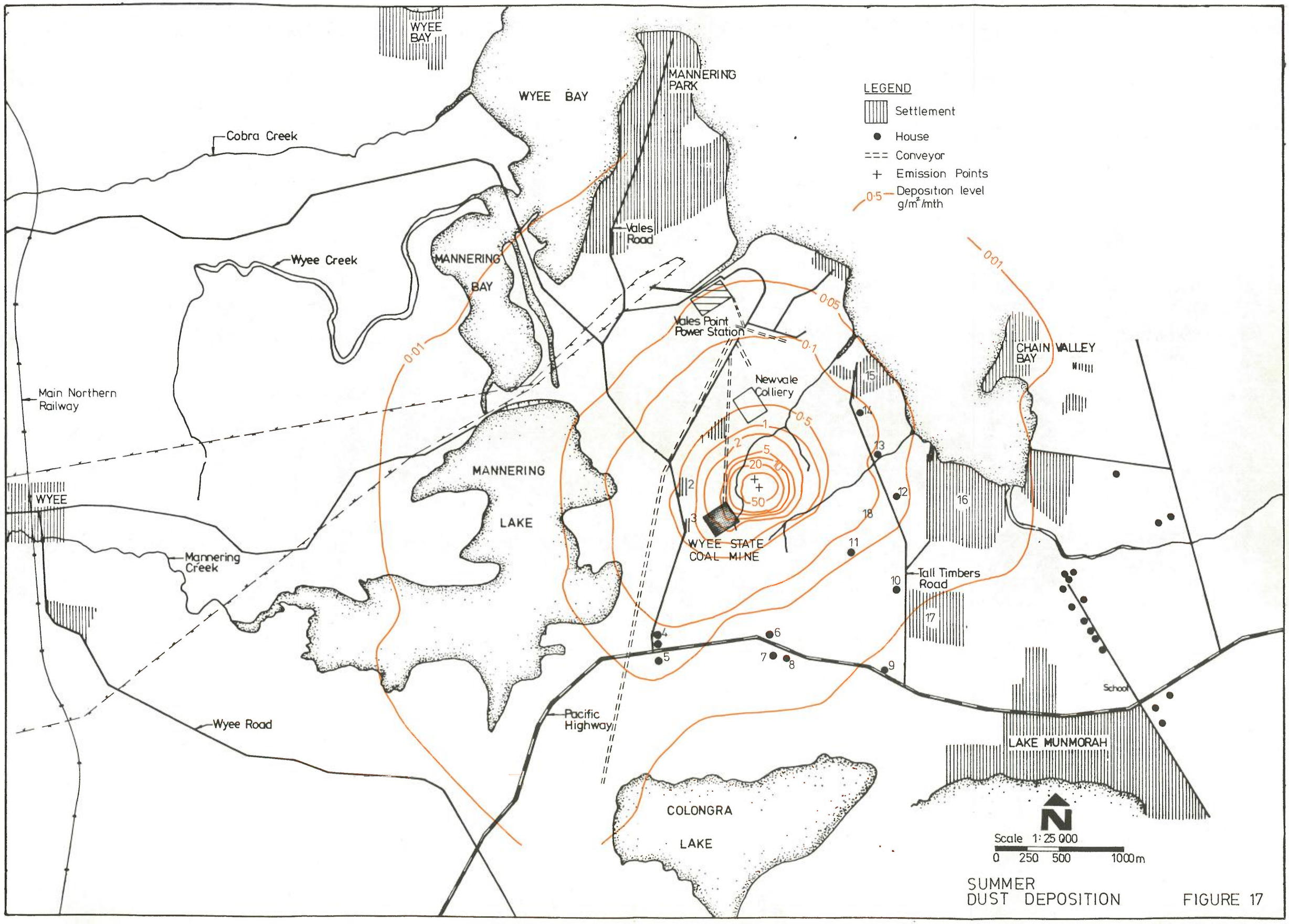


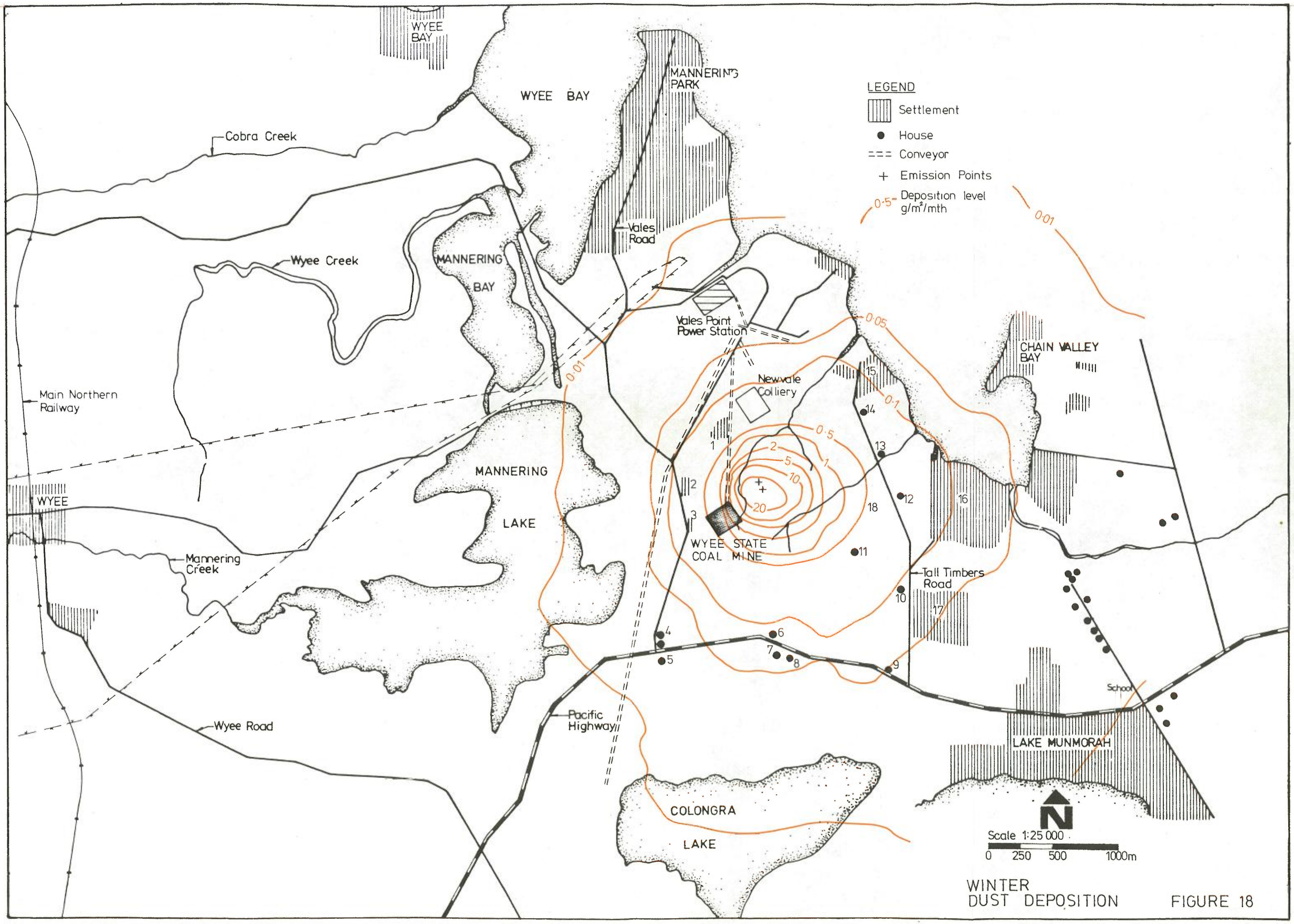
YEARS 1966 - 1974

Instrument availability 75%

WIND SPEED & DIRECTION FIGURE 15

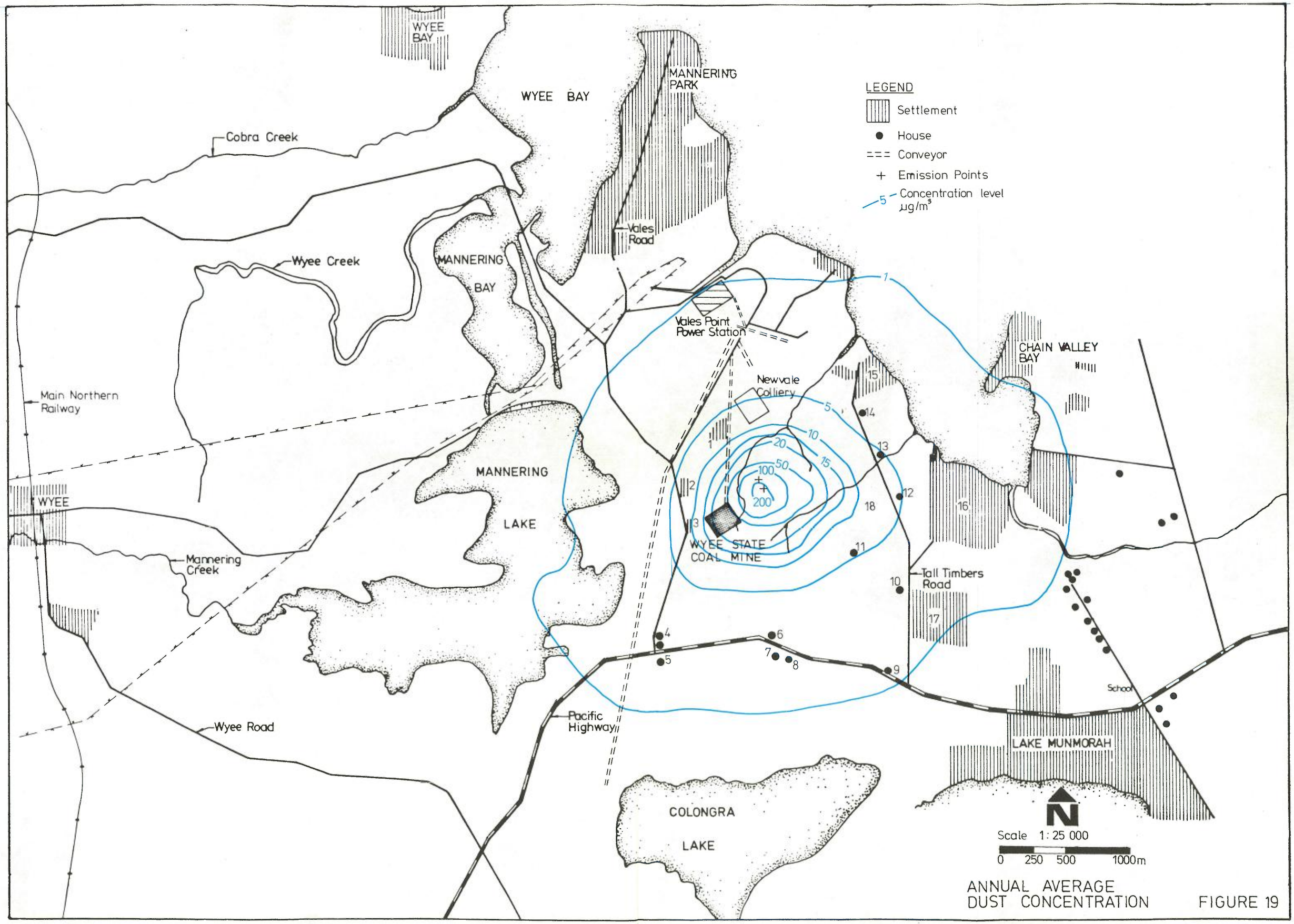

WYEE BAY
WYEE BAY
MANNERING PARK
LEGEND
Settlement
House
Conveyor
Emission Points
Deposition level g/m²/mth
Cobra Creek
Vales Road
Wyee Creek
MANNERING BAY
Vales Point Power Station
0·05
0·1
0·001
CHAIN VALLEY BAY
Newvale Colliery
0·5
1
2
5
10
20
50
Main Northern Railway
MANNERING LAKE
WYEE
Mannering Creek
WYEE STATE COAL MINE
Tall Timbers Road
Wyee Road
Pacific Highway
School
LAKE MUNMORAH
COLONGRA LAKE
Scale 1:25 000
0 250 500 1000m
ANNUAL AVERAGE DUST DEPOSITION
FIGURE 16


WYEE BAY
WYEE BAY
MANNERING PARK
LEGEND
Settlement
House
Conveyor
Emission Points
0·5 Deposition level g/m²/mth
Cobra Creek
Wyee Creek
Vales Road
MANNERING BAY
Vales Point Power Station
0·01
0·05
0·1
0·5
1
2
5
20
10
50
Newvale Colliery
CHAIN VALLEY BAY
Main Northern Railway
MANNERING LAKE
WYEE
Mannering Creek
WYEE STATE COAL MINE
Tall Timbers Road
Wyee Road
Pacific Highway
COLONGRA LAKE
LAKE MUNMORAH
School
Scale 1:25 000
0 250 500 1000m
SUMMER DUST DEPOSITION
FIGURE 17



WINTER
DUST DEPOSITION

FIGURE 18



ANNUAL AVERAGE DUST CONCENTRATION

FIGURE 19

WYEE BAY

WYEE BAY

MANNERING PARK

Cobra Creek

Wyee Creek

MANNERING BAY

Vales Road

Vales Point Power Station

Main Northern Railway

Newvale Colliery

CHAIN VALLEY BAY

MANNERING LAKE

WYEE

Mannering Creek

WYEE STATE COAL MINE

Tall Timbers Road

School

Pacific Highway

Wyee Road

LAKE MUNMORAH

COLONGRA LAKE

LEGEND

- Settlement
- House
- Corveyor
- Emission Points
- 5 — Concentration level µg/m³

Scale 1:25 000

0 250 500 1000m

SUMMER
DUST CONCENTRATION FIGURE 20

WYEE BAY

WYEE BAY

MANNERING PARK

Cobra Creek

Wyee Creek

MANNERING BAY

Vales Road

Vales Point Power Station

Main Northern Railway

Newvale Colliery

CHAIN VALLEY BAY

MANNERING LAKE

WYEE

Mannering Creek

WYEE STATE COAL MINE

Tall Timbers Road

School

Pacific Highway

Wyee Road

LAKE MUNMORAH

COLONGRA LAKE

LEGEND

- Settlement
- House
- Conveyor
- Emission Points
- Concentration level µg/m³

Scale 1: 25 000

0 250 500 1000 m

WINTER
DUST CONCENTRATION FIGURE 21

MANNERING BAY

MANNERING LAKE (Ash Dam)

330kV

330kV

Rutleys Road

Vales Point Power Station Facilities

Vales Road

Newvale Colliery

330kV

330kV

CHAIN VALLEY BAY

Tall Timbers Road

WYEE STATE COAL MINE

Vales Road

Pacific Highway

LEGEND

- Open forest dominated by Scribbly Gum Red Bloodwood
- Woodland dominated by Scribbly Gum Red Bloodwood
- Closed sedgeland dominated by Leptocarpus
- Low open forest dominated by Siebers Paperbark
- Low closed forest dominated by a Paperbark
- Herbfield dominated by Schoenus nitens
- Open forest dominated by Broad leaved Paperbark and Swamp Mahogany
- Open forest dominated by Swamp Oak
- Mangroves and Saltmarsh
- Cleared of native vegetation
- Dams

N

Scale 1:10 000

0 100 200 400m

VEGETATION FIGURE 22

WYEE BAY

WYEE BAY

MANNERING PARK

CHAIN VALLEY BAY

Cobra Creek

Rutleys Road

Wyee Creek

MANNERING BAY

Vales Road

Vales Point Power Station

Newvale Colliery

Main Northern Railway

CHAIN VALLEY BAY

MANNERING

LAKE

Vales Road

WYEE

WYEE STATE COAL MINE

Mannering Creek

Tall Timbers Road

Wyee Road

Pacific Highway

LAKE MUNMORAH

COLONGRA

LAKE

LEGEND

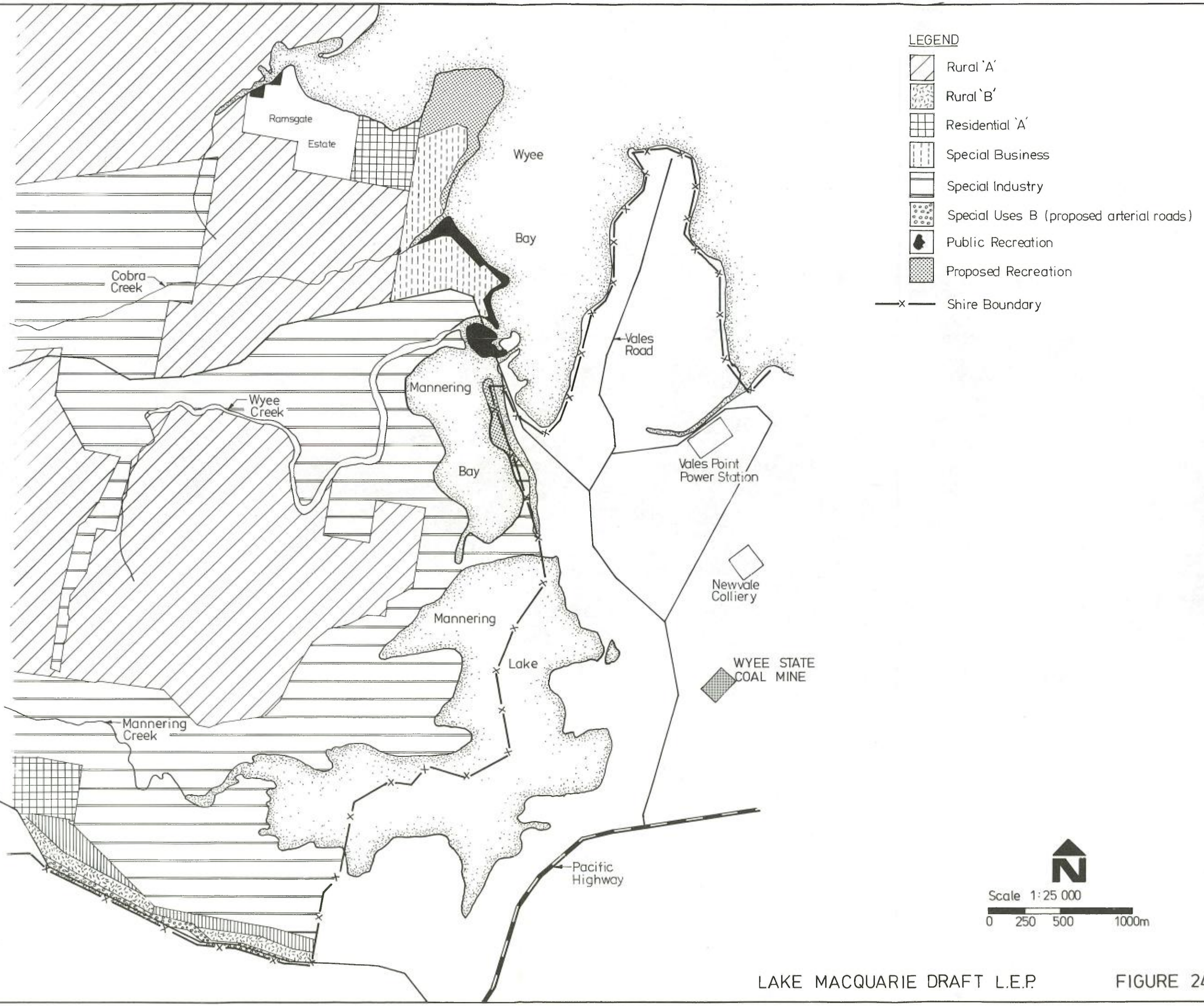
- Residential/Village
- Recreational
- Special Uses - Power Station
- Rural (c)
- Non Urban (b)
- Non Urban (a)
- Special Uses 5(a)
- Rural Scenic Protection 7(b)
- -x——x Shire Boundary

N

Scale 1:25 000

0 250 500 1000m

SUBREGIONAL PLANNING FIGURE 23



LAKE MACQUARIE DRAFT L.E.P. FIGURE 24

APPENDIX ONE

NOISE STUDY TECHNIQUES

A1.1 BACKGROUND SOUND PRESSURE LEVEL MEASUREMENTS

Ambient sound pressure level measurements were conducted at the sites shown in Figure 12, in accordance with AS1055-1978.

A Bruel & Kjaer precision sound pressure level meter type 2209, fitted with a microphone type 4165, was used. The meter was set on fast response on the 'A' weighted scale.

Background levels were ascertained in two ways:

i. the manual recording of the minimum needle deflections.

ii. the feeding of the sound level meter output into a Bruel & Kjaer portable graphic level recorder type 2306.

Sound measurements were continuously recorder over 15 and 20 minute periods. The level recorder printouts were manually sampled at five second intervals, and these formed the basis for statistical analysis performed by computer.

The sound recording equipment was calibrated at the commencement and conclusion of all readings using the Bruel & Kjaer sound level calibrator type 4230.

Noise level contours along the Pacific Highway were determined from a knowledge of annual average daily traffic flows.

A1.2 SOUND PROPAGATION

Sound propagation from the upgraded surface facilities was evaluated using the following equations:

i. **Washing Module**

S.P.L. = S.W.L. - 17 log r - 8 - excess attenuation

ii. **Transfer Points**

S.P.L. = S.W.L. - 20 log r - 8 - excess attenuation

iii. **Conveyors**

S.P.L. = S.W.L. - 17 log r - 8 - excess attenuation

where S.P.L. = sound pressure level at the receiver
S.W.L. = sound power level of the source
r = distance between source and receiver in metres

and excess attenuation has been assumed to be zero, given the low frequency component of the source noise and the relatively small r.

The log distance attenuation relationship has been formulated on the assumption that at a distance of 750 m (closest approach of potential impacted receiver) the washing module and conveyors are seen as finite line sources.

APPENDIX TWO

AIR QUALITY STUDIES

2.

A2.1 INTRODUCTION

The level of increase of dust deposition and airborne dust concentration arising from the development of additional surface facilities at Wyee State Coal Mine has been determined by the application of mathematical modelling techniques to describe the behaviour of emissions from the site.

The following discussion indicates the nature of the dust sources, the means of calculating the dispersion patterns of emitted dust, and the levels of dust likely to be encountered in the vicinity of the development under varying meteorological conditions.

A2.2 EMISSION INVENTORY

A2.2.1 Dust Sources

Modifications to existing operations at Wyee are described in detail in Section 2 of the main report.

Incremental dust emissions will be generated from new raw coal handling facilities, comprising a 3000 t storage bin, a 15000 t emergency stockpile and a 50000 t temporary stockpile area. Handling to and from the bin and emergency stockpile will be by conveyor, the stockpile being initiated by rill tower and tunnel reclaimed using vibratory feeders. The 50000 t temporary stockpile will be serviced by a front-end loader.

All elevated conveyor gantries will be fully enclosed and water sprays will be fitted at conveyor transfer points, and provide full stockpile coverage.

The washing module and reject handling systems will not generate dust. The product handling system is currently used for the handling of

screened and crushed coal from the mine - there will be no increase in emissions from this source.

Consequently, incremental fugitive dust emissions will be confined to wind erosion from the raw coal stockpile, and emissions arising from the stacking and reclaiming of coal from the temporary 50000 tonnes stockpile.

A2.2 Dust Emission Factors

At the present time there is no standard procedure employed in Australia to quantify the dust emissions from stockpile facilities for the purpose of dust dispersion modelling. In the United States the USEPA published the results of an experimental programme which included dust measurements in the vicinity of stockpile facilities (USEPA, 1978; USEPA, 1981). The results for stockpiles were not conclusive and the USEPA recommended that they not be used for estimating the ambient air impact of fugitive dust.

In the absence of a standard quantification method, an alternative method has been adopted in this study to meet the requirement of the SPCC with respect to estimated dust deposition rates in the vicinity of the proposal. Empirical equations based upon limited test data and best engineering judgement are used by a number of State agencies in the USA to determine the dust emission rates.

The chosen equation (State of Indiana, 1982) is related to wind erosion and has the form:

$$E = 5.25 \times 10^{-11}.W.s.d.f.D. \left(\frac{100-n}{100}\right)$$

where E = wind eroison (tpy)
W = material put through storage cycle (tpy)
s = silt content (%)
d = dry days per years (d)
f = frequency of winds in excess of 12 mph (%)
D = duration of material storage (d)
and n = control efficiency (%)

In the estimate of dust emissions it has been conservatively assumed that 20 per cent of all mine output will be handled via the emergency raw coal stockpile (15,000 t). The value of W in the above equation is thus 400,000 tpy.

It was further assumed that the temporary (50,000t) raw coal stockpile would be used for a total of one month in any year, yielding a value for W in this case of 167,000 tpy.

The values chosen for the remaining variables are indicated in Table A2.1.

TABLE A2.1

VALUES OF WIND EROSION EQUATION PARAMETERS

Parameter	Value	Source
s	4%	State of Indiana (1982)
d	269.5 days	Munmorah Power Station Climatic Data
f	26.48%	
D	365 days	

Emissions from the temporary 50000 t stockpile arising from its handling by front-end loader were estimated using the following relationship, assuming an emission factor of 0.02 kg/t.

$$E = EF.Q.\ (\frac{100-n}{100}) \qquad \text{[USEPA, 1981]}$$

where E = the emission (kg/y)
EF = an emission factor (kg/t)
Q = the quantity of coal handled (tpy)
and n = the control efficiency (%)

Dust controls were assumed to be 50 per cent effective.

The resultant emission inventory for the proposal is given in Table A2.2.

In order to check the realism of the estimated emission rate the total emission of 133.8 tpy was compared with the total obtained from an alternative method (Kalika and Catizone, 1980). When an emission factor of 0.22 kg per tonne of coal is applied to the throughput of W = 56700 t, the total emission of 124.7 t of dust obtained is in a close agreement with the above estimate.

TABLE A2.2

EMISSION INVENTORY

Source	Emission Rate (tpy)
Emergency raw coal stockpile	89.8
Temporary 50000 t raw coal stockpile	37.4
Stacking and reclaiming of the temporary raw coal stockpile	6.6
Total emissions	133.8

A2.3 THE MODEL

Dust emission sources were simulated with the two emission points shown in Figure 16. Emissions from the emergency raw coal stockpile were allocated to one point and those from the temporary raw coal stockpile to a second. Emissions due to the stacking and reclaiming of coal from the temporary raw coal stockpile were divided between both points.

Ground level values were then calculated using a standard Gaussian long term dispersion model. The deposition of particles was simulated by the method of Dunbault et al (1976) as adopted by the USEPA for the Industrial Source Complex model (USEPA, 1979).

Particle settling was introduced into the vertical dispersion term and a ground reflection coefficient specified to approximate the

retention or re-entrainment of dust particles on the surface. The model returns approximately 80 per cent of the total emitted dust in the form of deposited particles. The remaining mass is accounted for by dust deposition taking place too close to the emission points to be detected at the closest receptor point and by a relatively small mass of dust remaining in suspension. Model predictions of the distribution of dust from a surface coal mine were found to be in a close agreement with observations near three existing mines in the Hunter Valley.

The basic equation used in the model for the sector-averaged deposition rate D resulting from a point source of strength Q_t was:

$$D = \frac{(1-R)}{\sqrt{2\pi}\, x^2 \left(\frac{2\pi}{n}\right)} \sum_{i,j} \frac{Q_t\, f_{i,j}}{\sigma_z} \quad \text{(Decay Term)} \quad \text{(Vertical Term)}$$

where R is the reflection coefficient, x is the downwind distance and n the number of wind sectors. No washout was included in the calculation and the vertical term was simplifiedto the form of:

$$\text{(Vertical Term)} = \left[\left[bH + (1-b)\,\frac{v_D x}{\bar{u}_i}\right] \exp\left[-\tfrac{1}{2}\,\frac{\left(H - v_D\, x/\bar{u}_i\right)^2}{\sigma_z^{\,2}}\right]\right]$$

where $\sigma_z = a\, x^b$ and H indicated the elevation of the source.

Similarly the concentration of total suspended particles near the ground was expressed as:

$$C = \frac{2}{\sqrt{2\pi} \times \left(\frac{2\pi}{n}\right)} \sum_{i,j} \frac{Q\ f_{i,j}}{\bar{u}_i\, \sigma_z} \quad \text{(Decay Term)} \quad \text{(Vertical Term)}$$

where

$$\text{(Vertical Term)} = \left[\frac{(1+R)}{2} \exp\left[-\tfrac{1}{2}\,\frac{\left(H - v_D\, x/\bar{u}_i\right)^2}{\sigma_z^{\,2}}\right]\right]$$

The above equations were used to determine the average annual and maximum monthly situations. A level terrain was assumed and a computer plotting routine was employed to construct the contour maps from a large number of receptor values.

The average annual and maximum monthly values of deposition and concentration have the disadvantage of masking low frequency, high magnitude events which correspond to high wind episodes. Estimates of short-term dust levels can be obtained from a modified version of the model. The model would require detailed input information including hourly variations in wind speed and direction, atmospheric stability and dust liberation rates.

The nature of the existing data and the uncertainties in the dust liberation rates cannot justify the extensive computer time that would be needed to execute a short term model. Estimates of 24 hour and 6 hour peak values were obtained instead and related to the monthly levels predicted by the long term model.

A daily maximum was determined as the 24 hour dust level which would result when the wind blows persistently from the source towards the receptor for 24 hours of the day. It was assumed that the wind speed equalled the long term average wind speed from that direction but the frequency of the wind from the direction was set to one. Thus the value reflects the persistence of one wind sector and is related to the monthly prediction as:

$$\text{24 hour value} = \left(\frac{\text{Monthly prediction}}{\text{30 days}}\right) \times \left(\frac{\text{Persistence of wind}}{\text{Monthly frequency observed}}\right)$$

So for instance the 24 hour maximum value due to persistence at a receptor which was estimated to receive 1 $g/m^2.mth$ from a certain wind sector which had a frequency of 25 per cent would be:

$$\text{24 hour value} = \left(\frac{1\ g/m^2.mth}{30\ days}\right) \times \left(\frac{1}{0.25}\right) = 0.133\ g/m^2.day$$

Expressed in rates of fallout, the daily peak in the fallout rate at the receptor would exceed the average monthly rate by a factor of (1/0.25) = 4.

The 24 hour value was used to illustrate the magnitude of the daily peak in the estimated monthly value due to persistence. The high wind episode differs from the persistence in that it is caused by wind velocities which are higher than those averaged in the monthly wind matrix. The duration of high wind episodes is shorter than 24 hours and extends typically over a few hours. An interval of six hours was selected as a conservative estimate of the duration of the episode. The episodic value can be related to the estimated monthly value and the 24 hour value as:

$$\underbrace{\text{6 hour value}}_{\text{24 hour value}} = \left(\frac{\text{Monthly prediction}}{\text{30 days}}\right) \times \left(\frac{\text{Persistence}}{\text{Monthly frequency}}\right) \times \left(\frac{\text{6 hours}}{\text{24 hours}}\right) \times \left(\frac{Q(u)}{\bar{Q}}\right)$$

The last term on the right hand side expresses the possible dependence of the dust emissions (source term) on wind velocity. The following example illustrates the use of the formula for a linear increase in the dust liberation rate with wind speed [$Q(u)/\bar{Q} = u/\bar{u}$].

The six hour maximum value during a high wind episode associated with u = 10 m/sec expected at the receptor for which a mean rate of 1 g/m^2.mth and a 24 hour maximum of 0.133 g/m^2.day were determined would be:

$$\text{6 hour value} = (0.133\ g/m^2.\text{mth}) \times \left(\frac{\text{6 hours}}{\text{24 hours}}\right) \times \left(\frac{\text{10 m/sec}}{\text{4 m/sec}}\right) = 0.083\ g/m^2.\text{6 hrs}$$

Expressed in rates of fallout the six hour peak in the rate would exceed the 24 hour peak rate by a factor of (10/4) = 2.5 and the average monthly rate by (4 x 2.5) = 10.

A2.4 RESULTS

The results of the dispersion modelling are illustrated graphically in Figures 16 to 21.

A discussion of the predicted increase in dust deposition and concentration and the resultant impacts is provided in Sections 3.4.2 and 3.4.3 of the main report.

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Kalika, P.W., & Catizone, P.(1980)	Fugitive Emissions Concerns for Coal Storage and Handling at Utility Operating Stations. In Fourth Symposium on Fugitive Emissions Measurement and Control, New Orleans, LA NTIS PB 81-174393.
State of Indiana (1982)	Fugitive Emissions Inventory. State Board of Health (Private communication).
USEPA (1978)	Survey of Fugitive Dust from Coal Mines. USEPA Publ. EPA-908/1-78-00.
USEPA (1979)	User's Guide to Industrial Source Complex Dispersion Model. USEPA Publ. EPA-450/4-79-030.
USEPA (1981)	Improved Emission Factors for Fugitive Dust from Western Surface Coal Mining Sources. Project Summary, USEPA Pre-publication.

APPENDIX THREE

SPECIES LISTS

3.

TABLE A3.1

PLANT SPECIES OCCURRING WITHIN THE AREA SHOWN ON FIGURE

Family/Scientific Name		Common Name
PTERIDOPHYTA		
ADIANTACEAE		
Cheilanthes tennuifolia	(Burm. f) Sw	Rock Fern
DENNSTAEDTIACEAE		
Pteridium esculentum	(Forst. f) Cockayne	Bracken
GYMNOSPERMAE		
PINACEAE		
*Pinus elliotii		Slash Pine
ANGIOSPERMAE		
CAESALPINIASEAE		
*Cassia sp		
CAMPANULACEAE		
Wahlenbergia sp		Bluebell
CAPRIFOLIACEAE		
?Sambucus australasica	(Lindl.) Fritsch	Native Elder
CASSYTHACEAE		
Cassytha pubescens	R.Br.	Devil's Twine
CASUARINACEAE		
Casuarina littoralis	Salisb.	
C. glauca	Sieb. ex Spreng	Swamp Oak
COMPOSITAE (ASTERACEAE)		
*Eupatorium adenophorum	Spreng.	Crofton Weed
Senecio lautus	Forst. ex Willd	Variable Groundsel
Tagetes minuta	L.	Stinking Roger
CYPERACEAE		
Baumea teretifolia	(R.Br.) Palla	
Fimbristylis ferruginea	(L.) Vahl	
Gahnia spp.		
Ptilanthelium deustum	(R.Br.) Kukenth	
Schcenus brevifolius	R.Br.	
S. nitens		
DROSERACEAE		
Drosera peltata	Sm. ex Willd	Sundew
EPACRIDACEAE		
Epacris microphylla	R.Br.	
E. obtusifolia	Sm.	

TABLE A3.1 (Continued)

Family/Scientific Name		Common Name
EUPHORBIACEAE		
Glochidion ferdinandi	(J.Muell.) F.M.Bailey	Cheese Tree
*Ricinus communis	L.	Castor Oil Plant
GOODENIACEAE		
Goodenia ovata	Sm.	
Scaevola calendulacea	(Kennedy) Druce	
GRAMINEAE (POACEAE)		
*Andropogon virginicus	L.	Whiskey Grass
*Chloris gayana	Kunth	Rhodes Grass
*Cortaderia selloana	(Schult.) Aschers et Graebn	Pampas Grass
Cynoden dactylon	(L.) Pers	Couch
Eragrostis philippica	Jedwabnick	
Imperata cylindrica	(L.) Beauv. var major (Nees). C.E.Hubbard	Blady Grass
*Pennisetum clandestinum	Hochst. ex Chiov.	Kikuyu
Sporobolus virginicus	(L.) Kunth	Sand Couch
Themeda australis	(R.Br.) Stapf	Kangaroo Grass
HAEMODORACEAE		
Haemodorum planifolium	R.Br.	Bloodroot
HALORAGACEAE		
Haloragis teucroides	(DC.) Schlecht	
IRIDACEAE		
Patersonia sericea	R.Br.	Purple Flag
JUNCACEAE		
*Juncus acutus	L.	
J. continuus		
J. kraussii		
J. maritimus	Lam.	
J. planifolius	R.Br.	
LILIACEAE		
Blandfordia sp.		Christmas Bell
Sowerbaea juncea	Sm.	Vanilla Plant
MIMOSACEAE		
Acacia botrycephala	(Vent.) Desf.	Sunshine Wattle
A. irrorata	Sieber ex Spreng var irrorata	
A. myrtifolia	(Sm.) Willd	Myrtle Wattle
A. suaveolens	(Sm.) Willd	
MUSACEAE		
*Musa paradisiaca		Banana

TABLE A3.1 (Continued)

Family/Scientific Name		Common Name
MYRTACEAE		
Angophora costata	(Gaertn.) Druce	Rusty Gum
Callistemon citrinus	(Curtis) Skeels	Lemon Bottlebrush
C. linearis	DC	
Eucalyptus amplifolia	Naudin	Cabbage Gum
E. capitellata	Sm.	Brown Stringybark
E. gummifora	(Gaertn.) Hochr	Red Bloodwood
E. haemastoma	Sm.	Scribbly Gum
E. racemosa-haemastoma	intergrade	Scribbly Gum
?E. racemosa		Scribbly Gum
E. robusta	Sm.	Swamp Mahogany
Leptospermum attenuatum	Sm.	
J. juniperinum	Sm.	
?Melaleuca armillaris		Bracelet Honey myrtle
M. linariifolia	Sm.	Snow in Summer
M. sieberi	Schau. in Walp	
M. thymifolia	Sm.	
M. quinquenervia	(Cav.) S.T. Blake	Broad-leaved Paperbark
*Tristania conferta	R.Br.	Brush Box
ORCHIDACEAE		
?Cymbidium suave	R.Br.	
Diuris sp.		A Donkey Orchid
Microtis sp.		
Pterostylis sp.		A Greenhood
Thelymitra sp.		A Sun Orchid
PAPILIONACEAE (FABACEAE)		
Bossiaea ensata	Sieb. ex DC.	
Daviesia acicularis	Sm.	
Dillwynia retorta	(Weddl.) Druce var retorta	
Hardenbergia violacea	(Schneev.) Stearn	
Kennedia rubicunda	Vent.	
Mirbelia sp.		
Sphaerolobium vimineum	Sm.	
Vicia sp.		
PHILESIACEAE		
Eustrephus latifolius	R.Br.	Wombat Berry
PHYTOLACCACEAE		
*Phytolacca octandra	L.	Ink Weed
PITTOSPORACEAE		
Billardiera scandens	Sm.	Dumplings
POLYGALACEAE		
Comesperma ericinum	DC.	

TABLE A3.1 (Continued)

Family/Scientific Name		Common Name
PROTEACEAE		
Banksia aspleniifolia	Salisb.	
B. collina	R.Br.	
B. robur	Cav.	
B. serrata	L.f.	
Hakea bakerana	F.Muell. etc Maiden	
H. dactyloides	(Gaertn.) Cav.	
H. teretifolia	(Salisb.) J. Britten	
Isopogon anemonifolius	(Salsib.) Knight	
Petrophile sessilis	Sieb. ex Schult. et f.	
RHAMNACEAE		
Pomaderris discolor	(Vent.) Desf	
RESTIONACEAE		
Empodisma minus		
Leptocarpus tenax	(Labill.) R.Br.	
ROSACEAE		
*Rubus vulgaris	Weihe et Nees	
SANTALACEAE		
Exocarpus cupressiformis		Native Cherry
SAPINDACEAE		
Dodoneae triquetra	Wendl.	Hopbush
SALICACEAE		
*Salix babylonica	L.	Weeping Willow
STYLIDIACEAE		
Stylidium graminifolium	Swartz ex Willd	
THYMELACEAE		
Pimelea linifolia	Sm.	Slender Rice Flower
TYPHACEAE		
*Typha sp.		
UMBELLIFERAE		
Actinotus minor	(Sm.) DC.	
Hydrocotyle bonariensis	han.	
Platysace sp.		
VERBENACEAE		
Avicennia marina	(Forsk.) Vierh.	Grey Mangrove
XANTHORRHOEACEAE		
Lomandra obliqua	(Thumb) Macbride	
Xanthorrhoea media ssp latifolia	Lee	

TABLE A3.1 (Continued)

Family/Scientific Name	Common Name
ZAMIACEAE Macrozamia sp.	

Note: * refers to species not indigenous to the area

? tentative identification

Mr. and Mrs. A. Johnston are gratefully acknowledged for supplying orchid names as is the National Herbarium of New South Wales for identifying a number of species.

Nomenclature from Beadle et al (1972)

TABLE A3.2

BIRD SPECIES OBSERVED ON AND NEAR THE SITE

Common Name	Scientific Name	Habitat
Australian Pelican	Pelecanus conspicillatus	D
Little Black Cormorant	Phalacrocorax sulcirostris	D
Little Pied Cormorant	P. melanoleucos	D
White-faced Heron	Ardea novaehollandiae	B, D
Large Egret	Egretta alba	D
Black Swan	Cygnus atratus	D
Black-shouldered Kite	Elanus notatus	A, B, C
Whistling Kite	Haliastur sphenurus	D
Masked Plover	Vanellus miles	C
Silver Gull	Larus novaehollandiae	D
Crested Tern	Sterna bergii	D
Common Bronzewing	Phaps chalcoptera	A
Crested Pigeon	Ocyphaps lophotes	A, C
Fan-tailed Cuckoo	Cuculus pyrrhophanus	A
Boobook Owl	Ninox novaeseelandiae	
Eastern Rosella	Platycercus eximius	A, C
Kookaburra	Dacelo novaeguineae	A, C
Sacred Kingfisher	Halcyon sancta	
Welcome Swallow	Hirundo neoxena	A, C
Fairy Martin	Cecropis ariel	A, B
Black-faced Cuckoo-shrike	Coracina novaehollandiae	A, C
Variegated Wren	Malurus lamberti	A
Striated Thornbill	Acanthiza lineata	A
Brown Thornbill	A. pusilla	A
Yellow-rumped Thornbill	A. chrysorrhoa	A
Jacky Winter	Microeca leucophaea	
Grey Fantail	Rhipidura fuliginosa	A
Willie Wagtail	R. leucophrys	C
Eastern Whipbird	Psophodes olivaceus	A, B
Striated Pardalote	Pardalotus striatus	A
Yellow-faced Honeyeater	Lichenostomus chrysops	A
Noisy Friar-bird	Philemon corniculatus	A
White-cheeked Honeyeater	Phylidonyris nigra	A, B
Eastern Spinebill	Acanthorhynchus tenuirostris	A, B
Noisy Miner	Manorina melanocephala	A
Red-browed Firetail	Emblema temporalis	A, C
Double-barred Finch	Peophila bichenovii	
House Sparrow	Passer domesticus	C
Common Starling	Sturnis vulgaris	C
Common Myna	Acridotheres tristis	C
Australian Magpie-Lark	Grallina cyanoleuca	A, C
Dusky Woodswallow	Artamus cyanopterus	A
Australian Magpie	Gymnorhina tibicen	C
Australian Raven	Corvus coronoides	A, B, C, D

Note: Key to habitat types:
A - Dry Sclerophyll Open-forest and Woodland
B - Freshwater Swamplands and associated Paperbark stands
C - Cleared and disturbed areas
D - Shoreline vegetation bounding Chain Valley Bay and Mannering Bay and the adjacent waters.
Those species lacking habitat classification were amongst a number reported by Mr. and Mrs. Johnstone.
Nomenclature from H.T. Condon (1975) and R.A.O.U. (1975).

TABLE A3.3

REPTILES AND AMPHIBIANS KNOWN TO OCCUR ON THE SITE

Common Name	Scientific Name
Green Tree Frog	Litoria caerulea
Bearded Dragon	Amphibolurus barbatus
Jacky Lizard	A. muricatus
Copper-tailed Skink	Ctenotus taeniolatus
Garden Skink	Lamphropholis guichenoti
Eastern Blue-tongued Lizard	Tiliqua scincoides
Common Tree Snake	Dendrelaphis punctulatus
Red-bellied Black Snake	Pseudechis porphyriacus

Note: Mr. and Mrs. A. Johnstone are acknowledged for supplying most of the above species list. Nomenclature from Cogger (1975).

TABLE A3.4

MAMMALS KNOWN TO OCCUR ON OR NEAR THE SITE

Common Name	Scientific Name
Native	
Echidna	Tachyglossus aculeatus
Long-nosed Bandicoot	Perameles nasuta
Brush-tailed Possum	Trichosurus vulpecula
Sugar Glider	Petaurus breviceps
Red-necked Scrub Wallaby?	Macropus rufogriseus
Swamp Wallaby?	Wallabia bicolor
Grey-headed Fruit Bat	Pteropus poliocephalus
Unidentified Bat	
Introduced	
Hare	Oryctolagus cuniculus
Black Rat	Rattus rattus
House Mouse	Mus musculus
Red Fox	Vulpes vulpes

Note: ? refers to tentative sightings in the vicinity of the ash dam.

Mr. and Mrs. A. Johnstone are gratefully acknowledged for supplying the above list.

APPENDIX FOUR

DERIVATION OF ECONOMIC MULTIPLIERS

A4.1 INTRODUCTION

Input-output analysis was used to derive the employment, income and output multipliers during the construction and operational phases of the Wyee proposal.

These multipliers have been used in Section 3.8 to assess the implications of the project on the regional economy.

A4.2 THE REGIONAL MULTIPLIERS USED IN THE STUDY

A set of input-output tables based on a 25 x 26 sector survey has been constructed for the Hunter Region for the years 1976-77 by Garlick (1979). The tables consist of 19 intermediate sectors, six primary input sectors and seven final demand sectors.

A4.2.1 Construction Phase Multipliers

The output, income and employment multipliers for the Hunter Region are presented in Table A4.1.

TABLE A4.1

CONSTRUCTION PHASE: OUTPUT, INCOME AND EMPLOYMENT MULTIPLIERS, WYEE STATE MINE, HUNTER REGION

	Output (1)	Income (2)	Employment* (3)
Direct	.4009	.2682	16.3538
Indirect	.1712	.1160	10.4931
Induced	.7960	.1663	17.1513
Total (1+2+3)	1.3681	.5505	43.9982
Total (1+2)	.5721	.3842	26.8469
Total (2+3)	.9672	.2823	27.6444
Type I (and Simple Output Multiplier)	1.5721	1.4323	1.6416
Type II (and Total Output Multiplier)	2.3681	2.0523	2.6904

* Number of persons employed per million dollars of output.

Output Effects

Each dollar spent in a year during the construction phase of the proposed washery produces a direct or immediate effect on the output in the Hunter Region of 40 cents in the dollar. The indirect effects of a dollar invested is 17 cents in the dollar. The induced effect through increased consumption expenditure is 80 cents.

The total effect (direct, indirect and induced) of a one dollar increase in output of construction is to increase regional output by $1.37.

The simple output multiplier for this sector is 1.57 for the region. The total output multiplier is 2.37.

Income Effects

For each dollar spent during the construction, a total of 1.64 jobs would be created in the region through the Type I employment multiplier. When the induced effect is added to the direct and indirect effects, the Type II multiplier shows that for every one construction job created, 2.69 jobs are created in the region.

A4.2.2 Interpretation of Multipliers and Assumptions

i. The construction phase impacts are not permanent and will last only as long as the construction period, in this case about 14 months.

ii. If substitute materials of a lower or higher relative cost are used or if greater or lower quantities of materials are imported to the region, the impacts must necessarily change.

iii. The normal reservations concerning the restrictive assumptions on input-output models, particularly in relation to rigidity of production functions and propensities to consume should be borne in mind (Maandeville et al, 1979).

iv. The input-output model used in this analysis is static, relating to the years 1976-77 for the Hunter Region. To the extent that structural change and changed capacity would affect each sector's technological coefficients they would also affect the magnitude of the multipliers used.

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