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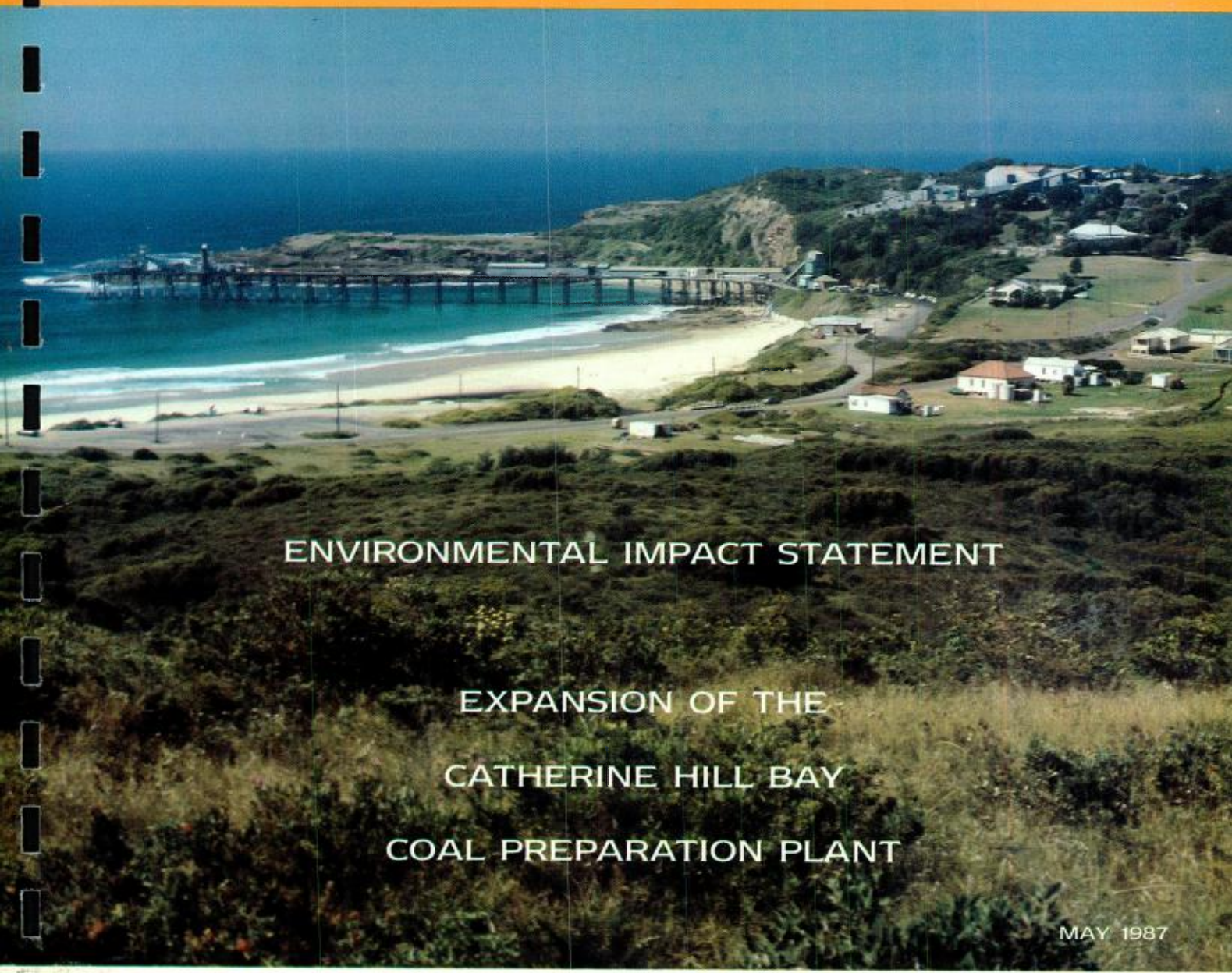
Environmental impact statement : expansion of the Catherine Hill Bay coal preparation plant : appendices for environmental impact statement



ENVIRONMENTAL IMPACT STATEMENT

EXPANSION OF THE CATHERINE HILL BAY COAL PREPARATION PLANT

MAY 1987

JOHNSTONE ENVIRONMENTAL TECHNOLOGY PTY. LIMITED
AND
LONGWORTH & McKENZIE PTY. LIMITED

ENVIRONMENTAL IMPACT STATEMENT

FOR

EXPANSION OF THE COAL PREPARATION PLANT

AND FOR THE DEVELOPMENT OF

NEW COAL HANDLING FACILITIES

AND

COAL WASHERY REJECT EMPLACEMENT AREAS

AT

CATHERINE HILL BAY N.S.W.

FOR

COAL & ALLIED OPERATIONS PTY. LIMITED

Initial investigation work and evaluation of environmental impact for expansion of the Catherine Hill Bay Coal Preparation Plant was undertaken under a contract to Longworth & McKenzie Pty. Limited, while the Study Director and other principal authors of this report worked for that company. Further evaluation of the proposed Catherine Hill Bay developments, final assessment of environmental impact and amendment and completion of the Environmental Impact Statement was undertaken under a contract from Coal & Allied Operations Pty. Limited to Johnstone Environmental Technology Pty. Limited, where the Study Director and principal authors now work, in conjunction with Longworth & McKenzie Pty. Limited.

MAY 1987

JET JOHNSTONE ENVIRONMENTAL TECHNOLOGY PTY. LIMITED

CERTIFICATION OF ENVIRONMENTAL IMPACT STATEMENT IN ACCORDANCE WITH SECTION 77 (3) (d) OF THE ENVIRONMENTAL PLANNING AND ASSESSMENT ACT 1979 (AS AMENDED)

This Environmental Impact Statement has been prepared on behalf of Coal & Allied Operations Pty. Limited, being the applicant making the Development Applications for extension of the Catherine Hill Bay Coal Preparation Plant and for construction of new coal washery reject emplacements, new coal handling facilities and other associated works.

The developments forming the expansion of the Catherine Hill Bay Coal Preparation Plant comprise the Stage 1 expansion of the Coal Preparation Plant by the addition of two washing modules and associated coal handling equipment and construction of a water supply pipeline from Kanangra Drive in Wyong Shire to Wallarah Colliery. This will be followed by the Stage 2 development comprising expansion of the Coal Preparation Plant by addition of a further four modules, construction of new coal handling equipment and new stockpile areas, construction of an overland conveyer from Wallarah Colliery to Catherine Hill Bay and other associated conveyers to link the overland conveyer, the coal stockpile areas and the Coal Preparation Plant, construction of coal washery reject emplacements, extraction of gravel, construction of associated environmental protection works including Pollution Collection and Water Supply Dams in Catherine Hill Creek valley and construction of a water supply pipeline to the Coal Preparation Plant.

This Environmental Impact Statement accompanies the Development Applications, which relate to land known generally as Portions 9, 10, 19 and 20 in the City of Lake Macquarie and Portions 30, 54 and 57 in Wyong Shire which are shown on Figure 4 of the Environmental Impact Statement and land known specifically as:

Portion 9 : C.T. Vol. 877 Folio 1;
Portion 10 : C.T. Vol. 877 Folio 2;
Portion 30 : C.T. Vol. 877 Folio 3;
Portion 54 : C.T. Vol. 877 Folio 6;
Portion 57 : C.T. Vol. 877 Folio 7;

Lot 22, D.P. 593154 : C.T. Vol. 13544 Folio 110;
Lot 203, D.P. 702669;
Portions 9, 10, 54 : C.T. Vol. 4831 Folio 12;
Portions 54, 30 : C.T. Vol. 1439 Folio 151;
Unformed roads in the Village of Cowper (Village of Catherine Hill Bay) but excluding all 'paper roads' as herein described;
Montefiore Street (Village of Cowper) and
the Pacific Highway in Portion 10;

all within the Parish of Wallarah, County of Northumberland.

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

This Environmental Impact Statement has been prepared by Edward T.C. Johnstone B.A., M.A., C. Eng., M.I.M., M.Aus. I.M.M., M.A.W.W.A., a director of Johnstone Environmental Technology Pty. Limited, of 52, Frenchs Road, Willoughby N.S.W. and others as set out in Section 13.0 of the Environmental Impact Statement.

I, Edward T.C. Johnstone of 52 Frenchs Road, Willoughby, N.S.W. hereby certify that I have prepared the contents of this Statement in accordance with Clauses 34 and 35 of the Environmental Planning and Assessment Regulation 1980.

E.T.C. Johnstone

22nd May, 1987

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1.0 SUMMARY

1.1 Introduction

This Environmental Impact Statement assesses a two stage proposal for progressive upgrading of the Catherine Hill Bay Coal Preparation Plant and also progressive development of new coal handling facilities and coal washery reject disposal emplacements.

The proposal by Coal & Allied Operations Pty. Limited is both to improve the efficiency of the Coal Preparation Plant by providing more intensive coal washing processes and to allow for expanded coal throughput.

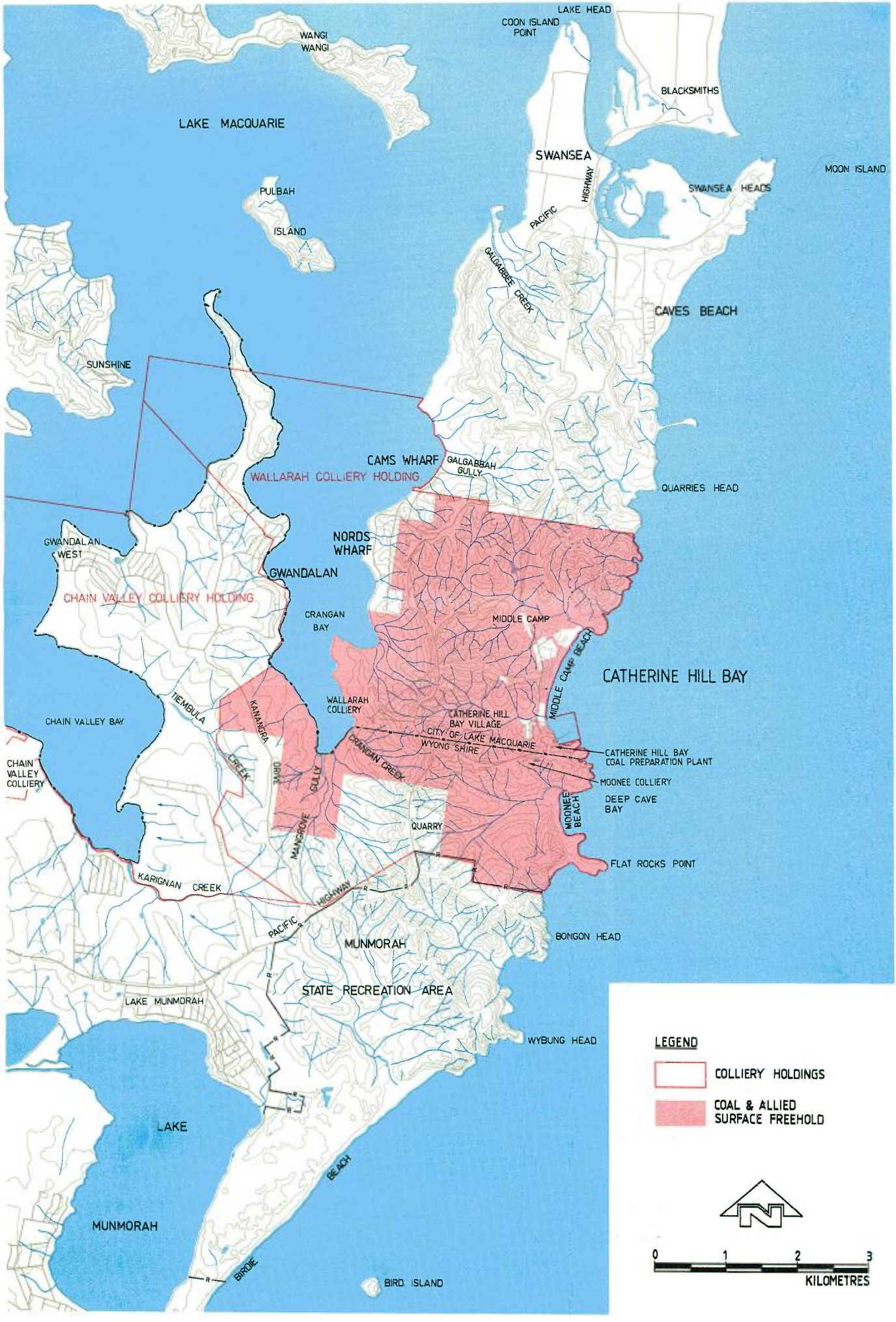
The overall development, which is to install six new modules in the Coal Preparation Plant to process a nominal throughput of 1200 tph of raw coal with associated coal stockpiles, conveyers and coal washery reject emplacements, will be progressively developed as each component is constructed over the 10 or so year development timescale.

However it is urgent to commission the initial two modules of the Coal Preparation Plant, which is located on land zoned 4(b) : Special Industry (Coal Mining), in order to meet the market requirements for export coal quality and to enable the current production capacity of the Company's regional mining operations to be realised.

Accordingly the overall development is proposed as a staged project. Stage 1 will cover the installation of two new modules as a part of the Coal Preparation Plant, with associated conveyers, all within the area of land in the City of Lake Macquarie zoned 4(b) : Special Industry (Coal Mining) and construction of a water supply pipeline from Kanangra Drive in Wyong Shire to Wallarah Colliery.

All of the rest of the development will be in Stage 2 and will cover installation of a further four modules in the Coal Preparation Plant, within the 4(b) zoned land, and also conveyers, coal stockpiles, water supply dams, coal washery reject emplacements and extension of the water supply pipeline in land zoned as 7 (a) : Environmental Protection

LOCATION MAP **FIGURE 1**



LOCALITY PLAN

FIGURE 2

Protection (Scenic) and 7(c) : Environmental Protection (Coastal Lands Acquisition) in the City of Lake Macquarie, and 7(b) : Rural Scenic Protection and 7(e) : Coastal Lands Acquisition in Wyong Shire.

Separate Development Applications are being lodged for the Stage 1 and Stage 2 developments and consequently this environmental impact statement has been structured so as to allow a clear understanding of the environmental impact of Stage 1 and Stage 2 of the development independently. Both the Stage 1 and the Stage 2 developments are complete and do not depend on the other stage for their satisfactory implementation. Sections 6, 7 and 8 of this report address the project description, environmental safeguards and environmental impact assessment for the Stage 1 development and if read in conjunction with Sections 2, 3, 4 and 5, provide a full environmental evaluation for the Stage 1 Development Application. Sections 9, 10, 11 and 12 describe the Stage 2 development, give details of the environmental safeguards to be applied and assess the environmental impact of the Stage 2 development. As for Stage 1, if read in conjunction with Sections 2, 3, 4 and 5 of this report and the appropriate appendix, they give a full environmental evaluation for the Stage 2 Development Application.

1.2 Outline of Proposed Developments

The Catherine Hill Bay Coal Preparation Plant, which is located at Catherine Hill Bay, N.S.W., currently has a maximum throughput capacity of about 420 tph (equivalent to 1,900,000 tpa) of raw coal. It is proposed to increase this progressively to 1200 tph (equivalent to 5,000,000 tpa) of raw coal, which will be supplied from Coal & Allied's existing and established underground collieries in the region.

The production from Wallarah and Moonee Collieries, together with a proportion of the production from Chain Valley Colliery, is at present processed at the Catherine Hill Bay Coal Preparation Plant to produce a high calorific value, low ash, low sulphur, high volatile coal which is ideal for combustion purposes and is marketed as the Wallarah Brand.

LEGEND

- EXISTING FACILITIES
- PROPOSED STAGE 1 DEVELOPMENT (2,500,000 TPA)
- PROPOSED STAGE 2 - 5,000,000 TPA DEVELOPMENT

0 0.5 1.0
KILOMETRES

AERIAL PHOTOGRAPH OF CATHERINE HILL BAY ENVIRONS **FIGURE 3**

These collieries are approved and have existing mining leases, which will be worked to produce the coal to be processed at Catherine Hill Bay. No new development approvals are needed for the coal mining activity and consequently this environmental impact statement and the Development Applications relate only to the surface developments, which may be summarised as :

1. Installation of additional coal washing facilities in the Catherine Hill Bay Coal Preparation Plant in two stages. The first stage will have a raw coal input capacity of 2,500,000 tpa and the second stage will have an ultimate capacity of 5,000,000 tpa of raw coal;

2. Construction of a surface (overland) conveyer, passing beneath the Pacific Highway, to transport coal directly from the Company's Wallarah Colliery to Catherine Hill Bay;

3. Establishment of permanent and increased coal stockpile capacity (in stages), with associated mechanised coal handling systems, where the existing emergency coal stockpile and coal reject emplacements are located;

4. Development of a new transportation conveyor drift adjacent to the existing emergency raw coal stockpile area, which will access the Great Northern and Fassifern coal seams;

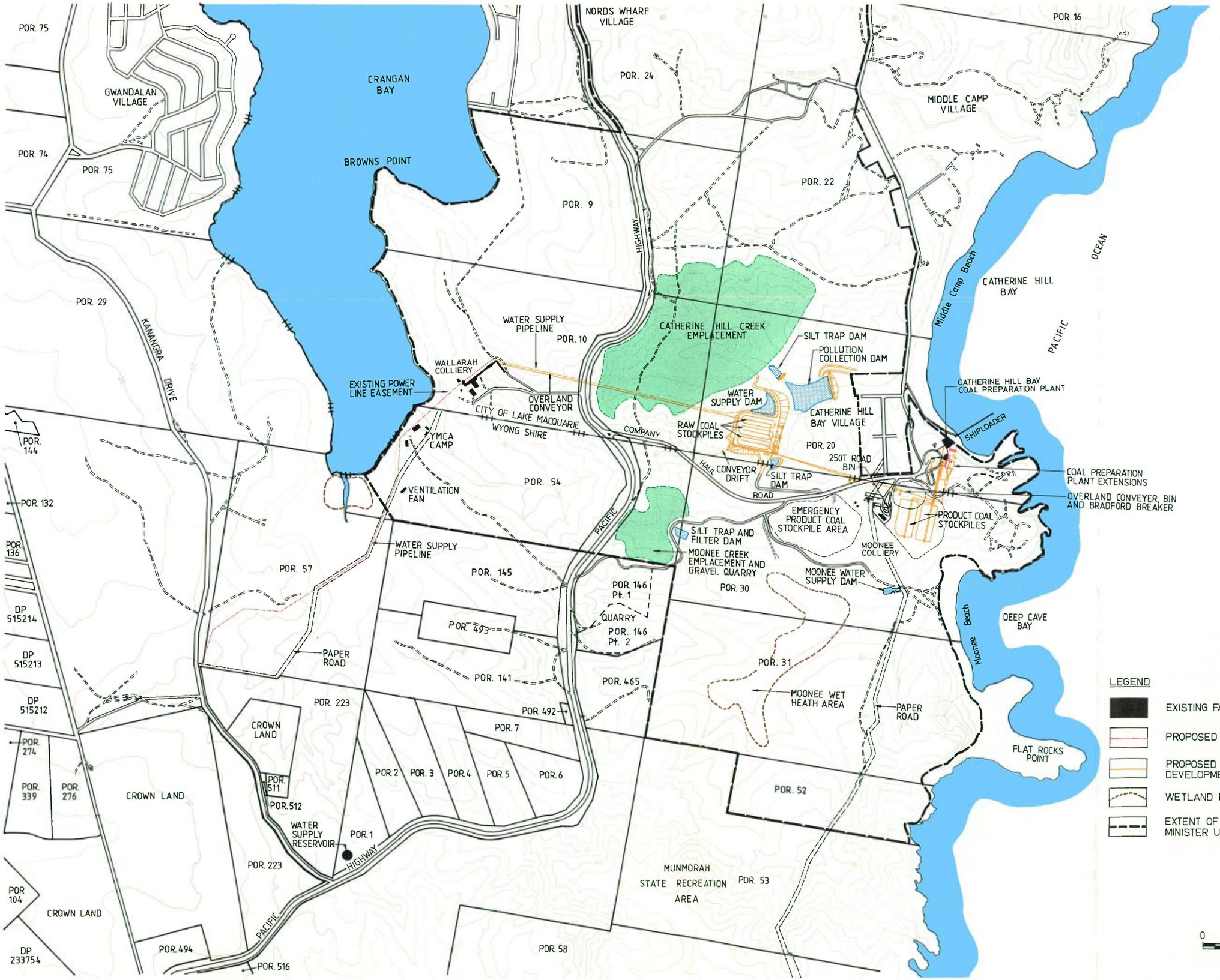
5. Construction of coal washery reject emplacements with an estimated capacity of 10,300,000 m^3;

6. Construction of a water supply pipeline from Kanangra Drive in Wyong Shire, and Water Supply and Pollution Collection dams in the Catherine Hill Creek valley;

7. Construction of various pollution control structures and facilities (in stages) relating to the above facilities; and

8. Provision of an upgraded electricity supply and reticulation within the Company's property.

The components of the proposed developments are shown on Figure 4.



LEGEND

- EXISTING FACILITIES
- PROPOSED STAGE 1 DEVELOPMENT
- PROPOSED STAGE 2 - 5,000,000TPA DEVELOPMENT
- WETLAND PROTECTED UNDER S.E.P.P. 14
- EXTENT OF LAND SUBJECT TO DIRECTION BY THE MINISTER UNDER SECTION 101 OF THE E.P.&A. ACT 1985

0 200 400 600 800 1000
METRES

THE DEVELOPMENT PROPOSAL **FIGURE 4**

1.3 Summary of Company's Objectives

Coal & Allied Operations Pty. Limited operate three collieries in the Catherine Hill Bay Region, which supply raw (Run-of-Mine) coal to the Coal Preparation Plant at Catherine Hill Bay, as shown on Figure 2. Of these, Wallarah Colliery is located at Crangan Bay on Lake Macquarie, Moonee Colliery is established to the east of the Pacific Highway adjacent to the Catherine Hill Bay Coal Preparation Plant and Loading Jetty at Catherine Hill Bay, and Chain Valley Colliery is established to the south-east of Lake Macquarie, from where an overland conveyer is used to transport coal directly from this colliery to the Vales Point Power Station.

Coal & Allied now propose to upgrade the Catherine Hill Bay Coal Preparation Plant in order to meet current export quality standards and to maintain the Company's competitiveness in the market place. This is necessary because the trend in export markets is towards lower ash steaming coals and a modified and upgraded Coal Preparation Plant is needed to supply this product.

Broadly, the new works (as set out in the preceding section) will cover installation of additional coal preparation (washing) facilities adjacent to the existing Coal Preparation Plant, new stockpile and coal handling facilites in the vicinity of the existing Moonee Entry, Coal Preparation Plant and emergency stockpile areas, as well as a new overland conveyer (passing in a tunnel under the Pacific Highway) from Wallarah Colliery to the new raw coal stockpile facilities. The overland conveyer will eliminate road haulage of raw (R.O.M.) coal from Wallarah Colliery along the Pacific Highway. It will also be necessary to develop new coal washery reject disposal areas to serve the expanded Coal Preparation Plant.

At present the Company's three mines in the region (Moonee, Wallarah and Chain Valley) have a capacity of approximately 3,100,000 tpa, but production of raw coal is constrained by the current capacity of the Catherine Hill Bay Coal Preparation Plant, which is 1,900,000 tpa, and the sale of about an additional 600,000 tpa of raw coal direct to the Vales Point Power Station under a continuing contract with the Electricity Commission of N.S.W.

The overall development proposal provides for an initial Stage 1 expansion of the Coal Preparation Plant to a capacity of 2,500,000 tpa which, together with the direct sale to the Vales Point Power Station, will enable the current production capacity (3,100,000 tpa) of the Company's mining operations to be realised. This includes production from Moonee Colliery, which has been developed since 1983 to the stage where production can be increased from the current 300,000 tpa to 900,000 tpa of raw coal.

This initial development (Stage 1) to a total projected production of 3,100,000 tpa will provide ongoing employment at the three mines and at Catherine Hill Bay Coal Preparation Plant for the existing workforce of about 750 people and will also generate approximately 100 additional job opportunities.

Transport of washed product coal away from Catherine Hill Bay will be by coastal collier to Newcastle and Balls Head (Sydney) for trans-shipment into bulk ocean carriers. To augment transport of coal away from Catherine Hill Bay, the Company's new 6666 DWT self discharging bulk carrier MV "Wallarah" was launched in Japan during January 1986 and commenced delivery of product coal from Catherine Hill Bay to the Port Waratah Coal Services facilities in the Port of Newcastle for trans-shipment into bulk ocean carriers in mid 1986. Concurrently with this, shipment of coal continues to Balls Head.

The initial Stage 1 expansion of the Coal Preparation Plant capacity to 2,500,000 tpa (600 tph) of raw coal is proposed as the first stage of a 1200 tph plant to provide for future expansion of the Company's mining operations in the region to 5,600,000 tpa of raw coal.

The Stage 2 development will be progressive. In the earlier part of the development, production of raw coal will be increased to 4,200,000 tpa from the Wallarah and Great Northern Coal Seams, of which 3,600,000 tpa will be processed in the Catherine Hill Bay Coal Preparation Plant and the balance of 600,000 tpa will go direct to the Vales Point Power Station.

TABLE 1 : PROGRESSIVE EXPANSION OF CATHERINE HILL BAY COAL PREPARATION PLANT

	Current Operations	Stage 1 Development	Stage 2 3,600,000 tpa Development	Stage 2 5,000,000 tpa Development
Catherine Hill Bay Coal Preparation Plant Throughput	420 tph	600 tph	800 tph	1200 tph
Wallarah Colliery	1,000,000 tpa	1,000,000 tpa	1,500,000 tpa	1,500,000 tpa
Moonee Colliery	300,000 tpa	900,000 tpa	300,000 tpa	Wallarah Seam worked out
New Transportation Drift (Raw Coal Stockpile Area)			900,000 tpa	2,600,000 tpa
Chain Valley Colliery	1,200,000 tpa	1,200,000 tpa	1,500,000 tpa	1,500,000 tpa
Total Raw Coal Production	2,500,000 tpa	3,100,000 tpa	4,200,000 tpa	5,600,000 tpa
Supply to Vales Point Power Station	600,000 tpa	600,000 tpa	600,000 tpa	600,000 tpa
Raw Coal to Catherine Hill Bay Coal Preparation Plant	1,900,000 tpa	2,500,000 tpa	3,600,000 tpa	5,000,000 tpa
Estimated Product Coal for Export	1,700,000 tpa	2,000,000 tpa	2,800,000 tpa	3,600,000 tpa
Total Workforce (Direct)	About 750	Estimated 850	Progressive to estimated 1250	

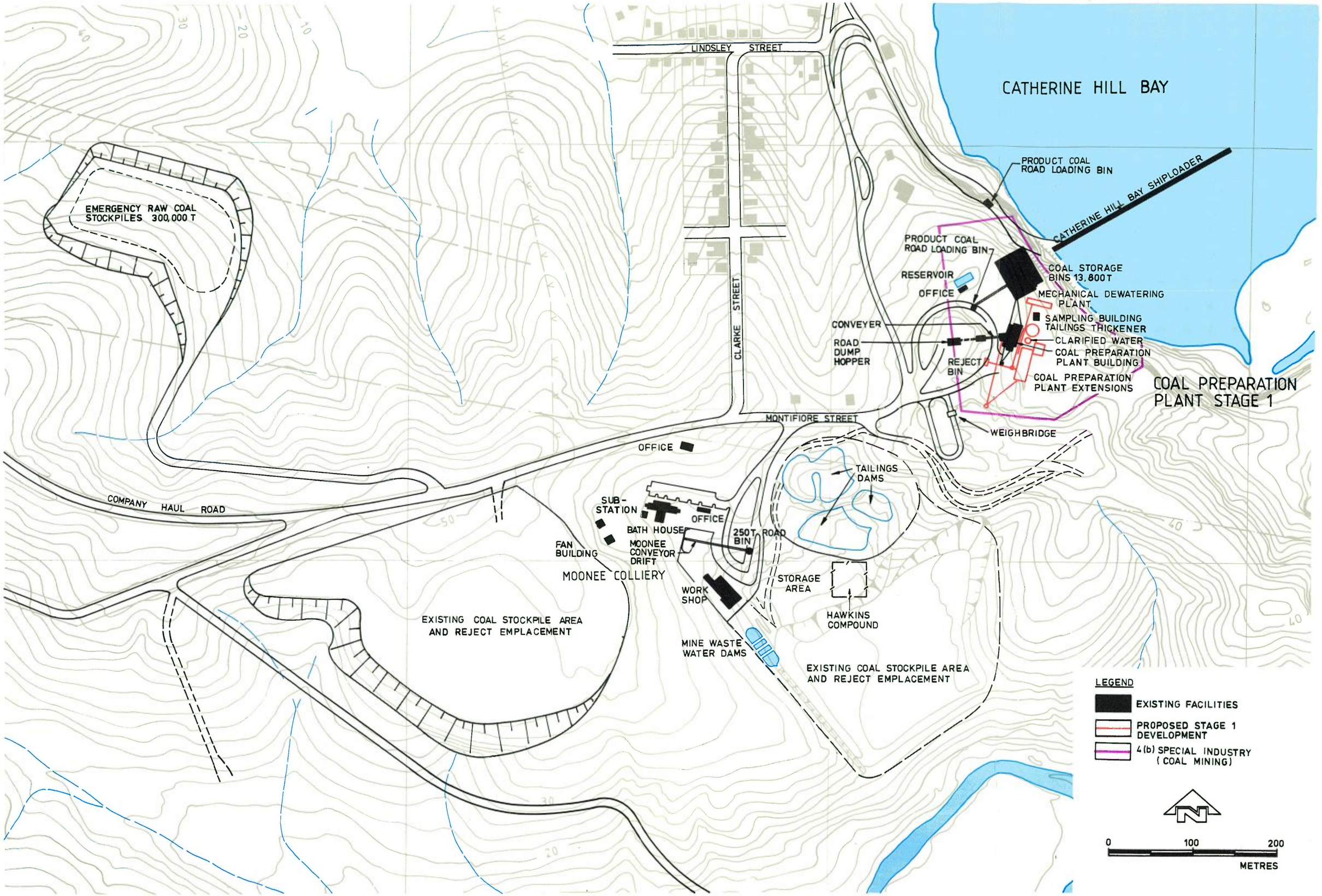
NOTE: All tonnages given are for raw coal except the product coal tonnage for export.

Subsequently production will commence in the Fassifern Seam (below the Great Northern Seam) and the production of raw coal will be increased to 5,600,000 tpa, of which 5,000,000 tpa will be processed at Catherine Hill Bay (the balance of 600,000 tpa will continue to go to the Vales Point Power Station).

During the 3,600,000 tpa phase of the Stage 2 development, a new transportation conveyor drift will be driven into the Great Northern and Fassifern Seams feeding to the raw coal stockpile facilities adjacent to the overland conveyer. This new drift will access coal reserves in the existing lease area between the mining operations at Wallarah and Moonee Collieries. Additional modules will be added to the Coal Preparation Plant as raw coal production is increased so that all product coal is washed. This will require progressive installation of two 200 tph heavy medium bath modules and two heavy medium cyclone and spiral modules to give a Coal Preparation Plant capacity of 1200 tph. These Stage 2 developments will enable progressive long term employment for approximately 400 additional people (to total about 1,250 people for the Stage 2 : 5,000,000 tpa development).

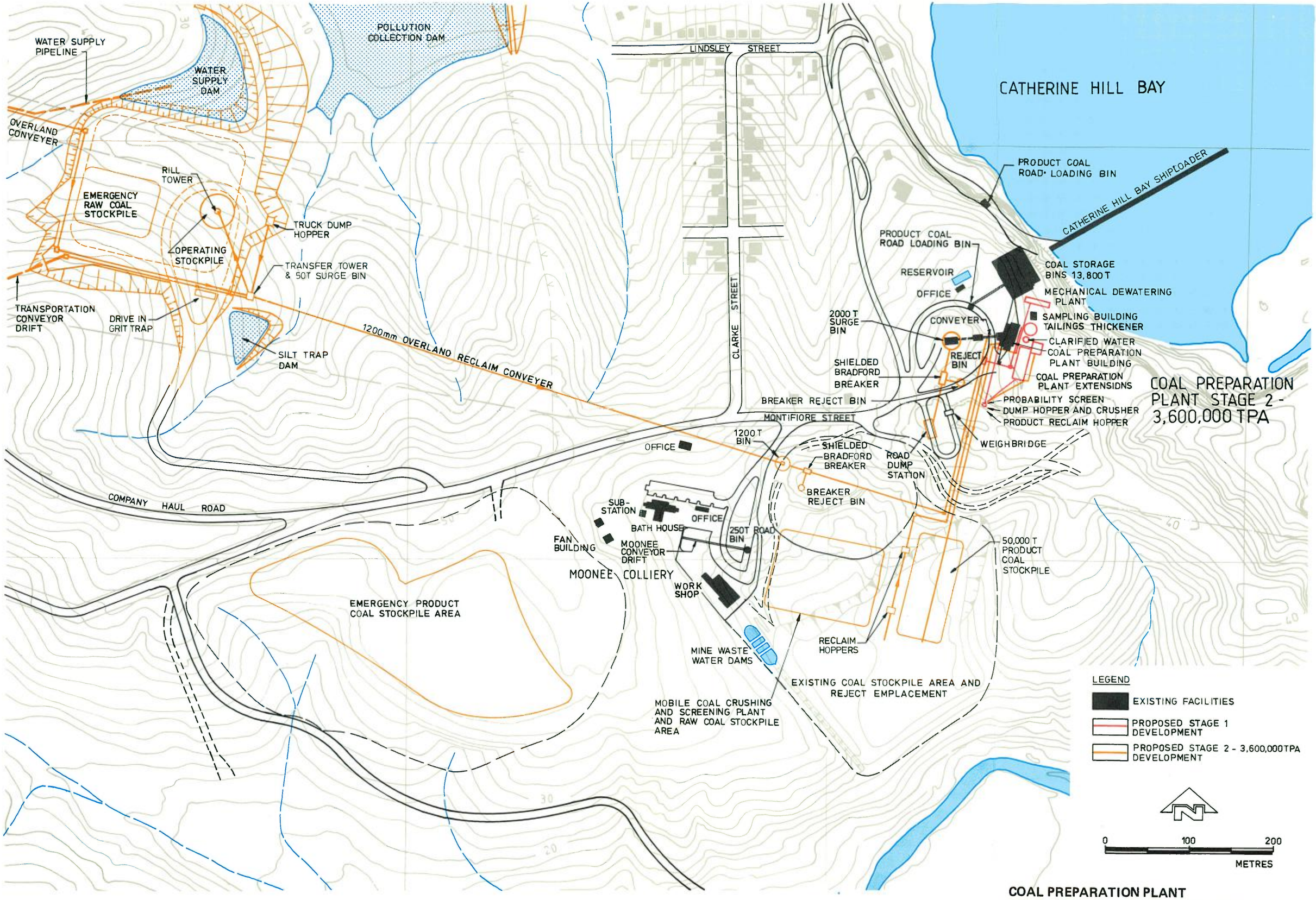
The extent of the proposed development is shown on Figures 3 and 4, while phases of the proposed coal handling facilities are shown on Figures 5, 6 and 7. Table 1 summarises production of coal from the Company's regional mines and the progressive expansion of the Catherine Hill Bay Coal Preparation Plant.

These proposed developments are required to ensure the continuity of economic mining operations in the Catherine Hill Bay region, which are confidently estimated to be in the order of 50 years and are essential if the Company is to maintain, and progressively increase, its current (direct) employment levels at its existing underground collieries near Catherine Hill Bay.



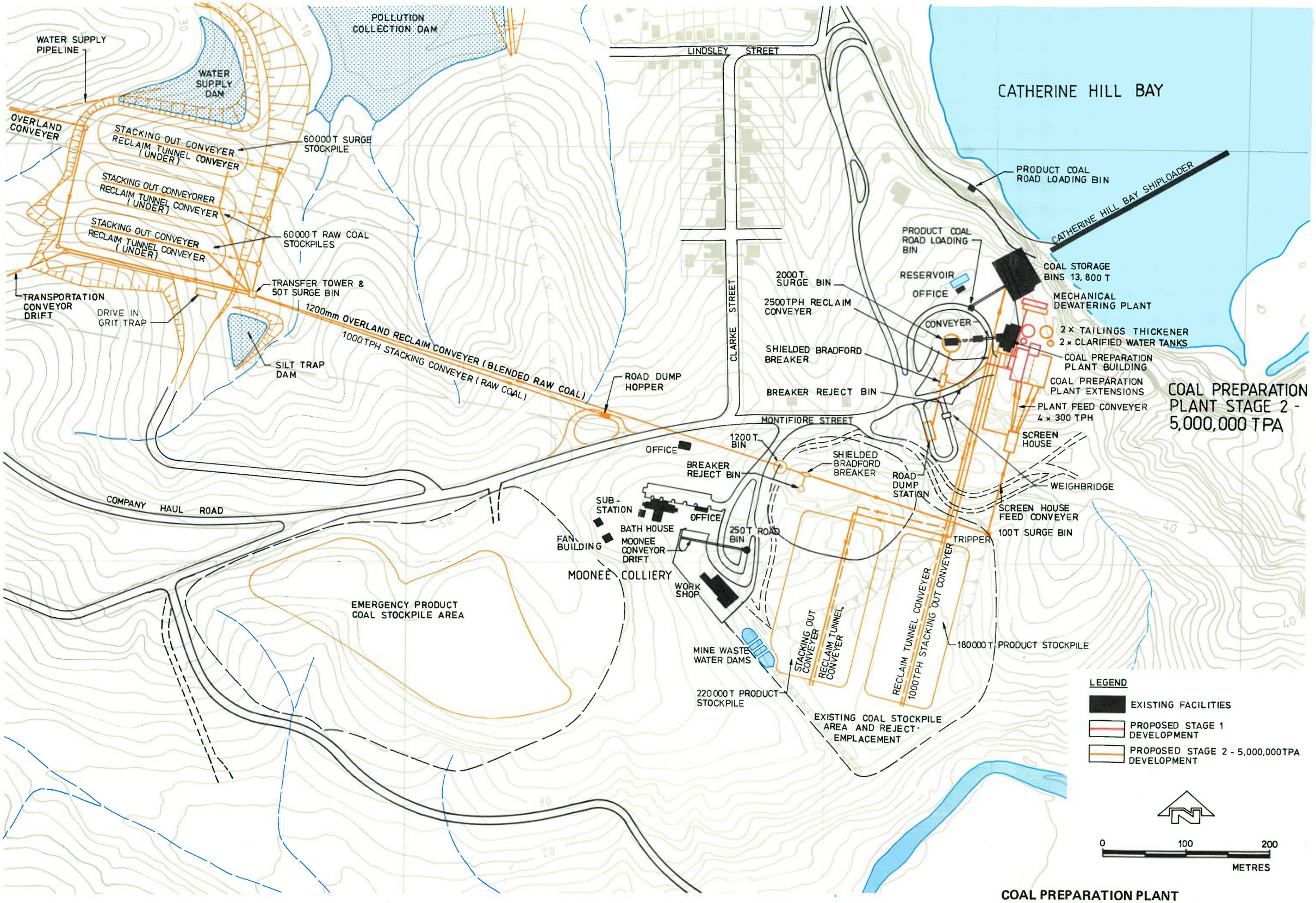
COAL PREPARATION PLANT DEVELOPMENT – STAGE 1

FIGURE 5



COAL PREPARATION PLANT DEVELOPMENT – STAGE 2 (3,600,000 tpa DEVELOPMENT)

FIGURE 6



COAL PREPARATION PLANT DEVELOPMENT – STAGE 2 (5,000,000 tpa DEVELOPMENT)

FIGURE 7

1.4 Alternatives to the Proposal

Various alternatives have been considered to upgrade the Catherine Hill Bay Coal Preparation Plant. The alternatives, described in more detail in Section 3, may be summarised as :

(i) A study of coal transport alternatives available to the Company showed the overall advantages of using coastal colliers rather than road haulage to transport coal from Catherine Hill Bay to the Port of Newcastle. This indicated that the existing shiploading facility should be easily accessible from a new Coal Preparation Plant, while continuing to maintain truck loading abilities for the occasions when excess demand for product coal or high seas force this mode of transport to be used for short periods.

(ii) The Catherine Hill Bay Coal Preparation Plant was commissioned in 1964. It washes raw coal from three local collieries, which are readily accessible to the present Coal Preparation Plant and other existing facilities. An alternative site for construction of a new Coal Preparation Plant at Catherine Hill Bay was considered but this was rejected because of major foundation and undermining problems, as well as increased costs of development.

(iii) Alternative site developments were considered to reduce the visual and noise impacts.

(iv) Alternatives for transporting raw coal by conveyer from Wallarah Colliery were considered. The selected conveyor route will cause the least disturbance to the environment and minimises impacts on the residents of Catherine Hill Bay.

(v) Alternative sites for both raw coal and product coal stockpiles were considered in detail to minimise visual impact and optimise dust control prior to selecting the preferred option.

(vi) Alternative methods for disposal of coal washery reject generated by the Coal Preparation Plant were considered before selecting landfill as the appropriate method (particularly in the short term).

(vii) Seventeen alternative sites for coal washery reject emplacement were considered in detail prior to selecting the preferred options.

(viii) Alternative landforms and configurations for the emplacements were considered to minimise the impact of the emplacements on the environment and to optimise the emplacement design for maximum capacity without adverse environmental consequences.

1.5 Environmental Impact Assessment of Stage 1 Coal Preparation Plant Expansion Development

The whole of the proposed Stage 1 expansion of the Catherine Hill Bay Coal Preparation Plant is on land zoned 4(b) : Special Industry (Coal Mining) under the City of Lake Macquarie Local Environmental Plan. The proposed development is permissible with the consent of Lake Macquarie City Council, but is subject to a direction under Section 101 of the Environmental Planning and Assessment Act and will therefore be determined by the Minister for Planning and Environment.

The development comprises the construction of two modules of dense medium cyclones and spirals each of 200 tph capacity in a new building adjacent to the existing Coal Preparation Plant (jig plant) building and associated conveyers, a tailings thickener and mechanical dewatering equipment as well as construction of a 350 mm diameter buried water supply pipeline from Kanangra Drive across Portion 57 and thence to Wallarah Colliery.

All coal handling equipment will be enclosed. Consequently the new plant will not increase dust emission even though the production of the Coal Preparation Plant will be increased by 600,000 tpa to 2,500,000 tpa of raw coal. All coal will continue to be taken to the plant by trucks using the existing dump station. Road transport from Moonee Colliery will increase by about 150 truck loads (300 truck trips) on weekdays when the Coal Preparation Plant is operating. All transport of coal from Moonee Colliery will be on private roads away from the village of Catherine Hill Bay. There will be no increase in production or truck transport of coal from Wallarah Colliery or Chain Valley Colliery.

The building for the new Coal Preparation Plant modules will be constrained in height and cut into the hillside to reduce its prominence. It will be clad on the outside down to ground level on the western and northern sides and there will be no openings on these sides in order to reduce noise emission. These measures will ensure that the visual impact of the new building will be minimised, particularly as careful selection of colours is to be implemented (as discussed in Appendix H).

Noise emission will be controlled to no more than 78 dBA at 10 m from the northern and western walls of the Coal Preparation Plant to ensure that there will be minimal increase in continuous noise emission at the nearest residence in Catherine Hill Bay village. This will not cause disturbance or any noise intrusion problem. The increased trucking of coal from Moonee Colliery to the washery will increase the number of movements but the peak noise levels will remain the same.

The expanded Coal Preparation Plant will subject the coal to more intense washing processes and will generate more coal fines (tailings). These will be mechanically dewatered and disposed of with the coarse washery reject in the existing disposal emplacements, or will be recovered for blending in fuel coal where appropriate. The Coal Preparation Plant will also require an increased supply of water, which will be obtained from the existing Moonee Valley pondage and by the new pipeline from the Wyong Shire reticulated supply. For this purpose a new 350 mm diameter pipeline will be constructed from the existing 450 mm diameter pipeline along Kanangra Drive across Company freehold land. This supply will ensure adequate water is available both for the Stage 1 and Stage 2 developments at Catherine Hill Bay. The Stage 1 development will not increase coal stockpile or coal washery reject emplacement areas. Existing pollution controls for water quality and fugitive dust emission will be maintained and the recently established water and air quality monitoring programme will be continued.

The increase in washed coal production from the Stage 1 development will create about 100 new (direct) job opportunities in the Coal Preparation Plant and at Moonee Colliery. Additional employment opportunities will be created by the additional 2260 tpd (150 truck loads) of coal to be transported from Moonee Colliery to the Coal Preparation Plant. It is anticipated that these positions will be filled by people presently living in the Lake Macquarie and Wyong areas, who currently commute to work elsewhere or who are unemployed.

It is concluded that the proposed expansion of the Catherine Hill Bay Coal Preparation Plant (Stage 1) to a nominal capacity of 600 tph will significantly improve coal quality and enable the company to expand their export sales of coal thus creating over 100 additional direct job opportunities. The development will also secure the existing 750 jobs the Company provides in the region, which would be endangered if the development does not proceed. The proposed development will be a minor permissible development in an area, which is zoned 4(b) : Special Industry (Coal Mining) by Lake Macquarie City Council so as to allow coal industry works to be undertaken. The development will not cause increased air or water pollution and will not create a noise intrusion problem in the village of Catherine Hill Bay.

1.6 Environmental Impact Assessment of Stage 2 Coal Preparation Plant, Materials Handling and Coal Washery Reject Emplacement Developments.

Stage 2 of the Catherine Hill Bay Coal Preparation Plant expansion is proposed as a progressive multicomponent development of the Company's regional operations in the City of Lake Macquarie and Wyong Shire areas, based on Catherine Hill Bay. The developments will progressively lift raw coal production from 3,100,000 tpa (the Stage 1 development output) to 5,600,000 tpa, of which 5,000,000 tpa will be processed in the Catherine Hill Bay Coal Preparation Plant for the export markets.

The development components are :

- installation of two modules of dense medium cyclones and spirals and two modules of dense medium baths in the Coal Preparation Plant;
- installation of conveyers, tailings thickener and fine coal dewatering equipment to service the washing modules;
- construction of an overland conveyer from Wallarah Colliery to Catherine Hill Bay, passing under the Pacific Highway;
- construction of raw coal stockpiles and mechanical coal handling equipment;
- development of a new coal transportation conveyor drift adjacent to the raw coal stockpiles, accessing the Great Northern and Fassifern Seams;
- construction of washed (product) coal stockpiles.
- construction of interconnecting coal transport conveyers, Bradford breaker, bins and transfer stations;
- construction of a new dump station (for truck transported coal), Bradford breaker and 2000 tonne bin adjacent to the Coal Preparation Plant;
- construction of new coal washery reject emplacements;
- construction of water Pollution Collection and Water Supply dams;
- extension of the 350 mm diameter water supply pipeline from Wallarah Colliery to the new Water Supply Dam at Catherine Hill Bay;
- augmentation of electrical power supply and reticulation to the new equipment and facilities.

The proposed progressive (Stage 2) development of the Catherine Hill Bay facilities is a major expansion, both in terms of output and land area affected, of an installation which has been progressively upgraded since coal mining commenced in the area over 100 years ago. As an established land-use in the district currently employing 750 people, which would be increased to over 850 people by the Stage 1 Coal Preparation Plant expansion, the Company's coal mining operations are a part of the local environment. The significance of the historic use of this area for coal mining activities has been demonstrated by conservation orders on the wharf at Catherine Hill Bay and the townships of Catherine Hill Bay and Middle Camp.

The boundary between the City of Lake Macquarie to the north and Wyong Shire to the south divides the area affected by the proposed Stage 2 developments. As a consequence two separate Local Environmental Plans constrain the proposed developments. Although the Environmental Protection zonings of both Local Environmental Plans prohibit most of the developments proposed, it should however be noted that the Company have existing use rights in the 7(e) : Coastal Lands Acquisition zoned land in Wyong Shire.

Because of this zoning, the coal industry nature of the proposed Stage 2 developments, their location near the coast in an environmentally sensitive area, their regional importance, the important employment and economic consequences of the developments and the regional environmental planning significance of the Stage 2 expansion of an existing and established coal mining activity at Catherine Hill Bay, the Minister for Planning and Environment has directed both Lake Macquarie City Council and Wyong Shire Council to refer the Development Applications for the Stage 2 developments to him for determination under the provisions of Sections 100A and 101 of the Environmental Planning and Assessment Act. This allows the Minister to approve or reject the Development Applications for the proposal, even though the zoning prohibits the development from proceeding unless a new Local Environmental Plan is approved.

The Stage 2 development proposals for upgrading the Coal Preparation Plant and coal handling facilities to accommodate increased throughput of coal, increasing the stockpile areas and capacities for raw coal and product coal to accommodate fluctuations in mining operations, Coal Preparation Plant operations and transportation of product coal (including availability of shipping) are developments of major significance. They will also cause the quantity of coal washery reject from the Coal Preparation Plant to increase as a result of increased raw coal throughput. The proportion of reject material per tonne of raw coal processed will also increase as the inherent quality of the coal seams mined deteriorates. This will necessitate the development of major emplacements to dispose of the reject to be produced.

Developments of this magnitude must take account of the environmental consequences and the planning must ensure adequate environmental protection is included in the project designs. For the proposed Catherine Hill Bay Stage 2 developments, environmental and social impacts that **could** result are :

(i) increasing coal preparation facilities, coal handling operations and coal stockpile areas **could** increase noise levels and emission of fugitive dust;

(ii) increasing stockpile areas and handling facilities **could** have a visual impact in the local environment (for example the product coal stockpile areas will be visible from Bongon Head Lookout, however the impact is not considered to be significant in this view);

(iii) increasing the life, capacity and washing intensity of the Coal Preparation Plant **could** increase the quantity of washery reject material for disposal. Disposal of this quantity of material **could** have an impact on the local environment;

(iv) the coal stockpile areas and reject emplacements **could** cause water pollution;

(v) the developments **could** impact on the open space character of the coast near Catherine Hill Bay;

(vi) the developments **could** secure ongoing employment for the Company's current employees in the region and **could** provide about 400 new direct job opportunities in the area;

(vii) there **could** be significant economic advantage from the construction activity, from the increase in disposable income of employees and from the increase in export earnings.

The developments proposed will incorporate safeguards to minimise their possible deleterious impact on the local environment. These include :

(a) design of the proposed developments has been undertaken interactively with the environmental assessment;

(b) disturbance and construction has been restricted in the Moonee Creek Valley to maintain a safe separation from the swamp heath areas;

(c) stockpiles have been located to minimise wind entrainment of dust and reduce visual intrusion within areas currently used for coal related activities;

(d) stockpile areas will be remote from housing;

(e) stockpiles will be kept damp using an automatic water spray system to control fugitive dust;

(f) coal handling operations will be progressively mechanised;

(g) elevated coal conveyers will be fully enclosed and ground level conveyers will be shielded;

(h) transport of coal has, where practicable, been taken off the public road system with a consequent major reduction in road transport of coal and improvement in road safety;

(i) the coal washery reject generated by the plant will be disposed of close to the Coal Preparation Plant in emplacements that have been designed with safeguards to minimise environmental impacts;

(j) the Coal Preparation Plant has been cut into the landform to minimise its visual prominence and external sheeting will be extended to ground level without any openings on the north and western sides to minimise noise emission towards the village of Catherine Hill Bay;

(k) noise generating components of the development have been located away from housing at Catherine Hill Bay and will be enclosed or acoustically treated to preclude noise disturbance of residents in the village;

(l) pollution control ponds and sediment run-off grit traps will be included to prevent dispersion of run-off siltation or fine coal from the proposed emplacements, stockpiles, Coal Preparation Plant and conveyers;

(m) a new dam will be built to contain water run-off from coal handling operations in the Catherine Hill Creek catchment and recycle it for use in the Coal Preparation Plant.

Individual environmental safeguards for the Stage 2 development are discussed more fully in Section 11.

Possible environmental impacts from the proposed developments have been identified and the designs modified to avoid adverse impacts. The interactive design technique employed has minimised adverse environmental consequences and determined safeguards which should be incorporated into the development. It is considered that these will satisfactorily control any potential pollution problems.

Recognising that houses in the village of Catherine Hill Bay are in close proximity to the colliery developments, special attention has been paid to the control of noise emission to avoid raising intrusive noise above current background levels. Mechanical equipment has been located as far away from residences as possible and it is planned to progressively reduce noise emission from the existing Coal Preparation Plant as well. No noise problem is anticipated.

The additional 400 (direct) job opportunities to be generated will be an important social benefit in an area of relatively high unemployment and where it is necessary for many people to commute long distances to work. The development will also secure the existing employment in Coal & Allied's regional coal mining operations.

The development will remove an average of 316 truck loads (peaking to 385 truck loads) per day of coal off the Pacific Highway between Wallarah Colliery and the Coal Preparation Plant, with only a modest increase of 44 trucks loads per day from Chain Valley Colliery occurring. The progressive mechanisation of the raw and product coal stockpiles will also substantially reduce the number of raw and product coal truck movements in the Catherine Hill Bay area.

Air and water pollution are not expected due to the controls to be installed and procedures to be followed for both handling of coal and emplacement of coal washery reject.

Adequate water will be available for all requirements from the Company's own supplies at Catherine Hill Bay and the new reticulated supply from Wyong Shire.

The components of the Stage 2 development will be visible from various viewing points, including Bongon Lookout in the Munmorah State Recreation Area, from Catherine Hill Bay Beach, from Moonee Beach and as a distant view from the Pacific Highway. Evaluation of the impact of the developments in the landscape shows that there will be an additional adverse impact but that, as the existing environment already contains similar facilities to those proposed, the level of adverse impact is considered to be acceptable.

Modification of the proposals has enabled the Company to secure the wet heaths of the Moonee Creek valley, which have been identified as an important environmental feature. No surface development will occur in the environmentally sensitive sections of the Moonee Creek valley, which will become a part of the Munmorah State Recreation Area under the N.S.W. Government's Coastal Lands Acquisition programme.

Adequate coal washery reject disposal has been identified and the two proposed emplacements can be developed and rehabilitated satisfactorily. Although visually prominent, the emplacements will be fully stable and will be constructed progressively with concurrent progressive rehabilitation. This will minimise the spatial extent of disturbance and active emplacement of coal washery reject (both coarse and tailings).

The proposed Stage 2 development described in this Environmental Impact Statement is considered to be appropriate to its locality. No significant adverse environmental impact will result from the proposed developments, although transient disturbance to the land surface and restricted recontouring of the landforms will occur. Any adverse environmental impacts will be outweighed by the benefits to the region to be gained from the proposed development.

1.7 Conclusions

The proposed Stage 1 expansion of the Catherine Hill Bay Coal Preparation Plant by the addition of 2 modules and the associated but independent Stage 2 addition of a further 4 modules to the Coal Preparation Plant and construction of new coal handling facilities is necessary for the Company to continue economically viable mining operations in the Catherine Hill Bay area. The developments are a continuation of a programme to upgrade facilities, which has always been necessary to maintain the viability of the existing coal mining operations in this area.

At present Coal & Allied employ about 750 people (directly) in the area and must improve their coal preparation facilities in order to remain competitive in the export market. Therefore the development is necessary for the Company to retain their existing coal exports and to increase them in the future. This will advantage the community because it will enable the Company to maintain existing employment levels and to progressively increase their current (direct) employment levels to approximately 850 people for Stage 1 and to a possible 1,250 people for Stage 2. Failure to proceed with the development will lead to a reduction in employment.

The initial development (Stage 1) will inject some $15 million (at 1987 prices) into the economy for capital works and will secure employment for the next 20-50 years. It will enable the Company to maximise coal extraction from its leases. The Stage 2 development will require additional capital expenditure of about $65 million (at 1987 prices) and will further increase employment.

The development will enable increased production with consequent additional export earnings of about $40 million per annum from the initial Stage 1 development.

No environmental impacts which would preclude approval of the proposed developments have been identified.

2.0 INTRODUCTION

2.1 Separate Stage 1 and Stage 2 Development Applications

The proposed upgrading of the Catherine Hill Bay Coal Preparation Plant will be undertaken progressively in a phased manner over a 10 or so year period. At the end of the proposed developments evaluated in this environmental impact statement, output of raw (R.O.M.) coal will have been increased from the current 2,500,000 tpa from the Company's three mines in the region to 5,600,000 tpa. This will be a major expansion, which will require development of new surface facilities in addition to expansion of the Coal Preparation Plant.

The existing Coal Preparation Plant is on an area of land zoned 4(b) : Special Industry (Coal Mining) under the City of Lake Macquarie Local Environmental Plan. This is a permissible development. The proposed developments are partly within the 4 (b) zoned land and also on land zoned 7(a) : Environmental Protection (Scenic) and 7(c) : Environment Protection (Coastal Lands Acquisition) in the City of Lake Macquarie, and 7(b) : Rural Scenic Protection and 7(e) : Coastal Lands Acquisition in Wyong Shire. The proposed developments in these zonings are currently prohibited, although it should be noted that the Company does have Existing Use Rights in the 7(e) zoned land in Wyong Shire adjacent to Moonee Colliery.

Two separate Development Applications are being lodged for the proposed developments, which have been divided into a Stage 1 and Stage 2. The Stage 1 Development Application is for construction of the first 2 modules of the expanded Coal Preparation Plant, associated conveyers and thickener and a new 350 mm water supply pipeline from Kanangra Drive across Company freehold land to Wallarah Colliery. These are all permissible developments within the existing zoning, although subject to a Direction under Section 101 of the Environmental Planning and Assessment Act for determination by the Minister.

The Stage 2 Development Application is for all other components of the proposed development, which are located both on land zoned 4(b) : Special Industry (Coal Mining) (where the proposed development is permissible) and on land zoned 7(a), 7(c), 7(b) and 7(e) where the proposed development is prohibited. This part of the development (Stage 2) is subject to a Direction under Section 101(2) of the Environmental Planning and Assessment Act whereby the Minister for Planning and Environment will determine the development application for both permitted and prohibited development.

Consequently this environmental impact statement has been structured so as to allow a clear understanding of the environmental impact of each stage of the proposed development as required by the Environmental Planning and Assessment Act for each Designated Development Application. Sections 6, 7 and 8 of this report assess the environmental impact of the Stage 1 development in conjunction with Sections 2, 3, 4 and 5; while Sections 9, 10, 11 and 12 assess the environmental impact of the Stage 2 development in conjunction with Sections 2, 3, 4, 5 and the appropriate appendices.

This overall environmental impact statement for the whole of the proposed Catherine Hill Bay Coal Preparation Plant expansion should be read in this way in order to obtain an understanding of the environmental impact of the separate (and independent) developments in each of the Stage 1 and Stage 2 Development Applications.

2.2 General Background

The urban settlement pattern, the local infrastructure, the wharf arrangements and restricted development in the locality of Catherine Hill Bay owe their origins to coal mining operations which commenced in the 1870's and have continued under different ownerships continuously since that time. Despite improvements to the Pacific Highway, the essential structure of coal mining at Catherine Hill Bay remains much as it was when initially developed - that is by transporting the coal to the coast and shipping it to local and overseas markets.

Wallarah Colliery was originally operated from a number of separate entries to the north and south of Catherine Hill Bay, the most recent of which was the Middle Camp Entry, which was opened about the turn of the century. Coal was carried to the Middle Camp pit-top and then taken to the Catherine Hill Bay jetty by a railway along the beach front. Most of this coal was loaded into ships (the old 'sixty milers') for transport to Sydney. By about 1940, the working face was too far from the Middle Camp Entry for men and materials access, so a new entry - the Moonee Entry - was constructed.

The Moonee Entry is near the south end of Catherine Hill Bay, some 500m from the present Catherine Hill Bay Coal Preparation Plant. It was used for men and materials access, and for ventilation purposes, from about 1940 to 1957, when the present Crangan Bay drift and pit top was developed. Between 1957 and 1983 the Moonee Entry was maintained as a working part of Wallarah Colliery for both emergency access and for ventilation. In 1983 the Moonee Entry was upgraded to provide access to coal reserves in the Wallarah Seam which are not accessible from the Crangan Bay pit-top, and was renamed Moonee Colliery.

The Moonee Colliery currently has the installed capacity to achieve a production of 300,000 tpa of raw or run-of-mine (R.O.M.) coal from the Wallarah Seam. Pit development has now progressed to the stage where production from Moonee Colliery can be increased to 900,000 tpa, with the potential for future development in the Wallarah, Great Northern and Fassifern Seams (including a new coal transportation conveyor drift) to produce 2,600,000 tpa of raw coal from the Wallarah Colliery Holding (excluding production from the Crangan Bay mine drift).

The Crangan Bay drift and pit-top (Wallarah Colliery) was opened in 1957 to reduce the movement time for men and materials underground while mining coal reserves from the Wallarah Seam and Great Northern Seam. It is located on the western side of the Pacific Highway, 2.6 km from Catherine Hill Bay and currently produces 1,000,000 tpa of raw coal, which is presently transported by truck from the colliery to Catherine Hill Bay via the Pacific Highway and a private haul road. Wallarah Colliery has the potential to achieve a production of 1,500,000 tpa of raw coal from the Great Northern

Seam. The man-riding elevator at Wallarah Colliery has already been constructed to provide access to the Wallarah, Great Northern and Fassifern Seams.

Chain Valley Colliery was established in 1962 to supply raw (run-of-mine) coal to the Vales Point Power Station. The coal for the power station is transported by overland conveyer, but a proportion of the coal produced is transported by truck to Catherine Hill Bay approximately 15 km away via the Pacific Highway and the Company's private haul road. With the completion of development in the Great Northern Seam, Chain Valley Colliery will achieve a production of 1,500,000 tpa of raw coal. Currently approximately 600,000 tpa of raw coal is conveyed direct from Chain Valley Colliery to the Vales Point Power Station out of a production of 1,200,000 tpa of raw coal.

The increased production at the Company's regional mines will be achieved by increasing the number of continuous miner units, the introduction of larger continuous miner units working with flexible coal transporters, or the introduction of longwall mining systems.

Coal & Allied Operations Pty. Limited estimate that some 306,000,000 (in situ) tonnes of coal are available in both the Wallarah and Chain Valley Colliery Holdings, in the Wallarah, Great Northern and Fassifern Seams, and that a further 360,000,000 tonnes may be contained in lower seams. Based on detailed assessment of reserves and the anticipated rate of production, mine life is confidently estimated to be in excess of 50 years.

Coal production from Wallarah Colliery and Moonee Colliery, together with a proportion of the production from Chain Valley Colliery, is processed in the Catherine Hill Bay Coal Preparation Plant (washery) at Catherine Hill Bay, predominantly for export. The Coal Preparation Plant commenced operations in 1964 and uses a Baum jig and classifying cyclones for beneficiation of the raw coal. Currently coal mined from the Wallarah and Great Northern Seams is washed to achieve a quality specification for steaming coal predominantly for the export market. The Coal Preparation Plant at present has an input capacity of 1,600,000 tpa of raw coal to produce steaming coal to a 13.5% ash specification, but can process a maximum of 1,900,000 tpa of raw coal.

2.3 Need for Upgrading of Coal Preparation Plant and Handling Facilities

The existing Coal Preparation Plant at Catherine Hill Bay currently achieves the required quality specification for steaming coal by washing a proportion of coal from the Wallarah and Great Northern Seams, which is blended with unwashed coal from the same two seams. In the future the Coal Preparation Plant will be required to wash a greater proportion of the raw coal produced and must be capable of achieving more demanding product quality levels. This is because the larger reserves of coal remaining in the Great Northern and Fassifern Seams than in the Wallarah Seam will lead to an overall decline in raw coal quality, which will reduce the opportunities to include unwashed coal in product blends and because any new export coal specifications will require lower ash coal.

Since the Catherine Hill Bay Coal Preparation Plant was commissioned, advances in coal preparation technology have also increased the efficiency of coal recovery. The proposed improvements in the Coal Preparation Plant will enable raw coal, with varying proportions of ash, to be washed to achieve customer's specifications and will also enable the Company to maintain its competitiveness in the market place and meet the even lower ash specifications anticipated in the future.

The capacity of the existing Catherine Hill Bay Coal Preparation Plant of 1,900,000 tpa of raw coal is well below the current production capability of 3,100,000 tpa from the Company's regional mining operations. If the plant is to wash all of the available raw coal from the three collieries, the Company requires a 600tph capacity plant, which would cater for available production capacity from the region of 3,100,000 tpa of raw coal (600,000 tpa is sold direct to Vales Point Power Station) prior to sinking the proposed new coal transportation conveyor drift.

2.4 Need for Coal Washery Reject Disposal

Coal washery reject is the by-product of the coal beneficiation process in the Coal Preparation Plant. The quantity produced is related to the specification requirements and the ash content of the raw coal. At present two coal seams are being mined, the Wallarah Seam and the Great Northern Seam, which are combined before being treated at the Catherine Hill Bay Coal Preparation Plant. The Wallarah Seam coal has a lower ash content than the Great Northern Seam coal and thus blending reduces the quantity of ash that is removed per tonne of raw coal treated in the Coal Preparation Plant.

As the Wallarah Seam coal reserves are mined out, there will be a progressive increase in the proportion of coal from the Great Northern Seam, which contains a higher proportion of impurities to be removed by the Coal Preparation Plant per tonne of coal washed. With the present blend and product specifications, there is approximately a 10% proportion of reject which is then disposed of in the existing reject emplacements. This proportion will increase to approximately 12% as the amount of Wallarah Seam coal diminishes, and in the future to 24%, when coal from the Fassifern Seam is included in the blend.

Based on a Stage 1 throughput of 2,500,000 tpa of raw coal, the rate of coal washery reject production is 300,000 tpa. With the Stage 2 development, the coal washery reject production rate will progressively increase to 1,200,000 tpa as the coal from the Fassifern Seam becomes a major input to the plant. All of the coal washery reject requires disposal and currently the only viable method is by surface emplacement (See Section 3.4).

2.5 Economic Considerations

The viability of the Company's regional coal mining operations, which are centred on facilities at Catherine Hill Bay, is dependent on the product coal being suitable for the consumers in the export market. This market is highly competitive and requires progressive improvements in mining operations, coal handling and quality control if markets are to be retained.

Technological improvements in coal preparation plants since 1964, when the Catherine Hill Bay Coal Preparation Plant was built, now enable processing to be adapted to the coal being treated and to provide more flexibility in meeting changes in the specifications of the product coal. These improvements have been included in the additions to the Catherine Hill Bay Coal Preparation Plant.

The proposed development will enable the company to meet client customer's requirements for steaming coal and to maintain the economic life of mining operations in the Catherine Hill Bay region by making it possible to process raw coal from the Great Northern Seam and the Fassifern Seam. Without these improvements, the Coal Preparation Plant will be unable to produce a steaming coal of acceptable quality from these coals, with a consequent loss of markets and employment at the Company's operations in the region.

2.6 Regional Planning Considerations

The proposed development is located in a region which overlays extensive coal meaures. Little urban development has occurred, initially due to relative inaccessibility and more recently to conserve the coal resources for mining. Non-development of the area to protect coal reserves has also led to the natural environment remaining substantially intact. This land is now considered to be valuable open space. It adjoins the Munmorah State Recreation Area to the south, and with that undeveloped land, is a buffer of coastal terrain between the urban development to the north and south.

The Company owned land falls in two local government areas; the City of Lake Macquarie and Wyong Shire. Both have environmental planning instruments that emphasise environmental protection in this region. However it should be recognised that there is an existing impact of coal mining in the locality which has not been recognised in the relevant Local Environmental Plans, even though the Company does have existing use rights in Wyong Shire.

The current mining and coal processing operations, and the existing ship loading facility are of regional significance. Coal & Allied currently employ approximately 750 people in the Catherine Hill Bay region and the ship loading facility provides transport, linking the regional coal reserves with Sydney and Newcastle without using the existing direct road or rail transport networks.

The proposed development is required for the Company to continue the mining of coal at its three regional collieries and to continue coal handling and processing operations at Catherine Hill Bay.

3.0 ALTERNATIVES TO THE PROPOSED DEVELOPMENTS

3.1 Alternative Locations for Surface Coal Handling Facilities

Considerable planning has gone into the materials handling systems associated with the development of the Coal Preparation Plant to minimise impact on the residents of Catherine Hill Bay and to minimise impact on the natural environment of the area.

The proposed overland conveyer from Wallarah Colliery will pass under the Pacific Highway and terminate adjacent to the current emergency coal stockpile area. The route selected for the overland conveyer is the most direct, uses an existing cleared easement and minimises impact on the environment. Alternative arrangements were considered which terminated closer to the Coal Preparation Plant, however, these options were discarded because of proximity to residents of Catherine Hill Bay. By providing a transfer point at the existing emergency coal stockpile area, onto a conveyer directed to the south of Catherine Hill Bay, the potential for impact on the residents of Catherine Hill Bay will be minimised. This configuration has enabled the overland conveyer rotary breaker to be effectively shielded from residents.

The existing raw coal emergency stockpile will be retained as it is strategically located in a well shielded location adjacent to the overland conveyer route and will be used to provide surge capacity for raw coal in the event of delays at the Coal Preparation Plant.

The product coal stockpiles will be located on the existing coal washery reject emplacement to the south of the Coal Preparation Plant (to the east of Moonee Colliery). Other higher locations to the north (closer to the Coal Preparation Plant) were evaluated and rejected because of potentially greater fugitive dust emission, greater visibility and the need for more elevated conveyers. In this way the Company will effectively minimise air pollution and will also minimise the area to be disturbed by utilising areas currently used for mining purposes.

3.2 Alternative Locations for the Coal Preparation Plant

The proposed expansion of the Catherine Hill Bay Coal Preparation Plant, which processes coal from the Company's three regional collieries, has been developed to utilise the efficient transport of coal away from Catherine Hill Bay by coastal collier. With the collieries fixing the sources of coal, and the shiploading facility fixing the destination for washed product coal, the alternative sites for the Coal Preparation Plant were restricted to the Catherine Hill Bay area.

Two sites were considered for the proposed expansion of the Coal Preparation Plant: the site of the existing Coal Preparation Plant and the current emergency coal stockpile area in the Catherine Hill Creek Valley. An investigation of these alternative sites concluded that the emergency stockpile area was unsuitable because of potential subsidence from earlier and extensive coal extraction in the Wallarah Seam using the Welsh Bord mining method immediately under this area. Furthermore, geotechnical and engineering investigations of the options available for these developments, determined that development of the expanded washing facilities on the site of the present plant is technically the most economic and advantageous.

3.3 Alternative Transport Options

Options for the transport of coal from the Company's three regional collieries to Catherine Hill Bay are:

- road transport
- conveyor transport
- underground transport

Because of the distance, land ownership and topography, it is not practicable to adopt surface overland conveyer transport of coal from Chain Valley Colliery to Catherine Hill Bay. Underground transport of coal is ruled out because of the existing workings in the coal seams. Therefore Chain Valley Colliery coal will continue to be transported by road. For Wallarah Colliery, conveyor transport will be adopted and this will substantially reduce the number of truck trips carrying coal to the Catherine Hill Bay Coal Preparation Plant.

Additionally, the new coal transportation conveyor drift entry adjacent to the emergency coal stockpile will access the coal seams and enable direct underground transport of coal from the Great Northern and Fassifern Seams to be adopted. This will also avoid road transport.

For transport of product coal away from Catherine Hill Bay, the Company's investigations have shown that the use of coastal colliers from Catherine Hill Bay is more efficient than transporting coal by either road or rail. This is the system presently utilised. It has recently been augmented by the Company's new self unloading vessel, the 6666 D.W.T. M.V. "Wallarah", which transports coal to Newcastle.

Only very small tonnages of coal for the domestic market will be transported away from Catherine Hill Bay by road. All bulk coal will be taken by ship to Port Waratah (Newcastle) or Balls Head (Sydney).

3.4 Alternative Methods of Coal Reject Disposal

Landfill is still the predominant and most widely accepted method of disposal for solid industrial waste materials in this country and overseas. Despite advances in technology and attempts to find further uses for some waste products, this practice is likely to continue to be necessary in the immediate future. Alternative methods to landfill suggested for disposal of coal washery reject include dumping at sea, underground disposal, and fluidised bed combustion. These options were canvassed in detail at the Public Inquiry into disposal of industrial waste at Wongawilli in 1985 (Ref. 1). Further detailed investigation is currently being undertaken into ocean disposal of coal washery reject, which indicates no greater acceptability than submitted to the Wongawilli Inquiry.

The disposal of both fine and coarse coal washery reject at sea has been practised in Australia and overseas, but is not now occurring in this country. Objections have been raised and concern expressed over the possible destruction of marine habitats, adverse effects on the fishing industry, and the risk of pollution by material being carried onto the shore. For these reasons it is not considered as a serious alternative, particularly in the short to medium term.

The disposal of coal washery reject material into underground mine workings has been practised overseas, but is now declining. It was used in collieries where the longwall advancing method of coal extraction was employed. In Australia, this mining system is not used as the longwall retreating method is found to be more efficient. The National Coal Board of Great Britain has now largely abandoned the practice of underground disposal due to economic and safety considerations. It was used there primarily for support and not as a disposal method. In this country, severe doubts exist concerning the safety of the method and in fact mining unions are opposed to its use for this reason. It is therefore not considered to be a viable alternative means of disposal for coal washery reject material.

The use of fluidised bed combustion as a means of generating power from low grade fuels such as coal washery reject has received much attention in recent years. However, there are some inherent disadvantages in terms of ash disposal, fuel preparation, pollution control and capital cost. The combustion results in only a 30% reduction in weight of the reject and an even smaller reduction in volume. This method is not economically acceptable as a means of disposal at present nor is it likely to be in the immediate future and has only been developed to the pilot plant stage in this country.

These methods are discussed in the Coal Reject Disposal Sub-Committee Report on Coal Reject Disposal in the Southern Coalfields (Ref 2), which concluded that surface emplacement is the only environmentally and economically feasible means of disposing of substantially all coal reject in the foreseeable future. This view was supported by Commissioner Simpson at the Public Inquiry into disposal of steelworks industrial waste (including coal washery reject) at Wongawilli (Ref. 1).

Given that none of these alternative methods of disposal are viable at present and that it is unlikely that other volume outlets or uses for these waste materials will develop in the short term, landfilling must continue to be the only feasible method of disposal.

3.5 Alternative Emplacement Sites

3.5.1 Site Assessments

The requirements of the Company for coal washery reject disposal are to ensure adequate capacity, either alone or in conjunction with other preferred disposal sites, to emplace the projected volume of coal washery reject from the estimated coal reserves. For the Catherine Hill Bay region, it is estimated that the recoverable reserves in the Chain Valley and Wallarah Colliery Holdings are some 220 million tonnes contained in the Wallarah, Great Northern and Fassifern Seams. It is estimated that this will produce some 50,000,000 tonnes (32,000,000 m^3) of coal washery reject.

For a disposal site to be satisfactory :

(i) the emplacement must be both geotechnically and structurally stable;

(ii) it must be as close as possible to the Coal Preparation Plant as this minimises transportation, particularly on the public road system;

(iii) if possible, no transport of coal washery reject on the public road system should be required;

(iv) no transport of coal washery reject on or across the Pacific Highway is acceptable;

(v) the site must be suitable to dispose of coal washery reject on a 24 hour basis;

(vi) the site must be suitable for heavy truck access (approximately 75-85 truck loads per day for 2,500,000 tpa capacity and about 260-270 truck loads per day for 5,000,000 tpa capacity);

(vii) it must be possible to develop the emplacement without environmental problems; and

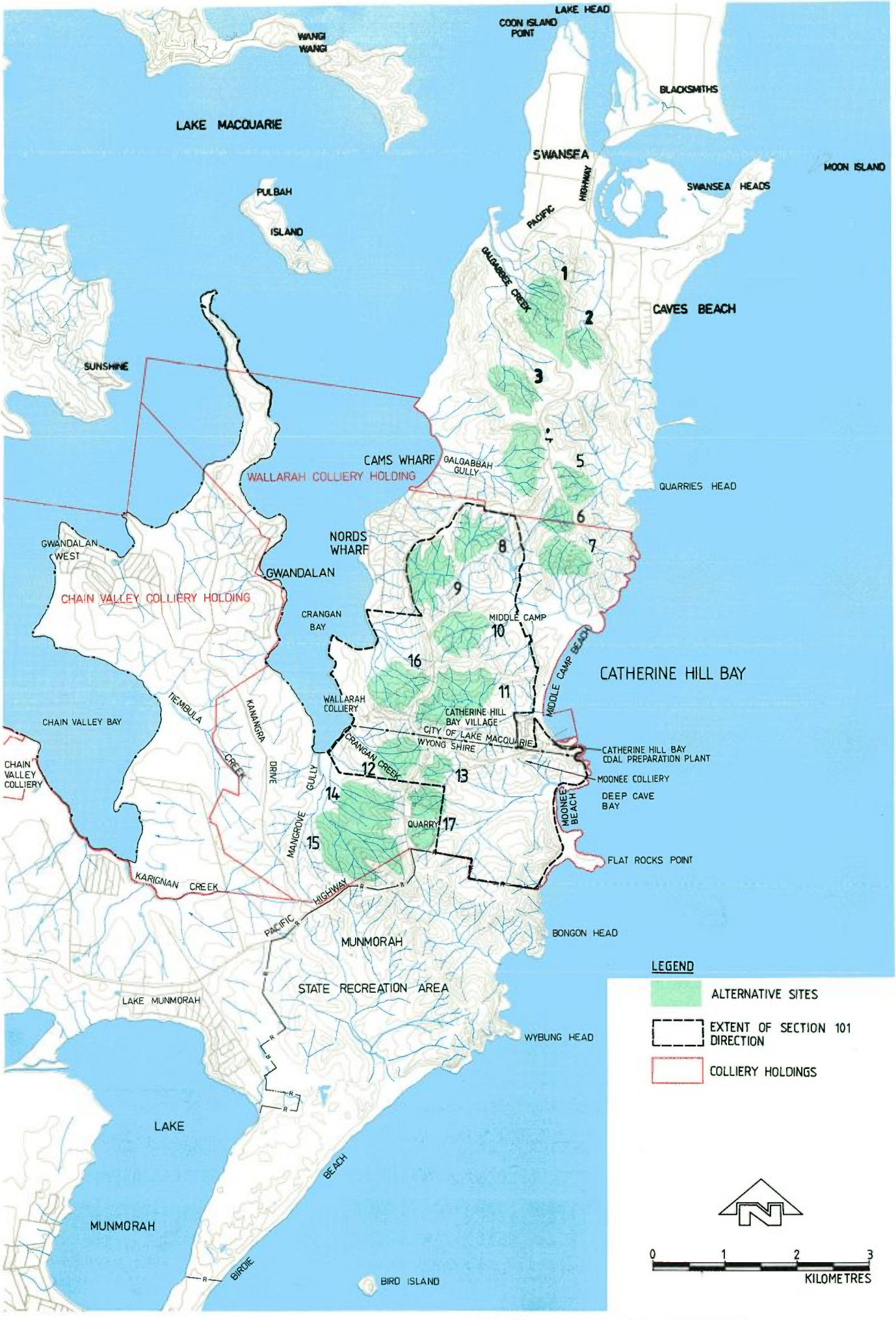
(viii) the finished emplacement must be compatible with the surrounding landscape and return the land to the present open space character.

All potential disposal sites, which met these criteria, and some others within economic trucking distance, were assessed. The locations extended as far north as Swansea and south to the town of Lake Munmorah. Valleys on both sides of the Pacific Highway were considered as possible sites. A brief description of each site is included in Appendix A of this report. Table 2 is a summary of the assessment made of each site, which are located on Figure 8.

3.5.2 Discussion of Sites Reviewed

All the sites described in Table 2 were capable of being used for the disposal of coal washery reject material. Other areas were also investigated, but existing development or the nature of the terrain made them inappropriate for further consideration. Areas west of Lake Munmorah township and valleys to the south of Swansea were discounted for these reasons.

Each site was assessed in relation to benefits gained by filling, and environmental factors which impose development constraints on the site. Reject material could be used to rehabilitate disturbed mining areas, or to construct roadway embankments. The use of coal washery reject in embankment fill would only be related to road embankments along the Pacific Highway through this area. Sites 8, 9, 11, 12 and 15 could facilitate a realignment of the Pacific Highway, however the Highway has only recently been upgraded to a 4-lane carriageway on a new alignment as a BiCentennial Project, funded by the Federal Government. Personal discussions with members of the Department of Main Roads indicated that no future realignment was being considered for this part of the Highway, as the Northern Expressway



ALTERNATIVE COAL WASHERY REJECT EMPLACEMENT SITES

FIGURE 8

will be constructed on the west side of Lake Macquarie and extended north beyond Newcastle. This will mean that the Pacific Highway through Swansea will only be used for destinations in the Newcastle area.

There are several quarries in the area which have been abandoned but their capacity for coal washery reject storage, if restricted to the quarry areas only, is very limited. To accommodate a significant quantity of coal washery reject the development would need to extend beyond the existing quarry onto undisturbed area, so that the emplacement would probably have more environmental impact than the abandoned mining area. Sites 1, 6 and 17 are mine or quarry sites close to, but not visible from the Pacific Highway. Smaller quarries in the area were not considered because their areal disturbance is very limited.

Many sites inspected had specific environmental factors which would either constrain development, or make the site inappropriate for the Company's requirements. However, access to the sites was a common factor that could be used to compare individual sites with each other.

The road network in the study area is a major consideration when determining the most appropriate site for reject disposal. The two major roads through the study area are :

(i) the Pacific Highway, and

(ii) Flowers Drive.

Both have environmental factors which make them unsuitable for transport of coal washery reject by truck. Use of the Pacific Highway creates a conflict between fast moving through traffic and slow moving local traffic. Use of Flowers Drive is inappropriate because this road has a narrow carriageway and passes through the townships of Catherine Hill Bay and Middle Camp.

Transport of Coal Washery Reject by Truck Avoiding the Pacific Highway and Flowers Drive (Sites 8, 9, 10, 11, 13, 17)

The only sites that will not require the use of the Pacific Highway or Flowers Drive are sites 8, 9, 10, 11, 13 and 17. Sites 8, 9, 10, and 11 can be made accessible from the Company's haul road from Catherine Hill Bay by constructing a new private haul road. Sites 13 and 17 would have access from the southern public access road to Catherine Hill Bay.

Sites 10, 11 and 13 have been inspected to determine the significance of vegetation communities on each site. Sites 10 and 11 are adjacent valleys with similar vegetation communities, although vegetation on site 10 is considered to have higher conservation value than Site 11. Site 13 has been limited in extent to avoid areas of Moonee Creek catchment and also the pocket of Forest with Cabbage Tree Palms in the upper area of the catchment was avoided in identifying an appropriate emplacement site in an open woodland area. Site 17 covers areas of the Moonee catchment that have been affected by quarrying operations.

Within the local environment, Site 13 and Site 17 are adjacent to Munmorah State Recreation Area and the area proposed to be acquired by the Government from Coal & Allied (see Section 4.2). These sites are closer to, and therefore more prominent, in the view from Munmorah State Recreation Area than Sites 8, 9, 10 and 11. All six sites are visible from the Pacific Highway. Although filling on Site 17 is within an area previously disturbed by quarrying, an emplacement could expand the existing visual impact, which is small at present because of adjacent tree cover.

Based on environmental factors and using trucks to transport the coal washery reject material, the most appropriate individual site for development is Site 11.

Transport of Coal Washery Reject by Conveyer to Avoid Transport along Pacific Highway (Sites 12, 14, 15, 16)

If tailings were dewatered or disposed of in some other way, it may be possible to use a second conveyor system to return the coal washery reject to the western side of the Pacific Highway without interfering with traffic flow along the Pacific Highway. The coal washery reject material could then be stockpiled west of the Highway and transported by truck along private haul roads to valley sites in the vicinity of the Wallarah Colliery without using the Pacific Highway. This handling procedure would be expensive to develop. Sites 12, 14, 15 and 16 on the western side of the Pacific Highway, with access from Wallarah Colliery, have limited capacities and at least two of these sites would have to be developed consecutively to dispose of approximately 10 million m^3 of reject generated by the Coal Preparation Plant. These sites have been inspected generally for significant vegetation communities. None have been found.

The western side of the peninsular is visible from the waterfront residential area of Gwandalan. The extent of clearing required for each site would create a visible discontinuity to the tree canopy in the views from this residential area.

From both economic and environmental perspectives, Site 11 is again the preferred location for an emplacement, where reject is not transported along the Pacific Highway.

Transport of Coal Washery Reject along the Pacific Highway (Sites 3, 4, 5, 6, 7)

Sites 3 and 4 on the western side of the Pacific Highway would only be accessible via the Pacific Highway and the use of a conveyer to underpass the Pacific Highway would not significantly reduce the impact of transporting reject along the Pacific Highway. These sites are further away and with similar environmental impacts to other sites on the western side of the peninsula but with increased environmental effects related to traffic movement along the Pacific Highway.

Sites north of Catherine Hill Bay, but east of the Pacific Highway, would require a right-turning lane on the Pacific Highway to cross south bound traffic or transport along Flowers Drive through Middle Camp.

Development of Sites 5, 6, and 7 would have high haulage costs without gaining any benefits in comparison to an emplacement development on Sites 11 and 13. The haulage distance along the Highway is both an economic and environmental constraint. Haulage through Middle Camp is unacceptable.

Site 1 is the only site east of the Highway where landfill may improve the site condition. However the landform proposed to accommodate sufficient volume to make it an alternative site extends landfill well beyond the area presently disturbed. The completed emplacement would be suitable to be included in a passive recreation facility as it lies on the outskirts of Swansea. The disadvantage of this site is its distance from the Coal Preparation Plant and the necessity for trucks to transport the coal washery reject along the Pacific Highway. A new intersection would be required at Scenic Drive to facilitate trucks turning right from the Pacific Highway.

The benefits to be gained by rehabilitating Site 1 are difficult to assess in economic terms, but the transport cost of filling at this site will far exceed the cost of filling at Site 11 or Site 13. This site could be rehabilitated with a smaller filling operation restricted to disturbed areas. It would cost less and cause less disturbance to the local environment than the emplacement described in the Site 1 description.

3.5.3 Conclusion

The most suitable sites for an emplacement in the vicinity of Catherine Hill Bay are Sites 11 and 13, which together have a combined capacity of 10,300,000 m^3. This meets the Company's objective to provide coal washery reject disposal capacity for the proposed output from the Catherine Hill Bay Coal Preparation Plant for the next 20 years or so.

A landform for an emplacement on Site 11 was determined to maximise the storage capacity for the site taking environmental factors into account, with particular emphasis on visual impact from the Pacific Highway. This emplacement has a capacity of 9,600,000 m^3. The Moonee Creek emplacement (Site 13) has a capacity of some 700,000 m^3 (excluding additional capacity obtained by quarrying the ridge gravel prior to emplacement of the coal washery reject).

Other available sites which could be used without acquiring land outside the Comapny's freehold (Sites 8,9,10,12 and 16) would add an additional 25,500,000 m^3 of emplacement capacity. These sites could be developed without trucking on public roads and with minimal environmental impact. They are all within the area of land covered by the Minister for Planning and Environment's Section 101 direction (see Section 4.3 and Figures 4, 8 and 10) and would add another 35 years of emplacement disposal capacity at planned rates of production.

As discussed in Section 3.5.1., the estimated recoverable reserves of 220,000,000 tonnes in the Company's existing Chain Valley Colliery and Wallarah Colliery Holdings will produce some 32,000,000 m^3 (50,000,000 tonnes) of coal washery reject, which is within the combined capacity of Sites 8, 9, 10, 11, 12, 13 and 16 and which consequently could be satisfactorily disposed of by land emplacement close to the Catherine Hill Bay Coal Preparation Plant.

However, within the time frame of indentified emplacement capacity (22 years for Sites 11 and 13 and 35 years for Sites 8, 9, 10, 12 and 16) technological advances may identify more appropriate methods than landfill for disposal of coal washery reject. The most appropriate method for coal washery reject disposal in the long term may prove to be off-shore dumping, which at this stage requires intensive investigation to determine what effects off-shore dumping will have on the marine environment.

3.6 Consequences of Not Proceeding, and Justification for the Proposed Developments

The proposed developments are required to upgrade the existing Catherine Hill Bay Coal Preparation Plant to meet the changing market demand for steaming coal, and to enable the production potential of the Company's three regional collieries to be realised.

Since the Catherine Hill Bay Coal Preparation Plant was commissioned, advances in coal preparation technology have been made to increase the efficiency of coal recovery. Further, the trend in many overseas markets is towards lower ash steaming coals. In order to meet this requirement and to maintain its competiveness in the marketplace, the Company must install more intensive coal cleaning processes at Catherine Hill Bay. These developments are required to ensure the continuity of economic mining operations in the region, which is confidently estimated to be in the order of 50 years and are essential if the Company is to expand its current production and employment levels.

Failure to proceed with the development will lead to a loss of market share, a reduction in employment and lower export earnings.

TABLE 2 : SUMMARY OF ALTERNATIVE COAL WASHERY REJECT EMPLACEMENT SITES

SITE		1	2	3	4	5
(i)	Location	East of Pacific Highway Abandoned Quarry Caves Beach	East of Pacific Highway Gully behind Caves Beach	West of Pacific Highway opposite Scenic Drive turnoff to Caves Beach	West of Pacific Highway North of Cam's Wharf	East of Pacific Highway East of Camp Yondaio
(ii)	Storage Capacity	7.6 million m^3	6.0 million m^3	4.9 million m^3	4.2 million m^3	2.7 million m^3
(iii)	Distance from C.P.P.	11.5km	11km	9.5km	7km	9km
ENVIRONMENTAL CONSIDERATIONS						
(i)	Topography	Shallow Valley	Steep Valley	Valley	Shallow Valley	Narrow Valley
(ii)	Vegetation	70% undisturbed woodland 30% disturbed	60% undisturbed woodland 40% cleared	Undisturbed Woodland	Undisturbed Woodland	Undisturbed Woodland with groves of Livistona australis along creek line
(iii)	Visibility	Restricted	Visible from residential area	Restricted	Visible from local residential area	Visible from Camp Yandaio
(iv)	Stability	Stable	Stable	Stable	Stable	Stable
(v)	Catchment Area draining through site	56ha	55ha	50ha	54ha	17ha
SOCIAL CONSIDERATIONS						
(i)	Zoning	7(a) Environmental Protection (Scenic)	7(a) Environmental Protection (Scenic) 2(a) Residential A	7(a) Environmental Protection (Scenic)	7(a) Environmental Protection (Scenic)	7(a) Environmental Protection (Scenic)
(ii)	Land Use	Unofficial garbage dump	Vacant	Vacant	Vacant	Vacant
(iii)	Local Housing	800m east of site	Adjacent to E boundary	1 house overlooks site	Residences 500m SW of site	Youth Hostel on boundary of site
(iv)	Operating Restrictions on site	No	Yes	No	No	Yes
(v)	Highway Access	Yes	Yes	Yes	Yes	Yes
(vi)	Future Benefit	Rehabilitation of quarry	Limited Benefit	Nil	Nil	Nil
ECONOMIC CONSIDERATIONS						
(i)	Access	Upgrade Highway Intersection	Upgrade Highway Intersection and road access	New Highway Intersection and road access	Access from Cam's Wharf Road	Access from Flowers Drive
(ii)	Rehabilitation	Restoration of indigenous species	Restoration of indigenous plant species	Restoration of indigenous plant species	Restoration of indigenous plant species	Restoration of indigenous plant species
(iii)	Relocation of Service	Nil	Nil	Nil	Nil	Nil
SUITABILITY		Yes	No (Zoning and Proximity to houses)	Yes	Yes	Yes#
IN SECTION 101 DIRECTION ENVELOPE OR NOT		**No**	**No**	**No**	**No**	**No**

Technically suitable but not recommended

TABLE 2 : (CONT'D) SUMMARY OF ALTERNATIVE COAL WASHERY REJECT EMPLACEMENT SITES

SITE		6	7	8	9	10
(i)	Location	East of Pacific Highway at Mine Camp	East of Pacific Highway North-East of Middle Camp	East of Pacific Highway North of Middle Camp	East of Pacific Highway North West of Middle Camp	East of Pacific Highway West of Middle Camp
(ii)	Storage Capacity	2.9 million m^3	4.1 million m^3	4.7 million m^3	6.9 million m^3	5.2 million m^3
(iii)	Distance from C.P.P.	7.5km	8km	5.0 km	4 km	3km
ENVIRONMENTAL CONSIDERATIONS						
(i)	Topography	Shallow Valley	Shallow Valley facing south	Broad Shallow Valley	Broad Steep Valley	Broad Valley
(ii)	Vegetation	Generally cleared woodland	Undisturbed Woodland	Undisturbed Woodland	Undisturbed Woodland	Undisturbed Woodland
(iii)	Visibility	Restricted Visibility from Pacific Highway	Restricted Visibility from Middle Camp	Restricted Visibility from Pacific Highway	Restricted Visibility from Pacific Highway	Restricted Visibility from Pacific Highway
(iv)	Stability	Stable	Stable	Stable	Stable	Stable
(v)	Catchment Area draining through site	34ha	37ha	53ha	64ha	67ha
SOCIAL CONSIDERATION						
(i)	Zoning	7(a) Environmental Protection (Scenic)	7(a) Environmental Protection (Scenic)	7(a) Environmental Protection (Scenic)	7(a) Environmental Protection (Scenic)	7(a) Environmental Protection (Scenic)
(ii)	Land Use	Abandoned Mining Areas	Vacant	Vacant	Vacant	Vacant
(iii)	Local Housing	Remote	Residence 500m from site Access passes close to housing	Remote	Remote	150m from outskirts of Middle Camp
(iv)	Operating Restrictions on site	No	Yes	No	No	No
(v)	Highway Access	Yes	Yes	Yes	Yes	No
(vi)	Future Benefit	Limited benefit	Nil	Nil	Nil	Nil
ECONOMIC CONSIDERATIONS						
(i)	Access	Access from Flowers Drives	Access from Flowers Drive	Access from Flowers Drive	Access from Flowers Drive	Access from private haul road
(ii)	Rehabilitation	Restoration of indigenous plant species	Restoration of indigenous plant species species	Restoration of indigenous plant species	Restoration of indigenous plant species	Restoration of indigenous plant species
(iii)	Relocation of Services	Relocation of minor road	Nil	Nil	Nil	Relocation of power line
SUITABILITY		Yes	Yes#	Yes	Yes	Yes
IN SECTION 101 DIRECTION ENVELOPE OR NOT		**No**	**No**	**Yes**	**Yes**	**Yes**

Technically suitable but not recommended

TABLE 2 : (CONT'D) SUMMARY OF ALTERNATIVE COAL WASHERY REJECT EMPLACEMENT SITES

SITE		11	12	13
(i)	Location	East of Pacific Highway West of Catherine Hill Bay Settlement	West of Pacific Highway South of Wallarah Colliery	East of Pacific Highway South of Catherine Hill Bay
(ii)	Storage Capacity	9.6 million m^3	3.8 million m^3	0.7 million m^3
(iii)	Distance from C.P.P.	2km	3km	1.5km
ENVIRONMENTAL CONSIDERATIONS				
(i)	Topography	Wide Valley	Shallow Valley	Shallow Valley
(ii)	Vegetation	Undisturbed woodland with small groves of Livistona australis along Creeks	Undisturbed Woodland	Significant Vegetation - Heath -
(iii)	Visibility	Restricted visibility from Pacific Highway	Restricted Visibility from Pacific Highway	Visible from Bongon Point Lookout
(iv)	Stability	Stable	Stable	Stable
(v)	Catchment Area draining through site	85 ha	53ha	60ha
SOCIAL CONSIDERATION				
(i)	Zoning	7(a) Environmental Protection - Scenic	7(b) Rural - Scenic Protection I.D.O. No. 58	7(b) Rural - Scenic Protection I.D.O. No. 58 1(b) Highway Protection I.D.O. No. 58
(ii)	Land Use	Vacant	Vacant	Vacant
(iii)	Local Housing	Local Housing 250m from	Remote	Remote
(iv)	Operating Restrictions on site	No	No	No
(v)	Highway Access	No	Yes	No
(vi)	Future Benefit	Nil	Nil	Nil
ECONOMIC CONSIDERATIONS				
(i)	Access	Access from private haul road	*Access from Wallarah Colliery	Access from private haul road
(ii)	Rehabilitation	Restoration of indigenous plant species	Restoration of indigenous plant species	Restoration of indigenous plant species
(iii)	Relocation of Services	Telecom Cable and Power line will need to be raised	Nil	Yes (Telecom Cable)
SUITABILITY		Yes	Yes	Yes
IN SECTION 101 DIRECTION ENVELOPE OR NOT		**Yes**	**Yes**	**Yes**

* Use of conveyor between Coal Preparation Plant and Wallarah Colliery

TABLE 2 : (CONT'D) SUMMARY OF ALTERNATIVE COAL WASHERY REJECT EMPLACEMENT SITES

SITE		14	15	16	17
(i)	Location	West of Pacific Highway opposite quarry, South of Wallarah Colliery	West of Pacific Highway behind service station South of Wallarah Colliery	West of Pacific Highway North of Wallarah Colliery	East of Pacific Highway South of Catherine Hill Bay Settlement
(ii)	Storage Capacity	4.7 million m^3	9.0 million m^3	4.9 million m^3	2.9 million m^3
(iii)	Distance from C.P.P.	4.5km	5.5km	3.5km	2km
ENVIRONMENTAL CONSIDERATIONS					
(i)	Topography	Two gullies	Two gullies	Valley	Steep Valleys
(ii)	Vegetation	Undisturbed Woodland dense understorey	Generally undisturbed woodland	Generally undisturbed woodland cut by powerline easements	Disturbed woodland generally cleared
(iii)	Visibility	Limited visibility from the Pacific Hwy and Gwandalan	Limited visibility and from Pacific Hwy and and Gwandalan	Limited visibility from Pacific Hwy and Gwandalan	Restricted visibility from Pacific Highway
(iv)	Stability	Stable	Stable	Stable	Stable
(v)	Catchment Area draining through site	49ha	100ha	48ha	50ha
SOCIAL CONSIDERATION					
(i)	Zoning	6(a) Open Space - Recreation I.D.O. 58	6(a) Open Space - Recreation 6(b) Open Space - Special Purposes 7(b) Rural - Scenic Protection I.D.O. No. 58	7(a) Environmental Protection (Scenic)	7(b) Rural - Scenic Protection 7(e) Coastal Land Acquisition I.D.O. No. 58
(ii)	Land Use	Vacant	Vacant	Vacant	Active Quarry
(iii)	Local Housing	Remote	Remote	Remote	No
(iv)	Operating Restrictions on Site	No	No	No	No
(v)	Highway Access	Yes	Yes	Yes	No
(vi)	Future Benefit	Nil	Nil	Nil	Rehabilitation of Disturbed Area
ECONOMIC CONSIDERATIONS					
(i)	Access	* Access from Wallarah Colliery	* Access from Wallarah Colliery	* Access from Wallarah Colliery	Access from Coal Preparation Plant
(ii)	Rehabilitation	Restoration of indigenous plant species	Restoration of indigenous plant species	Restoration of indigenous plant species	Restoration of indigenous plant species
(iii)	Relocation of Services	Nil	Nil	Relocation of Power Lines	Nil
SUITABILITY		No	No	Yes#	Yes
IN SECTION 101 DIRECTION ENVELOPE OR NOT		**No**	**No**	**Yes**	**No**

* Use of conveyor between Coal Preparation Plant and Wallarah Colliery
\# Technically suitable, but not recommended

4.0 THE EXISTING ENVIRONMENT

4.1 Location of Site and Study Area

The Catherine Hill Bay Coal Preparation Plant, the coal stockpile facilities, the ship-loading jetty and the coal washery reject and tailings disposal areas are located at Catherine Hill Bay, on the New South Wales Central Coast, some 30 km south of Newcastle, as shown on Figures 1 and 2.

Wallarah Colliery is situated to the west of the Pacific Highway, near the shores of Crangan Bay, which is part of Lake Macquarie and Moonee Colliery is located on the coast, to the east of the Pacific Highway near the village of Catherine Hill Bay. A third pit-top facility, Chain Valley Colliery, is located at Chain Valley Bay on Lake Macquarie, near the Vales Point Power Station.

The study area referred to in this report extends generally from Swansea in the north to Lake Munmorah in the south, covering the area examined for potential coal washery reject emplacements, as shown on Figures 2 and 8, and is broadly the same as the "Swansea Unit" in the Lower Hunter Landscape Improvement Study (Ref. 3).

4.2 Land Use

The area of surface freehold owned by the company is shown on Figure 9. It extends south to the Munmorah State Recreation Area, and north to the Camp Yondaio Youth Hostel Reserve.

As a consequence of the Company's foresight in acquiring surface freehold in the area, the local area is generally undeveloped. There have been some quarrying activities on Company owned land in the past, but today the use of this land is restricted to the current coal related activities centred at Catherine Hill Bay and the pit-top areas - Moonee Colliery and Wallarah Colliery.

Mining has been the major industry in the area since the 1870's. The pit-top entry to the Wallarah Seam was originally located to the west of Middle Camp, but as the underground workings moved further from Middle Camp, the Moonee Entry was established. Subsequently the present pit-top for the Wallarah Colliery was established on the eastern shore of Crangan Bay.

The jetty at Catherine Hill Bay is the focus of the present coal handling operations. The Coal Preparation Plant established in 1964, the coal stockpiles and the jetty cover an area of 32 ha to the south-east of Catherine Hill Bay village and are separate from and yet identifiable with the residential area.

The townships of Middle Camp and Catherine Hill Bay were developed by the mining company originally to house personnel working in the mines. Then, as higher living standards were demanded, the workforce moved from these early settlements into the residential areas of Swansea and Doyalson. Some of the houses in Catherine Hill Bay and Middle Camp were sold by the company so that the majority of the present residents of these townships are no longer directly related to the mining operations which initially established them. Other nearby residential areas are located at Nords Wharf and Cam's Wharf on the foreshores of Lake Macquarie.

Another major development in the area is the Pacific Highway. The Highway originally passed through the villages of Catherine Hill Bay and Middle Camp but was relocated along the main ridgeline up the peninsular to Swansea. This route, recently realigned and upgraded, has been a major factor in consideration of alternative options for the proposed development.

Middle Camp Beach covers the beach between Middle Camp and Catherine Hill Bay. There is a Surf Club building at the south end of the beach, which is within 100 metres of the jetty used to load colliers for Sydney and Newcastle.

Moonee Beach, another popular beach, is located to the south of the Coal Preparation Plant. It has road access only through Company-owned land, but forms a part of the land to be acquired by the Government under the Coastal Lands Acquisition Programme for the extension of the Munmorah State Recreation Area, which is a newly established park on the Central Coast. It has an area of 1,050 ha covering valleys, coves and beaches similar to the Company owned land to the north. The present northern boundary of the Recreation area is some 2 km to the south of Catherine Hill Bay village, but this will be extended to the north as a part of the agreement between the Company and the N.S.W. State Government to transfer a part of the Moonee Valley, including the Moonee Valley wet heath areas covered by State Environmental Planning Policy No. 14 (SEPP 14), to Public Ownership (see Section 4.3).

From Bongon Head Look-out, which is near the present northern boundary of the State Recreation Area, visitors have a panoramic view north, which includes the coal handling facilities at Catherine Hill Bay in the middle distance, as may be seen in Figures 20 and 21. The current coal washery reject disposal areas are located on the southern side of the spur ridge on which the Coal Preparation Plant is located, and are the most prominent features of the development from this location.

The Camp Yondaio Youth Hostel, is located to the north of the Company owned land and has access to valleys containing rainforest communities which descend onto coastal areas of open heath.

There are a number of quarry sites in the area. The currently active quarry, operated by D and J Constructions Pty. Limited, is located on the Pacific Highway, south of the Catherine Hill Bay turnoff. The quarrying operation is partly screened from the Pacific Highway although operations have disturbed 20 ha of land. It abuts company owned land.

4.3 Zoning

Figure 10 shows the zoning for the study area under the two separate Local Environmental Plans of the City of Lake Macquarie and Wyong Shire, which are the two Local Government areas covering the proposed developments.

In the City of Lake Macquarie, Wallarah Colliery and Catherine Hill Bay Coal Preparation Plant areas are zoned 4(b): Special Industry (Coal Mining), and most of the rest of the area affected by the proposals is zoned 7(a): Environmental Protection (Scenic). A small area near the Coal Preparation Plant is zoned 7(c): Environmental Protection (Coastal Lands Acquisition).

In Wyong Shire, the proposed coal washery reject disposal area is zoned 7(b): Rural - Scenic Protection, while Moonee Colliery, the existing coal washery reject disposal area and the coal stockpile are zoned 7(e): Coastal Lands Acquisition. However it should be noted that both the Department of Environment and Planning and Wyong Shire Council acknowledge that the Company have existing use rights for these activities in Wyong Shire.

Under the provisions of both the City of Lake Macquarie Local Environmental Plan and the Wyong Shire Local Environmental Plan, the proposed developments are prohibited outside the 4(b) zoned land in the City of Lake Macquarie. When the Local Environmental Plans were exhibited, the Company lodged formal objections and also formally applied for rezoning to accommodate the overland conveyer, related stockpile facilities, related distribution conveyers and future coal washery reject disposal. Since lodging the initial objections in 1982, both Councils have considered these applications but declined to vary their exhibited Local Environmental Plans.

More recent (1985) applications to Lake Macquarie City Council have elicited the response that the concurrence of the Department of Environment and Planning would be required as well as a Local

Environmental Study in order to vary the zoning to allow the proposed developments to be approved. The situation is the same in Wyong Shire.

For the proposed Stage 2 developments, the Company has requested the Minister for Planning and Environment to issue a direction under Sections 101(1) and 101(2) of the Environmental Planning and Assessment (Amendment) Act, 1985, to enable the Minister to determine the proposed Stage 2 development proposal in spite of the present prohibitive zoning.

It should be noted that, in any event, the proposed Stage 2 development is 'Designated' development and would have been subject to determination by the Minister for Planning and Environment under the current Section 101 direction, which applies to major coal developments in many areas of New South Wales, if the impediment of zoning prohibition had not applied. In essence this means that issuing a Section 101 direction for prohibited development for this proposed development does **NOT** in any way affect any public participation rights or reduce the need for environmental impact assessment procedures. In order to apply a Section 101 direction, the Minister for Planning and Environment must be of the opinion that the direction is 'expedient in the public interest' having regard to matters of State or Regional significance. The company considers that the following matters are of relevance in this regard:

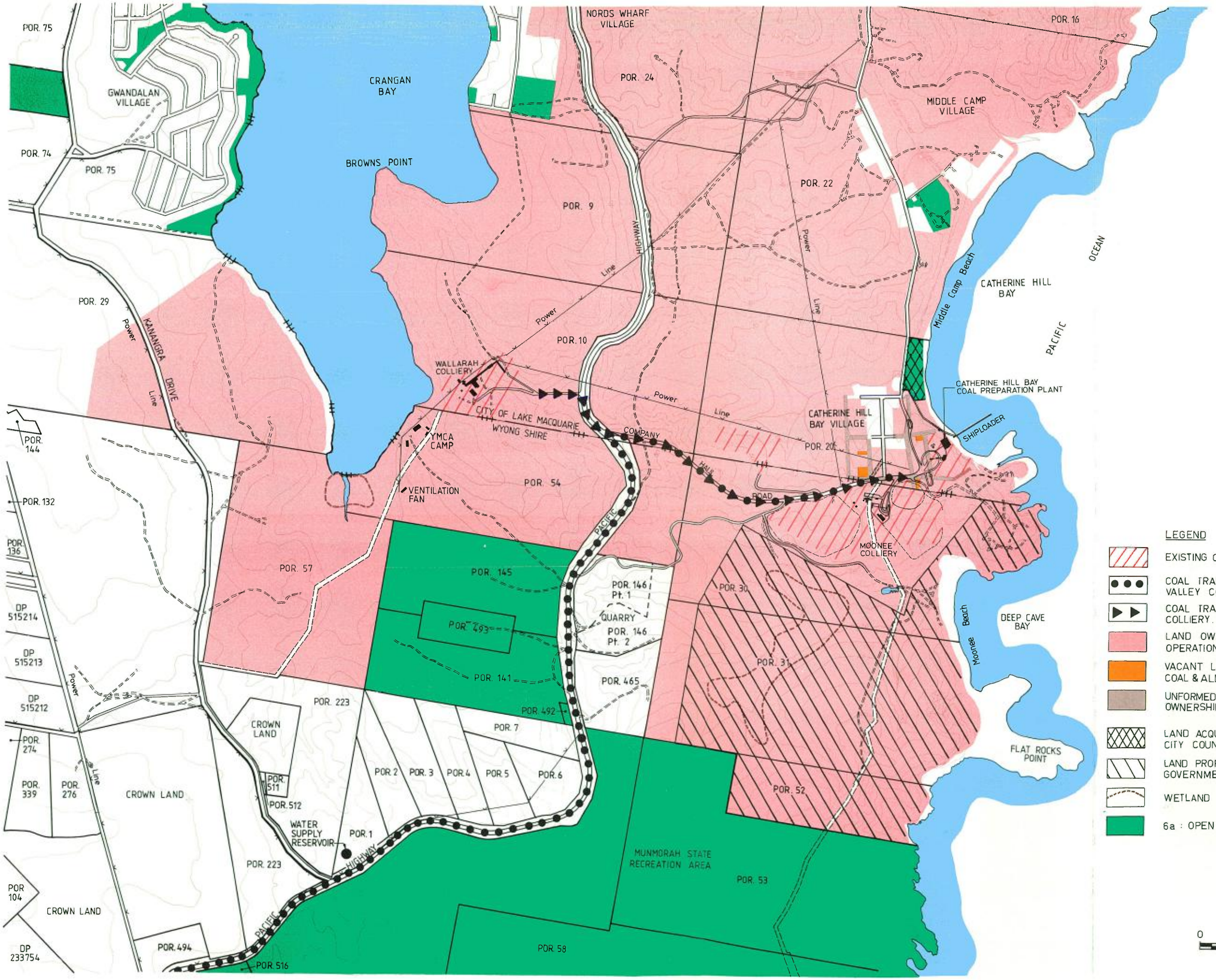
(i) the significance of the development proposal which would create 500 new jobs and involve investment of $80,000,000,

(ii) the Regional and State environmental significance of the Company's holdings in the area, which include a significant area of the coastline and a major wetland heath area identified as of State significance under SEPP-14 (Coastal Wetlands).

On 4th May, 1987, the Minister for Planning and Environment issued a direction to Lake Macquarie City Council and Wyong Shire Council covering the area of land edged in black on Figure 8 and also shown on Figures 4 and 10. The affected area is identified as 'Extent of Section 101 Direction'. The Minister's direction allows the Company to lodge valid development applications with both Councils for the proposed Stage 2 developments.

This Section 101 direction covers both the proposed Stage 2 developments evaluated in this environmental impact statement and coal washery reject emplacement no's 8, 9, 10, 12 and 16 (see Figure 8). This has been done so as to cover the area needed for emplacement of all coal washery reject from the Wallarah, Great Northern and Fassifern Seams in the Company's Wallarah and Chain Valley Colliery Holdings, if the additional emplacement areas are needed in future, as a part of the overall long term development plan to provide adequate capacity for coal washery reject disposal from all of the recoverable reserves in the Company's Wallarah and Chain Valley Colliery Holdings (see Section 3.5.3).

To the south of the existing coal related activity, the area of the wet heathland (coastal swamps) in the Moonee Creek Valley, which has been recognised in this environmental study as having very high environmental conservation value, has recently been included under the provisions of State Environmental Planning Policy No. 14. This land is presently zoned 7(e), but is now included in the area adjoining the Munmorah State Recreation Area which the Company and the N.S.W. State Government have agreed should come into public ownership and become a part of the State Recreation Area, under the Government's Coastal Lands Acquisition programme. The extent of this area is shown on Figure 9.



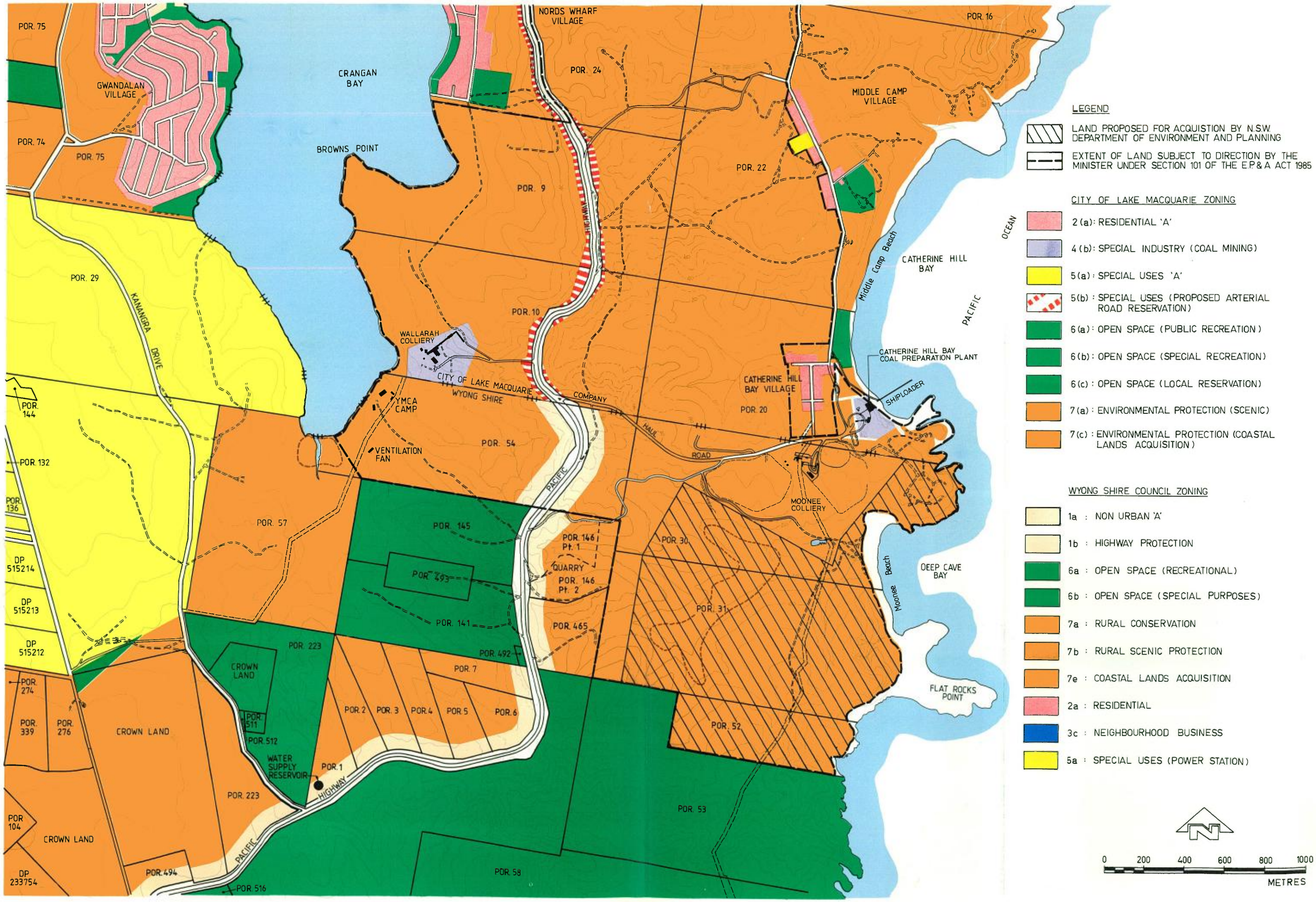
LEGEND

- EXISTING COAL MINING SURFACE FACILITIES
- COAL TRANSPORT ROUTE FROM CHAIN VALLEY COLLIERY.
- COAL TRANSPORT ROUTE FROM WALLARAH COLLIERY.
- LAND OWNED BY COAL & ALLIED OPERATIONS PTY. LTD.
- VACANT LAND PROPOSED FOR ACQUISITION BY COAL & ALLIED OPERATIONS PTY. LTD.
- UNFORMED ROADS IN COAL & ALLIED OWNERSHIP
- LAND ACQUIRED BY LAKE MACQUARIE CITY COUNCIL.
- LAND PROPOSED FOR ACQUISITION BY N.S.W. GOVERNMENT
- WETLAND PROTECTED UNDER S.E.P.P. 14.
- 6a : OPEN SPACE (RECREATIONAL)

0 200 400 600 800 1000
METRES

LAND-USE

FIGURE 9



LEGEND

LAND PROPOSED FOR ACQUISTION BY N.S.W. DEPARTMENT OF ENVIRONMENT AND PLANNING

EXTENT OF LAND SUBJECT TO DIRECTION BY THE MINISTER UNDER SECTION 101 OF THE E.P.& A ACT 1985

CITY OF LAKE MACQUARIE ZONING

- 2 (a): RESIDENTIAL 'A'
- 4 (b): SPECIAL INDUSTRY (COAL MINING)
- 5 (a): SPECIAL USES 'A'
- 5 (b): SPECIAL USES (PROPOSED ARTERIAL ROAD RESERVATION)
- 6 (a): OPEN SPACE (PUBLIC RECREATION)
- 6 (b): OPEN SPACE (SPECIAL RECREATION)
- 6 (c): OPEN SPACE (LOCAL RESERVATION)
- 7 (a): ENVIRONMENTAL PROTECTION (SCENIC)
- 7 (c): ENVIRONMENTAL PROTECTION (COASTAL LANDS ACQUISITION)

WYONG SHIRE COUNCIL ZONING

- 1a : NON URBAN 'A'
- 1b : HIGHWAY PROTECTION
- 6a : OPEN SPACE (RECREATIONAL)
- 6b : OPEN SPACE (SPECIAL PURPOSES)
- 7a : RURAL CONSERVATION
- 7b : RURAL SCENIC PROTECTION
- 7e : COASTAL LANDS ACQUISITION
- 2a : RESIDENTIAL
- 3c : NEIGHBOURHOOD BUSINESS
- 5a : SPECIAL USES (POWER STATION)

0 200 400 600 800 1000
METRES

ZONING

FIGURE 10

4.4 Planning Context

The Catherine Hill Bay area is a part of the undeveloped coastal land between the urban development in the City of Lake Macquarie at Swansea and Wyong Shire at Lake Munmorah. It forms a natural buffer between these two areas, which has been recognised as being strategically important in preventing the urban areas of Newcastle and the Central Coast joining up (Ref. 4). The area of the proposed developments is broadly within the Department of Environment and Planning's "Inter City Environmental Zone" where "further extensive urbanisation around the southern shores of Lake Macquarie" should be prevented and where it is strategically important to retain the rural and undeveloped character of the land. This includes the Company's freehold land near Catherine Hill Bay, which is still there because it has been a part of the Colliery Holding. Similarly the character of the coastal villages was developed by the coal mining activities they were built to serve.

Planning instruments and various other orders recognise these factors. The Environmental Protection - Scenic zoning of the Company's land in the City of Lake Macquarie prevents ribbon urban development there and the agreement between the Company and the Minister for Planning and Environment for Government acquisition of part of the Company's land abutting the Munmorah State Recreation Area will protect this land (see Figure 9). This includes Moonee Beach, which is owned by the Company at the present time.

It is recognised that use of the Company's freehold land to the east of the Pacific Highway, where the development is proposed, must be considered in terms of the longer term relationship of open space and coastal lands protection versus urban or other permanent change in the land use. Coal mining activity is a transient use, which is totally compatible with retention of the open space buffer function of the land. All uses proposed in this development, including coal washery reject disposal, fit into this category.

At present the Company operates a coal mine and a Coal Preparation Plant with stockpiles, coal reject emplacement and coal loading jetty at Catherine Hill Bay. These facilities are an integral part of the local environment and relate to the historic development of the settlements of Catherine Hill Bay and Middle Camp, both of which have been classified by the National Trust as Urban Conservation Areas because they are good examples of (Mining) company residential development in the late 19th century.

4.5 Wallarah Colliery Holding

The extent of Wallarah Colliery Holding is shown on Figure 2. Wallarah Colliery and Moonee Colliery extract coal from this Holding from the Wallarah and Great Northern Seams by way of two separate operations (the Wallarah Colliery at Crangan Bay and Moonee Colliery at Catherine Hill Bay). Both mine entries are used for men and materials access and for coal production. The extent of underground workings is shown in Figure 26.

4.6 Landform and Topography

The Catherine Hill Bay/Wallarah Colliery coal mining facilities are located within a narrow coastal strip of land separating Lake Macquarie and the Pacific Ocean. The peninsular is approximately 3 km wide with a main ridge, generally at R.L. 70 m but rising to a maximum height of R.L. 90 m, which is the watershed for valleys along the eastern and western sides of the ridge. These valleys, separated by secondary spurs along the main ridgeline, are generally steep sided with shallow grades across the valley floor. The Pacific Highway is located along the main ridge line.

Wallarah Colliery and the Catherine Hill Bay Coal Preparation Plant are located on opposite sides of the main ridge; the Colliery on the western side and the Coal Preparation Plant at Catherine Hill Bay and Moonee Colliery on the eastern side. Catherine Hill Bay village is located on the northern side of a secondary spur that forms the southern headland of Catherine Hill Bay. This spur lies between two

valleys - Moonee Creek to the south and Catherine Hill Creek to the north. The existing coal handling facilities lie across this spur and affect both of these valleys.

Catherine Hill Creek extends back to the main ridgeline on the peninsula and flows out into Catherine Hill Bay. It has an easterly aspect and is broken up by a number of small ridgelines between minor tributaries of Catherine Hill Creek. The valley rises from sea level to R.L. 90m along the northern ridge. The valley floor has a low grade from sea level to R.L. 20 m. Between R.L. 20 m and R.L. 50 m the valley side slopes are typically 1 vertical to 10 horizontal. Above R.L. 50 m the landform steepens to a typical slope of 1 vertical to 5 horizontal.

The Moonee Creek catchment area extends westward to the main ridgeline up the peninsular. It is a wide valley which is divided by shallow ridges into a number of small valleys. The catchment rises from sea level to R.L. 90m. The valley floor, which contains the wet heathlands, has a low grade from sea level to R.L. 30m. The valley slopes are typically 1 vertical to 10 horizontal between R.L. 10m and R.L. 50m. Above R.L. 50m, against the western ridge, the sides steepen to 1 vertical to 5 horizontal.

4.7 Geology

The geology of the study area consists generally of claystone, sandstone and shale of the Clifton Sub-group, which is part of the extensive Triassic Narrabeen Group sedimentary sequence within the Sydney Basin.

Below the Narrabeen Group strata lie the Newcastle Coal Measures, of Permian age, which contain the coal seams worked in the Catherine Hill Bay area. These coal measures outcrop in the rocky headlands along the coast between Wybung Head and Lake Entrance and also to the north of Middle Camp and in the Nords Wharf area.

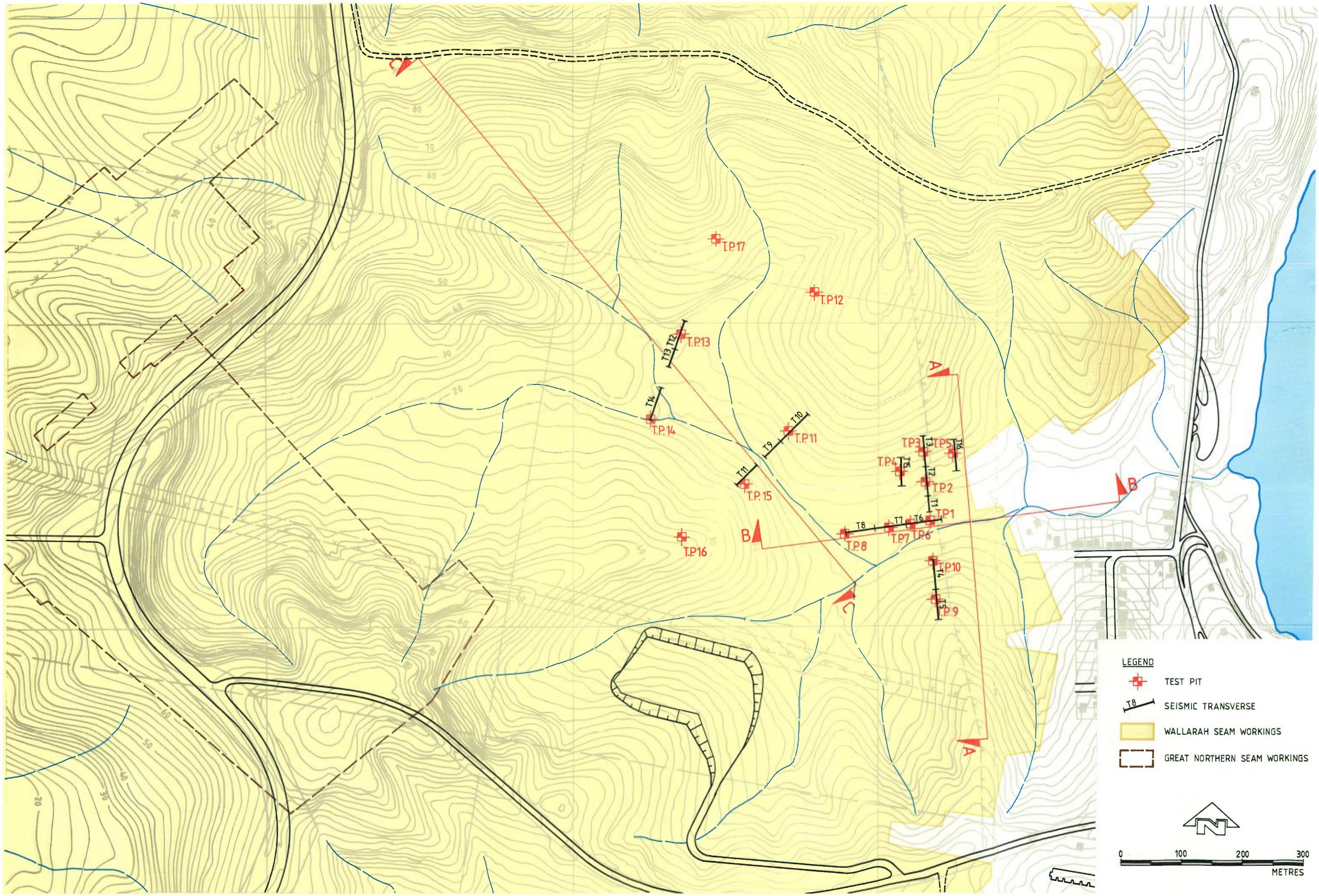
The area of the proposed overland conveyer, preferred coal washery reject emplacements, coal stockpile areas and Water Supply and Pollution Collection dams is directly underlain by sedimentary rocks of the Narrabeen Group with some overlying sandy alluvium in the valley floor. Rock outcrops are not common and most of the area has a soil cover.

4.8 Soils and Foundation Conditions

Site investigations for the proposed developments consisted of seismic profiling (to determine approximate bedrock profiles) and test pits at selected locations within the Catherine Hill Creek emplacement area and the foundation zone for the Pollution Collection Dam on Catherine Hill Creek. The location of seismic transects and test pits are shown on Figure 11.

The subsurface conditions within both proposed emplacement areas generally comprise a thin soil cover, with bedrock being exposed in some backhoe test pits in the Catherine Hill Creek Valley. Along the ridges, the soil cover generally comprises high plasticity clays, which are stiff to very stiff in consistency and grey in colour (with slight red mottling). These are thought to be residual in nature. Within the gully areas, however, the substrata generally comprises moist to wet, sands and clayey sands of colluvial origin. The underlying bedrock within this area is siltstone.

The subsurface conditions in the area of the proposed Pollution Collection Dam are variable both in nature and extent but basically comprise interlayered alluvial sands, gravels and clays. The profile consists generally of a thin veneer (around 0.5m) of moist to wet, brown/black, firm, intact clayey silt topsoil. However, the topsoil was found to be absent in some locations whilst at another the clayey silt was noted to extend to a depth of 2 metres. The underlying clays are generally moist, grey, stiff and of high plasticity. The interlayered sands were found to be generally grey, medium dense becoming clayey sands at times, whilst the gravels were generally fine to medium grained and dense.



FOUNDATION INVESTIGATIONS FIGURE 11

The depth to bedrock in this area is generally around 8 metres. However, some 80m north of the existing Catherine Hill Creek-line, along the proposed centreline of the dam, bedrock level was intersected at 16m (believed to be an old buried erosion channel). The underlying sandstone at this location is grey in colour, fresh and medium-strong to strong. A conglomerate band up to 1.7m thick was noted at depth.

The site of the Coal Preparation Plant and coal handling facilities has been generally cleared of natural surface material. It lies outside the extent of current coal mining operations in which some subsidence of the surface has occurred, but is partly above the original workings from the drifts in the cliff face.

4.9 Climate

Weather data recorded by the Bureau of Meteorology at Norah Head has been taken to be similar to the climate at Catherine Hill Bay. This coastal weather station is 14 km south of Catherine Hill Bay and has been in operation since 1969.

The rainfall in the coastal zone is higher than for inland zones. The mean annual rainfall at Norah Head is 1252 mm. The wettest 3 month period is during January, February and March, when it normally receives 36% of the annual rainfall. The driest 3 month period is during July, August and September when 16% of the annual rainfall is received. Mean monthly rainfalls are given in Table 3.

Wind data from Norah Head is presented as wind roses in Figure 12. In summer, the strongest winds are from the north-east, south-east and south with wind speeds in excess of 50km/hour; in autumn, winds are generally from the north-east and south; in winter, winds are predominantly from the south-east, south, and south-west; and in spring, winds swing back to the north-east and southerly sectors. From monthly wind records, January and September experience the strongest winds. The topography surrounding Catherine Hill Bay provides some protection against westerly winds but is generally exposed to the strong southerly and north-easterly winds, and would be classified in Terrain Category I in accordance with AS1170, Part 2 'Loading Code - Wind Forces for Structures'.

TABLE 3 : MEAN MONTHLY RAINFALL AT NORAH HEAD

	Mean Rainfall mm	Mean No. of Raindays
January	139	14
February	142	13
March	171	14
April	84	11
May	116	10
June	149	12
July	58	10
August	49	9
September	89	10
October	88	12
November	95	13
December	72	9
TOTAL	1252	137

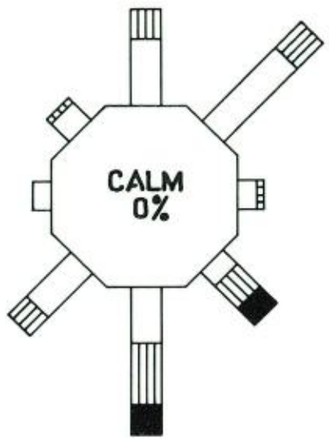
SOURCE : Bureau of Meteorology

TABLE 4 : MEAN MONTHLY TEMPERATURES FOR NORAH HEAD

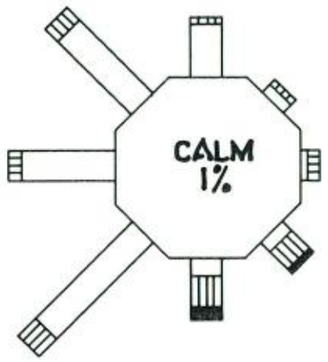
	Minimum °C	Maximum °C
January	19.4	25.1
February	19.7	25.5
March	18.6	24.7
April	15.9	22.7
May	12.9	20.1
June	10.3	17.4
July	9.1	17.1
August	10.1	18.3
September	11.9	19.9
October	14.2	21.5
November	16.0	22.7
December	18.2	25.2

SOURCE: Bureau of Meteorology

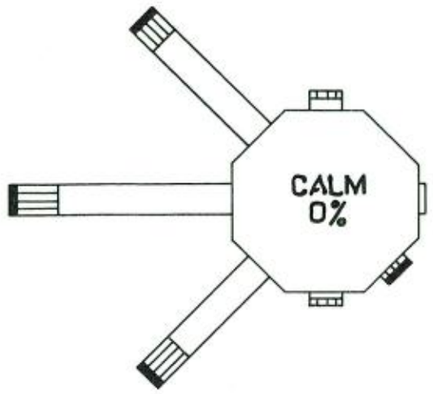
SUMMER
JAN 9am



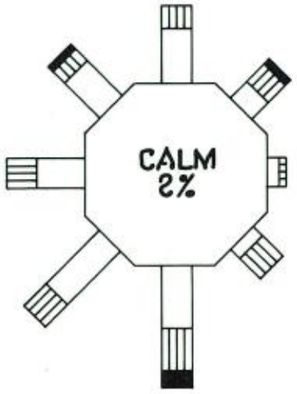
AUTUMN
APRIL 9am



WINTER
JULY 9am



SPRING
OCTOBER 9am



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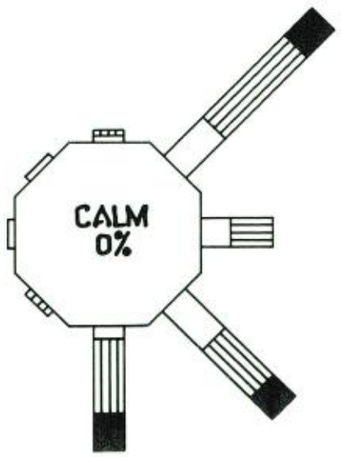

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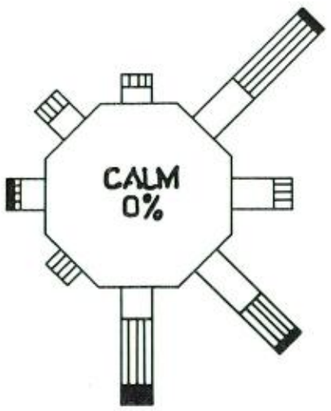

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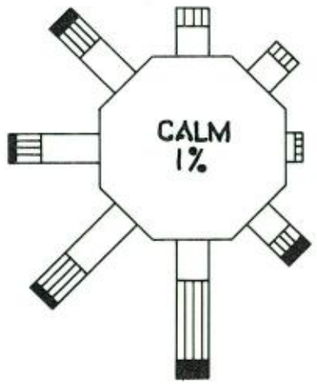
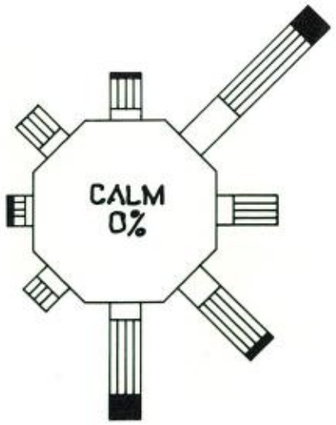
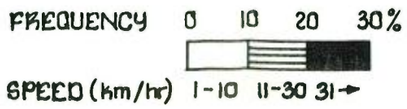


OCTOBER 3pm





WIND ROSES

FIGURE 12

TABLE 5 : MEAN RELATIVE HUMIDITY PERCENTAGES FOR NORAH HEAD

	9.00 A.M %	3.00 P.M %
January	74	76
February	89	83
March	71	67
April	62	55
May	63	55
June	67	50
July	70	62
August	79	68
September	61	57
October	64	62
November	68	69
December	69	73

SOURCE : Bureau of Meteorology

TABLE 6 : AVERAGE DAILY EVAPORATION DATA FOR MARYVILLE, NEWCASTLE

	mm/day
January	6.5
February	5.8
March	4.9
April	3.8
May	2.7
June	2.2
July	2.4
August	3.1
September	4.1
October	5.0
November	5.8
December	6.8

SOURCE : Bureau of Meterology

Temperatures along the coast are temperate with warm summers and mild winters. Table 4 shows the mean monthly maximum and minimum temperatures for Norah Head. For summer the average monthly temperatures range from 18.2°C to 25.5°C and for winter, from 9.1°C to 20.1°C.

Humidity readings are markedly higher in the summer months with the highest levels recorded in the mornings. Table 5 shows the mean monthly Relatively Humidity readings for both mornings and afternoons.

Evaporation data has been obtained from the Bureau of Meteorology Station at Maryville (Newcastle). Peak evaporation rates occur during December. Table 6 shows the average daily evaporation rates for each month.

4.11 Hydrology and Water Quality

Two catchment areas extending to the ridgeline on which the Pacific Highway has been built are affected by the existing coal operations at Catherine Hill Bay. They both drain to the ocean.

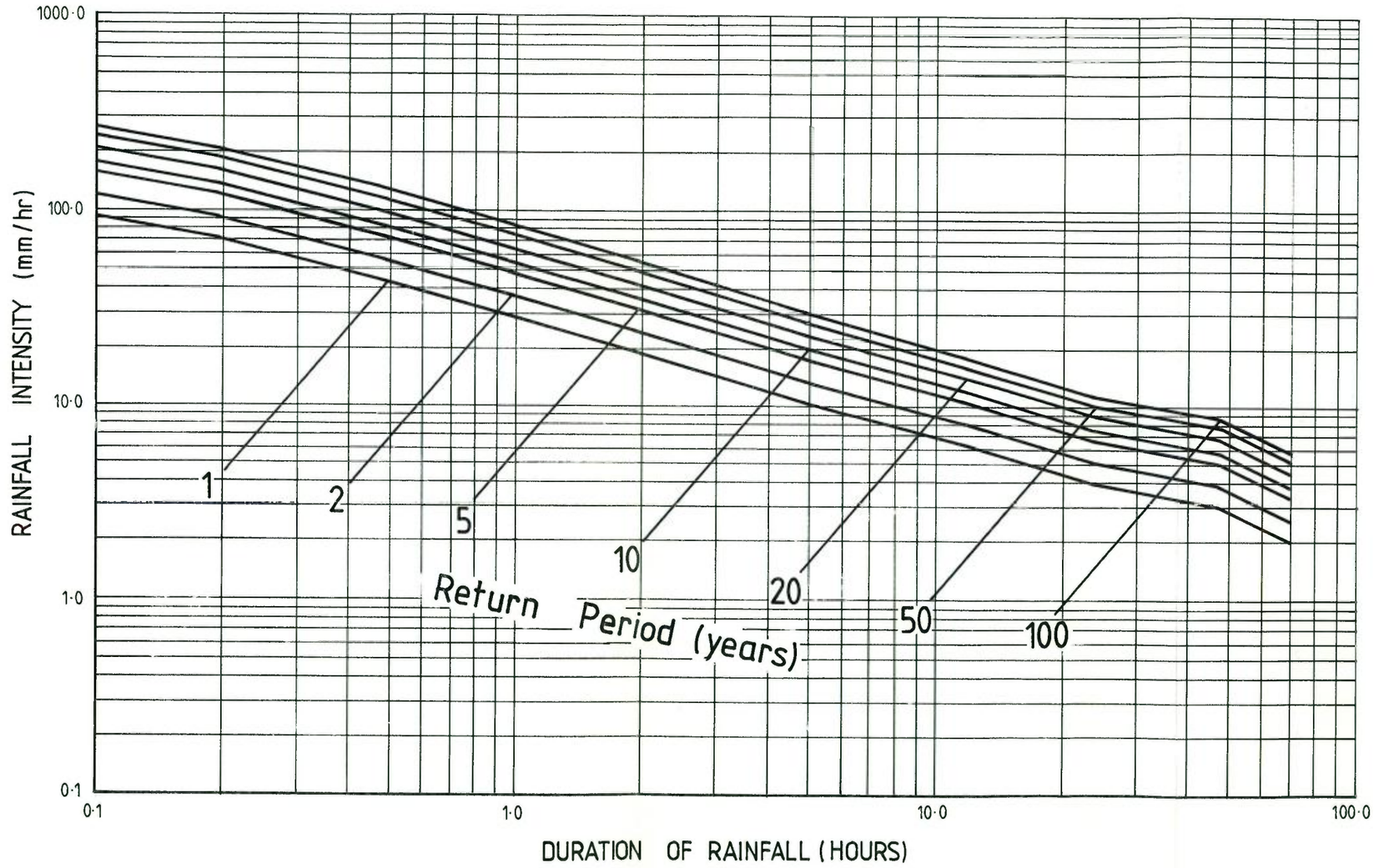
The southern catchment (Moonee Creek) drains an area of 340 ha. most of which is undisturbed. Installations in this catchment area include the Moonee Colliery, coal loading facilities, a coal reject emplacement, coal stockpile areas, a small water supply dam and water pollution control dams related to the Company's operations at Catherine Hill Bay, as well as a sand and gravel quarry which does not belong to the Company.

The northern catchment (Catherine Hill Creek) drains an area of 140 ha. which is also generally undisturbed. The village of Catherine Hill Bay lies in the area draining to the outlet of Catherine Hill Creek. Other developments within the catchment area are the coal

TABLE 7 : RESULTS OF WATER QUALITY MONITORING ON CATHERINE HILL CREEK

Test	Sampling Date 5/7/85	4/3/86	3/4/86	28/4/86	4/8/86	12/9/86	23/10/86	3/4/87
pH	5.3	6.1	5.9	8.2	7.0	6.5	7.2	7.2
Turbidity F.T.U.	11	6.6	5.0	1.5	6.0	60	25	3.8
Colour Pt/Co.	45	30	30	10	15	30	80	25
Non-filterable Residue mg/l	19	19	15	36	LT 10	79	LT 10	7
Total Dissolved Solids mg/l	480	NT	NT	NT	1500	834	876	1040
Chloride mg/l	173	NT	NT	NT	810	453	520	530
Sulphate mg/l	42.5	NT	NT	NT	96.4	56	44	58
Iron mg/l	1.3	0.04	0.04	0.01	0.18	0.57	4.4	0.28
Hardness Equivalent $CaCO_3$ mg/l	58	112	104	3713	306	138	135	202
Calcium mg/l	12	14	24	281	22	13	9.3	20
Magnesium mg/l	7	24	18.5	735	61	34	27	37

LT - Less Than
NT - Not Tested



RAINFALL INTENSITY DIAGRAM FIGURE 13

washery facilities and stockpile areas for washed coal awaiting shipment by collier to Balls Head in Sydney or the Port of Newcastle.

Both Moonee Creek and Catherine Hill Creek are classified by the State Pollution Control Commission as Class 'C' (Controlled Waterways). Water samples have been collected from Catherine Hill Creek to monitor the quality. The analyses are given in Table 7.

As rainfall intensity data based on direct observation are not available for this area, the rainfall intensity/storm duration/storm frequency characteristics have been derived using generalised procedures described in Australian Rainfall and Runoff (Ref 5). Figure 13 gives the rainfall intensities for storm durations occurring at different frequency intervals of 1 in 1, 1 in 2, 1 in 5, 1 in 10, 1 in 20, 1 in 50 and 1 in 100 years. Data for the probable maximum precipitation storms has been obtained from the Bureau of Meteorology and will be used to size the more permanent hydraulic structures in the proposed development. Table 8 summarises this information.

TABLE 8 : PROBABLE MAXIMUM PRECIPITATION (PMP) ESTIMATES FOR CATHERINE HILL CREEK

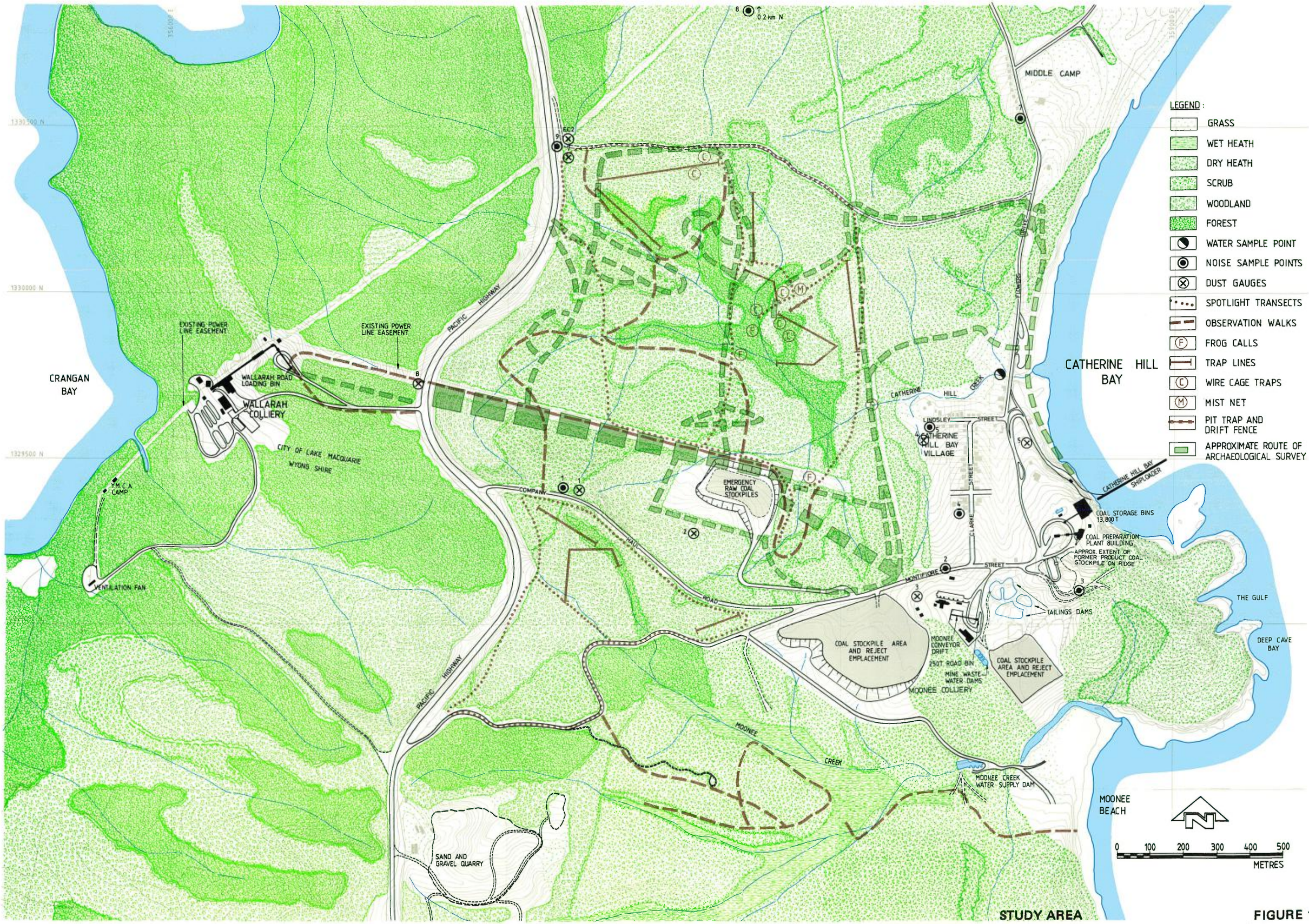
Duration (hr)	0.5	1	2	3	4	5	6
PMP (mm)	240	340	440	490	540	580	610

TABLE 9 : DUST DEPOSITION RATES FOR DUST GAUGE LOCATION E.C.2 Recorded By The Electricity Commission Of N.S.W.

Measurement of Insoluble Solids g/m^2/month

	1977	1978	1979	1980	1981	1982	1983	1984
January	2.7		-	-	-	-		0.3
		29.7					1.5	
February					-	-		
	29.7		1.2	0.3			2.5	0.5
March					-	-		
								1.9
April		7.3		1.0	-	-	-	
	7.3		0.5					0.9
May					-	-	-	
				0.7				0.3
June					-	-	-	
	0.6	0.2	0.6					0.3
July				0.3	-	-	1.0	
								0.3
August	1.1	5.4	0.4	1.1	-		1.5	
						1.6		
September	0.5				-		2.7	-
		0.5	0.9	1.6				
October	1.6				-	1.0		-
					-		0.6	
November	1.5	1.2	1.1	-	-			
						0.7		
December	-	3.2	-	-	-	1.2		-

NOTE: The location of Dust Gauge E.C.2 is shown on Figure 14.



STUDY AREA

FIGURE 14

TABLE 10 : DUST DEPOSITION MONITORING IN THE VICINITY OF CATHERINE HILL BAY

	Date Sample Collected										
	29/1/86	4/3/86	3/4/86	28/4/86	6/6/86	4/8/86	12/9/86	23/10/86	7/1/87	3/4/87#	14/5/87
	gm/m^2/month for all figures										
GAUGE 1											
Total Insoluble Solids	3.29	0.44	1.43	1.45	0.64	2.25	1.31	1.15	2.75	No	1.81
Ash	1.38	0.22	0.70	0.63	0.26	1.23	0.67	0.63	1.12	sample	1.01
Combustible Material	1.91	0.22	0.72	0.83	0.38	1.02	0.64	0.52	1.63		0.80
GAUGE 2											
Total Insoluble Solids	1.65	1.88	0.93	1.27	0.20	0.68	1.50	0.67	1.83	2.86	13.83
Ash	0.84	1.05	0.52	0.67	0.12	0.33	1.11	0.35	1.03	1.49	13.17
Combustible Material	0.81	0.83	0.41	0.61	0.09	0.35	0.38	0.32	0.80	1.37	0.66
GAUGE 3											
Total Insoluble Solids	3.96	3.38	6.11	7.83	2.02	9.55	5.90	5.04	8.39	6.71	6.12
Ash	2.21	2.08	2.99	3.58	0.86	4.24	2.84	2.74	1.86	4.03	3.33
Combustible Material	1.75	1.30	3.12	4.24	1.16	5.30	3.06	2.31	6.53	2.67	2.79
GAUGE 4											
Total Insoluble Solids	BROKEN	0.70		1.91	1.06	1.46	2.44	7.18	2.53	4.77	2.34
Ash		0.33	N.T.	0.94	0.49	0.75	1.23	5.31	1.42	1.83	1.11
Combustible Material	BOTTLE	0.37		0.97	0.58	0.71	1.20	1.88	1.11	2.94	1.23
GAUGE 5											
Total Insoluble Solids	5.13	2.86	4.16	15.22	3.34	BROKEN	24.02	1.71	14.03	0.46	4.51
Ash	2.64	1.57	1.45	13.69	2.58		17.74	0.97	8.47	0.41	2.37
Combustible Material	2.48	1.29	2.71	1.53	0.77	BOTTLE	6.28	0.74	5.56	0.05	2.14
GAUGE 6											
Total Insoluble Solids	1.83	0.57		1.03	4.16	BROKEN	0.40	4.41	1.88	3.03	0.61
Ash	1.09	0.38	N.T.	0.80	3.15		0.26	3.00	1.61	1.28	0.40
Combustible Material	0.74	0.19		0.23	1.01	BOTTLE	0.14	1.41	0.27	1.75	0.21
GAUGE 7											
Total Insoluble Solids	1.79	0.84	0.84	1.06	0.13	0.59	1.53	0.84	0.95	1.16	0.36
Ash	0.97	0.43	0.43	0.58	0.07	0.40	1.06	0.58	0.38	0.46	0.24
Combustible Material	0.82	0.41	0.41	0.48	0.06	0.20	0.47	0.25	0.56	0.70	0.12
GAUGE 8											
Total Insoluble Solids	1.63	2.54	2.08	1.26	0.32	1.07	0.38	1.92	Algal	2.72	2.13
Ash	0.93	1.35	0.82	0.58	0.19	0.56	0.21	1.42	Growth	1.63	1.21
Combustible Material	0.70	1.19	1.26	0.67	0.12	0.50	0.17	0.50	in bottle	1.10	0.92

N.T. Not tested

The locations of the dust deposit gauges is shown on Figure 14.
All gauges collected on 3/4/87 were contaminated with insects and algae to some extent.

4.11 Air Quality

The nearest dust gauge, which had been established prior to this environmental study, is located to the north-west of Catherine Hill Bay adjacent to the Pacific Highway. This gauge, designated E.C.2., is operated by the Electricity Commission and the results from January 1977 to August 1984 are given in Table 9. These figures show that background air quality is generally good. As the gauge is some distance from the Company's Coal Preparation Plant it is not necessarily indicative of dust levels closer to Catherine Hill Bay.

Air quality monitoring is also being undertaken at 8 locations near the Company's current coal activities and around the area affected by the proposed developments. The locations of these gauges are given on Figure 14 and results obtained to date are given in Table 10. Dust Gauge 7 (Table 10) is at the same location as Dust Gauge E.C.2 (Table 9).

These results show that air quality in the vicinity of Catherine Hill Bay is generally good, although there have been some occasions when coal dust blown off stockpiles and coal handling areas has caused deposition to rise. The level of dust deposition away from the Company's private haul road and coal handling areas, including beside the Pacific Highway, is generally lower than near these locations. The level of combustible deposition is higher near active coal handling areas and down wind of these facilities. This is particularly so for the coal stockpile area, which used to be located immediately to the south of the existing Coal Preparation Plant (on the ridge).

Use of this area for a stockpile has been discontinued, and it is not proposed to locate any stockpiles for the proposed development there to avoid an ongoing fugitive coal dust problem in the village of Catherine Hill Bay.

The Company presently make provisions to control dust from the Coal Preparation Plant by using an agglomerating agent within the Plant and on the shiploading conveyor system. Water tankers are used to control dust along roads, coal washery reject emplacement areas, and emergency coal stockpile areas.

levels during both the day and night. The same points were then revisited again on eight occasions during October 1986 as an additional follow-up survey twelve months later and on 6 occasions during May 1987 to confirm that typical night-time noise levels had not changed since the initial survey was undertaken in 1985. On each occasion, the minimum, maximum and L_{90} (the level which is exceeded for 90% of the time) levels were noted over a period of at least 5 minutes, and the significant noise sources noted. The background (L_{90}) and maximum levels obtained are given in Table 11 for the 1985 survey and in Tables 12 and 13 for the 1986 and 1987 surveys. In each table the results are arranged according to time of day, and the major noise sources are noted. During the period of each survey, weather conditions were good for noise measurement with fine, sunny days (partly cloudy) and cool nights. A slight breeze was noted on some occasions and all readings were taken without wind effects. Temperatures ranged from about 12°C to 22°C. All readings were taken using Bruel & Kjaer Precision Sound Level Meters, Type 2218 or 2203, which were calibrated and checked using a Sound Level Calibrator Type 4230.

The main residential area affected by the proposed Coal Preparation Plant expansion is the village of Catherine Hill Bay, represented by Sample Points 4 and 5. The main sources of noise here were found to be road traffic (particularly trucking) on both the Pacific Highway and the Company's private haul road, surf from Middle Camp Beach, the Coal Preparation Plant, birds, insects and local domestic noise.

The L_{90} levels at Point 4 (Clarke Street) were all between 42 dBA and 53 dBA and those at Point 5 (Lindsley Street) were between 37 dBA and 49 dBA. The results for both of these points showed very little variation according to time of day, though surf noise was more dominant during the night and early morning, with traffic more noticeable during the day. The results of the October, 1986 survey were similar to those obtained on the initial survey, twelve months earlier.

At both Points 4 and 5, Coal Preparation Plant and coal trucking activities were audible, but at Point 4, representing the southern part of Catherine Hill Bay village, these noise sources dominated the acoustic environment. At Point 5, which is more distant and partly shielded from the haul road, Coal Preparation Plant and colliery facilities, background and maximum levels were generally lower and caused mainly by distant traffic and surf. On some occasions (such as during May 1987) the sound of crashing surf was more dominant than at others.

In general, the maximum or peak noise levels that occurred at Point 4 were often due to coal trucking on the haul road (up to 65 dBA) in addition to less frequent local traffic. A further indication of the noise levels affecting this part of the village is given by a measurement taken of the equivalent continuous noise level (or L_{eq}). An L_{eq} reading of 51.2 dBA was obtained at Point 4 over a 20 minute period from 12.30 pm on 5th July 1985. This included sounds from the Coal Preparation Plant, trucking, birds and distant traffic. Other L_{eq} readings were taken over about 15 minutes in the middle of the day at sample Points 1 and 2, on the coal haul road, and these gave levels of between 64 and 68 dBA.

The residential areas at Middle Camp (Points 7 and 8) receive generally lower levels with surf, passing traffic and birds dominating at Point 7, and Pacific Highway traffic and birds dominating the more isolated houses near Point 8. The Coal Preparation Plant and Moonee Colliery are not contributing noise sources at these locations.

The survey indicates that the Coal Preparation Plant and particularly coal handling and trucking activities dominate the imposed (or non-natural) acoustic environment in the Catherine Hill Bay village area, at most hours of the day. Traffic on the Pacific Highway is also a major source of background noise at locations more distant from the coal handling facilities.

TABLE 11 : BACKGROUND NOISE LEVEL SURVEY, CATHERINE HILL BAY: JULY AND OCTOBER, 1985 (ALL RESULTS IN dBA)

		am 3.00–4.00 (5.7.85)	am 5.45–6.45 (30.10.85)	am 6.30–7.30 (5.7.85)	am 8.00–9.00 (30.10.85)	am 9.00–10.00 (5.7.85)	am 11.00–noon (5.7.85)	am/pm 11.00–1.00 (30.10.85)	pm 1.30–3.30 (4.7.85)	pm 4.00–5.00 (4.7.85)	pm 6.15–7.15 (4.7.85)	pm 8.30–9.30 (4.7.85)	pm 10.30–11.30 (4.7.85)	Comments
1. On haul road 200 m from Pacific Hwy.	L_{90}	45	49	51	50	50	49	49	50	51	46	48	47	- Highway traffic dominates (mainly trucks)
	L_{max}	60	88	78	73	80+	87	84	83	77	90	70	83	- Passing coal trucks
2. On haul road near mine office	L_{90}	47	50	50	50	49	48	51	53	54	51	43	49	- Moonee fans, conveyor; trucking and stockpiling
	L_{max}	85	83	83	89	88	80+	81	80	85	88	85	90	- Passing coal trucks
3. Near position of truck weighbridge	L_{90}	51	53	52	49	55	52	51	49	52	54	45	48	- Coal washery, stockpiling, fan, trucking, surf
	L_{max}	60	57	60	54	63	61	55	56	56	60	58	63	- Trucking, etc.
4. Alongside house next to hotel in Clarke St.	L_{90}	42	47	50	49	47	47	49	44	48	49	45	47	- Surf, washery, trucking activity, birds
	L_{max}	58	60	70	65	66	61	54	65	58	80	68	55	- Trucking & local traffic
5. At western end of Lyndsley St.	L_{90}	45	47	47	44	45	38	45	38	47	45	41	41	- Surf, distant traffic (on highway and haul road), birds
	L_{max}	50	63	62	49	54	57	56	52	52	51	46	48	- Birds, domestic noises
6. On ridge to north of Cath. Hill Bay	L_{90}	48	44	50	41	45	45	44	46	48	44	43	43	- Surf, distant traffic & washery, birds
	L_{max}	55	48	56	46	51	50	48	49	53	49	45	50	- Birds, plane, trucks, washery
7. Adjacent to southernmost house at Middle Camp	L_{90}	43	43	42	42	42	35	45	40	44	42	38	40	- Distant & passing traffic, surf, birds, insects
	L_{max}	48	78	72	68	82	76	71	72	76	73	45	68	- Passing traffic
8. Near house at top of hill, west of Middle Camp	L_{90}	40	43	42	39	38	34	40	42	37	40	39	39	- Distant highway traffic, birds, insects, local noise
	L_{max}	53	51	58	52	48	43	58	60	50	45	46	47	- Highway traffic, birds
9. On rise adjacent to Pacific Highway west of Middle Camp	L_{90}	47	54	53	53	52	50	50	53	54	50	49	50	- Traffic on highway adjacent
	L_{max}	65	68	72	67	67	63	63	61	62	65	63	65	- Traffic on highway adjacent

TABLE 12 : BACKGROUND NOISE LEVEL SURVEY, CATHERINE HILL BAY: OCTOBER, 1986 (ALL RESULTS IN dBA)

		am 6.20–7.20 (30.10.86)	am 8.30–9.30 (30.10.86)	am 10.15–11.45 (29.10.86)	pm 12.30–1.30 (29.10.86)	pm 3.00–4.15 (29.10.86)	pm 4.45–6.00 (29.10.86)	pm 7.45–8.45 (29.10.86)	pm 9.30–10.30 (29.10.86)	Comments
1. On haul road 200 m from Pacific Hwy.	L_{90}	49	48	48	54	46	46	43	44	- Highway Traffic
	L_{max}	86	92	88	91	78	85	52	79	- Passing coal trucks
2. On haul road near Mine office	L_{90}	52	52	52	55	51	50	53	51	- Moonee Entry fans, conveyor; trucking
	L_{max}	83	94	84	89	86	74	87	74	- Passing trucks, cars
3. Near position of truck weighbridge	L_{90}	52	52	47	50	49	50	45	47	- Washery, surf, conveyors
	L_{max}	72	65	58	56	57	69	54	48	- Trucking etc.
4. Alongside house next to hotel in Clarke St.	L_{90}	49	52	42	53	51	48	45	44	- Washery, surf, trucking
	L_{max}	59	72	74	74	71	74	80	52	- Trucking and other traffic
5. At western end of Lyndsley St.	L_{90}	44	43	37	42	39	42	40	40	- Surf, distance traffic trucking, birds
	L_{max}	53	51	52	56	48	50	47	42	- birds, plane etc.
6. On ridge to north of Cath. Hill Bay	L_{90}	45	41	45	45	45	46	45	44	- Surf, washery, distant traffic
	L_{max}	52	44	51	49	50	55	49	47	- birds, plane, traffic
7. Adjacent to southernmost house at Middle Camp	L_{90}	44	40	40	36	38	41	42	43	- Surf, traffic, birds
	L_{max}	73	70	75	77	78	81	84	87	- Passing traffic
8. Near house at top of hill, west of Middle Camp	L_{90}	44	42	38	37	37	37	35	38	- Distant traffic, birds, surf
	L_{max}	62	48	46	44	46	49	38	45	- birds, traffic etc.
9. On rise adjacent to Pacific Highway west of Middle Camp	L_{90}	52	53	52	48	47	48	48	48	- Highway traffic
	L_{max}	67	63	64	72	66	64	62	70	- Highway traffic (trucks)
10 At Bongon Trig. and Lookout	L_{90}			38		38				- Surf noise dominates
	L_{max}			44		46				

TABLE 13 : BACKGROUND NOISE LEVEL SURVEY, CATHERINE HILL BAY: MAY, 1987 (ALL RESULTS IN dBA)

		am 12.00–1.10 (14.5.87)	am 1.30–2.30 (14.5.87)*	am 3.30–4.30 (14.5.87)*	am 4.45–5.45 (14.5.87)*	am 9.15–10.15 (14.5.87)	pm 9.30–10.30 (13.5.87)	Comments
1. On haul road 200 m from Pacific Hwy.	L_{90}	45	45	47	44	47	48	- Highway traffic;
	L_{max}	60	56	90	86	90	76	- passing traffic;
2. On haul road near Mine office	L_{90}	53	51	53	51	54	51	- Washery, Moonee colliery, trucking;
	L_{max}	88	72	86	80+	88	84	- passing trucks;
3. Near truck weighbridge	L_{90}	52	50	55	54	57	54	- Washery, trucking activity;
	L_{max}	64	54	62	64	70	66	- trucking/unloading;
4. Alongside house next to hotel in Clarke St.	L_{90}	49	47	47	48	47	47	- Surf, washery, trucking;
	L_{max}	59	61	56	60	57	56	- truck movements;
5. At western end of Lyndsley St.	L_{90}	49	42	44	42	42	48	- Surf dominates, also
	L_{max}	54	46	49	48	55	54	- insects, traffic;
6. On ridge to north of Cath. Hill Bay	L_{90}	45	42	44	42	41	46	- Surf, distant traffic, insects;
	L_{max}	49	47	49	47	44	52	
7. Adjacent to southernmost house at Middle Camp	L_{90}	42	38	37	38	42	37	- Distant traffic, surf, passing traffic;
	L_{max}	47	77	43	44	77	42	
8. Near house at top of hill, west of Middle Camp	L_{90}	43	37	37	38	42	37	- Distant highway traffic, insects, birds;
	L_{max}	47	48	46	45	54	80+	
9. On rise adjacent to Pacific Highway west of Middle Camp	L_{90}	44	41	39	45	52	46	- Highway traffic dominates.
	L_{max}	64	65	63	66	70	67	

* Coal Preparation Plant (washery) not operating for most of this time

4.13 Vegetation

The vegetation in the vicinity of the proposed development between Wallarah Colliery and Catherine Hill Bay has been categorised by aerial photograph interpretation and has been mapped with the community boundaries as shown on Figure 14.

As an integral part of the alternative coal washery reject emplacement site analysis, two of the most suitable alternatives were examined in detail and a report and botanical species list were compiled for each of the two sites. These are presented in full in Appendix B. The information presented in these reports was used as critical criteria for the selection of the coal washery reject emplacement sites. The Company's criteria in selecting a suitable emplacement site are set out in Section 3.5.1.

In summary the vegetation in the area generally reflects the degree of exposure to the saline winds which blow onshore from the Pacific Ocean. The Pacific Highway, which runs along the main ridgeline separating Lake Macquarie from the Pacific Ocean, forms a visible boundary between the two major vegetation formations found in the study area.

On the more sheltered western side of the highway, Open Forest formations dominate; while the more exposed eastern side of the highway contains the lower growing Woodland and Scrub communities. Along either side of the highway there are variations in species composition and community formations but the area west of the Pacific Highway was not examined to the same degree, because the proposed development on this side of the highway is confined to areas which have already been cleared. East of the highway the vegetation communities are Woodland and Scrub, (predominantly), but also include Forest and Heath.

The **Woodland** community is dominated by Angophora costata, Eucalyptus piperita, and E. gummifera which reach a maximum height of 15-20m. This formation extends across to the north-eastern area of the proposed Catherine Hill Creek coal washery reject emplacement where there is a distinct understorey of Macrozamia communis and

some extremely old specimens of Xanthorrhoea media, (Blackboys). Elsewhere the understorey consists predominantly of Dodonaea triquetra, Acacia terminalis and Pultenaea villosa.

The **Scrub** vegetation is characteristically less than 10m in height and in this location is dominated by the Stringybarks, Eucalyptus oblonga and E. capitellata with E. haemastoma, the Scribbly Gum, and Allocasuarina littoralis. The understorey of shrubs includes Leptospermum attenuatum, Persoonia levis, Banksia marginata, Lambertia formosa, Acacia ulicifolia and Daviesia acicularis.

The **Forest** vegetation only occurs in the most sheltered locations on the eastern side of the highway. The trees are generally in excess of 20m in height. The grey gum, Eucalyptus punctata and the grey ironbark E. paniculata are most common with Syncarpia glomulifera E. robusta and Livistona australis, (the cabbage tree palm), occurring in the more moist valley floors. In these moist areas, the understorey contains typical closed forest species such as Glochidion ferdinandi, Elaeocarpus reticulatus, Acmena smithii and Ceratopetalum gummiferum and the ground cover is of ferns. In some places the understorey is replaced by thickets of Lantana camara, but these occur only in isolated pockets.

Within the study area there are two distinct **Heathland** communities. The more common dry heathland, which is dominated by Banksia species, including B. integrifolia in association with Allocasuarina distyla and Leptospermum attenuatum grows to 2m in height and is evident on the more exposed ridgelines.

The **Wet Heathland** is found only in the broad valley floor of the Moonee Creek valley which drains into Moonee Beach. This community has developed to 3m in height in some places and in these areas it is dominated by Banksia robur, Leptospermum juniperinum and Aotus ericoides with Gahnia sieberana, Baumea arthrophylla and the fern Gleichenia dicarpa. The conservation value of this community has been assessed to be **high** relative to that of the other communities described above and for this reason the proposed development has been located so as to avoid damage to this community.

4.14 Fauna Including Ornithology

Faunal surveys have been undertaken in the study area to investigate what species are currently to be found and whether there are any rare or endangered species present. The surveys have been undertaken by ecologists and an ornithologist. Their complete reports are included as Appendix C and D.

For this study, earlier reports and other information on the region were reviewed to establish what species would be expected to be present in the study area. Following this, three separate surveys were undertaken at different times of the year to investigate what species are present. For this work, the survey area was divided into three habitats; the woodland vegetation community along the valley slopes and ridges, the forests along drainage channels, and the heath areas.

Traps were set to sample the fauna within these habitats and an assessment made of microhabitats at these locations. Spotlighting transects were undertaken along all tracks within the study area, and general observations made indicating the evidence of occupation of the survey area by mammals, such as droppings, characteristic scratchings and diggings which were were used to locate mammal species. Figure 14 shows the location of trap lines, transects nets and observation paths.

4.14.1 Mammalian Fauna

The inventory of mammalian fauna found during the survey is given in Table 14, which shows that the range of mammals located within the survey area is typical of that found along the Central Coast of N.S.W., particularly in the Newcastle region.

Several small ground dwelling mammals commonly captured along the Central coast were not located within the survey area. These include the Common Planigale, the New Holland Mouse and the Common Dunnart. Their absence from the area indicates less than optimum habitat conditions. The low amounts of understorey and the ground cover within the woodland habitat, and the presence of introduced predators are factors that would discourage the presence of some of these mammals.

TABLE 14 : MAMMALS LOCATED IN THE CATHERINE HILL CREEK AND MOONEE CREEK AREAS

Species	Status
Monotremes:	
Short-beaked Echidna (Tachyglossus aculeatus)	C
Marsupials:	
Brown Antechinus (Antechinus stuartii)	A
Common Ringtail Possum (Pseudocheirus peregrinus)	C
Sugar Glider (Petauroides breviceps)	C
Swamp Wallaby (Wallabia bicolor)	C
Eutherians:	
Black Rat * (Rattus rattus)	A
Fox * (Vulpes vulpes)	A
Feral Dog * (Canis familiaris)	A
Horse * (Equus caballus)	C
Rabbit * (Oryctolagus cuniculus)	A

Common and Scientific Names and Australian Status from Strahan (1983)

A Abundant

C Common

* Introduced Species

The larger native mammals were not seen within the main survey area, although there were Swamp Wallaby tracks south of the survey area near the Munmorah State Recreation Area, where they are known to occur.

4.14.2 Avifauna

A total of 55 species of avifauna were identified in the study area by sight or call notes while undertaking the fieldwork. This number of bird species is relatively low for a survey of this length, when the total number of bird species known from the Munmorah area is 119 (see Table C4, Appendix C). Many more of these should have been found in the survey area. The reason is probably because there are very few avian habitats on the site. The dry sclerophyll forest with sparse undercover throughout the slopes and ridges had little significance ornithologically.

Even so the main component of the avifauna located during the survey were species that preferred woodland habitat. The relatively high number of Honeyeaters was due to the presence of several flowering plants during one survey. The wide range of Thornbills and other small forest birds are indicative of the dependance by avifauna on the timber cover in this area. Few grassland birds or larger species of forest birds e.g. quails and parrots were located. Also no water birds were observed in the main survey area. There was also a lack of variety in the species of raptor found in the area. Many of these absences can be explained in terms of lack of preferred habitat e.g. waterbirds, but the low diversity of other species is possibly due to the disturbed nature of the surrounding area. Low raptor diversity appears to be common in the Newcastle region and is possibly due to active hunting of these "nuisance" species. The low number of grass birds is possibly because of the low quantity of ground cover and the presence of introduced cats, dogs etc. The wet sclerophyll habitat that prevails along the creeks and gullies, with a rather dense ground cover provides a far better habitat for avian purposes. Even there birdlife was clearly restricted, though some of the species sighted do utilize rainforest or heath vegetation as a habitat e.g. Pheasant Coucal, Honeyeaters. This indicates that the area still retains sufficient quantity of these habitats to support some of their characteristic bird species.

The list of species identified is given in Table 15. Further information is given in Appendix C and D for those species that would be affected by a habitat change on the site.

TABLE 15 : AVIFAUNA IDENTIFIED DURING THE SURVEY

Family PHALACROCORACIDAE	
LITTLE BLACK CORMORANT	Phalacrocorax sulcirostris
Family ACCIPITRIDAE	
BROWN GOSHAWK	Accipiter fasciatus
BLACK-SHOULDERED KITE	Elanus notatus
Family LARIDAE	
SILVER GULL	Larus novaehollandiae
Family COLUMBIDAE	
SPOTTED DOVE	Streptopelia chinensis
BRUSH BROZEWING	Phaps elegans
Family CUCULIDAE	
FAN-TAILED CUCKOO	Cuculus pyrrhophanus
PHEASANT COUCAL	Centropus phasianinus
Family PODARGIDAE	
TAWNY FROGMOUTH	Podargus strigoides
Family APODIDAE	
SPINE-TAILED SWIFT	Hirundapus caudacutus
Family ALCEDINIDAE	
LAUGHING KOOKABURRA	Dacelo novaeguineae
SACRED KINGFISHER	Halcyon sancta
AZURE KINGFISHER	Ceyx azureus
Family CORACIIDAE	
DOLLAR-BIRD	Eurystomus orientalis
Family HIRUNDINIDAE	
WELCOME SWALLOW	Hirundo neoxena

TABLE 15 CONTINUED

Family CAMPEPHAGIDAE	
BLACK-FACED CUCKOO-SHRIKE	Coracina novaehollandiae
Family PACHYCEPHALIDAE	
GOLDEN WHISTLER	Pachycephala pectoralis
RUFOUS WHISTLER	Pachycephala rufiventris
GREY SHRIKE-THRUSH	Colluricincla harmonica
CRESTED SHRIKE-TIT	Falcunculus frontatus
Family MUSCICAPIDAE	
EASTERN YELLOW ROBIN	Eopsaltria australis
GREY FANTAIL	Rhipidura fuliginosa
WILLIE-WAGTAIL	Rhipidura leucophrys
LEADEN FLYCATCHER	Myiagra rubecula
Family ORTHONYCHIDAE	
EASTERN WHIPBIRD	Psphodes olivaceus
Family MALURIDAE	
BLUE WREN	Malurus cyaneus
VARIEGATED WREN	Malurus lambertii
WHITE-BROWED SCRUB-WREN	Sericornis frontalis
Family ACANTHIZIDAE	
YELLOW THORNBILL	Acanthiza nana
STRIATED THORNBILL	Acanthiza lineata
BROWN THORNBILL	Acanthiza pusilla
BUFF-RUMPED THORNBILL	Acanthiza reguloides
Family CLIMACTERIDAE	
WHITE-THROATED TREECREEPER	Climacteris leucophaea
Family NEOSITTIDAE	
VARIED SITELLA	Daphoenositta chrysoptera
Family ZOSTEROPIDAE	
GREY-BACKED SILVEREYE	Zosterops lateralis
Family MELIPHAGIDAE	
LITTLE WATTLEBIRD	Anthochaera chrysoptera
NOISY FRIARBIRD	Philemon corniculatus
WHITE-EARED HONEYEATER	Lichenostomus leucotis
NEW HOLLAND HONEYEATER	Phylidonyris novaehollandiae
WHITE-CHEEKED HONEYEATER	Phylidonyris nigra
NOISY MINER	Manorina melanocephala
LEWIN HONEYEATER	Meliphaga lewinii
YELLOW-FACED HONEYEATER	Meliphaga chrysops
WHITE-NAPED HONEYEATER	Melithreptus lunatus
TAWNY-CROWNED HONEYEATER	Gliciphila melanops
EASTERN SPINEBILL	Acanthorhynchus tenuirostris
Family PARDALOTIDAE	
SPOTTED PARDALOTE	Pardalotus punctatus
Family PLOCEIDAE	
RED-BROWED FIRETAIL	Emblema temporalis
Family PASSERIDAE	
HOUSE SPARROW	Passer domesticus
Family STURNIDAE	
COMMON STARLING	Sturnus vulgaris
COMMON MYNA	Acridotheres tristis
Family GRALLINIDAE	
MAGPIE-LARK	Grallina cyanoleuca
Family CRACTICIDAE	
GREY BUTCHERBIRD	Cracticus torquatus
BLACK-BACKED MAGPIE	Gymnorhina tibicen
Family CORVIDAE	
AUSTRALIAN RAVEN	Corvus coronoides

4.14.3 Herpetofauna

Few reptiles and amphibians were located during the survey. Some lizard tracks were observed in sandy areas and small skinks were seen in the woodland habitat. The tracks were made by the Bearded Dragon (Amphibolurus barbatus) and a Goanna (probably the Sand Monitor, Varanus gouldii). The skinks were the Weasel Skink (Leiolopisma mustelina) and the Eastern Grass Skink (Lampropholis delicata). According to published and unpublished sources, at least 47 reptiles are known from the Central Coast region.

Two frog species were located during the survey - the Common Eastern Toadlet (Crinia signifera) and the Dwarf Tree Frog (Litoria fallax). Available records show 15 frog species are to be found in the region.

The low diversity and density of herpetofauna during the survey is possibly due to the relatively cold conditions prevailing. The low quantity of ground cover and litter may also have been a factor in determining the diversity of species in the survey area.

4.14.4 Habitat Analysis

The characteristics of the habitats within the survey area are described in Appendix C. They demonstrate the difference found between the three habitats measured. Both forest and woodland habitats have a higher tree, grass, forb, fern and litter cover than that found within the heath habitat. The heath has a higher shrub cover than the other habitats.

The investigations revealed that the habitats in the survey area are not in as good condition as those found in other areas of the Central Coast Region. The lower values for many of the habitat characteristics may be due to a history of forestry and high fire occurrence in the area. The swampy area within the forest habitat may have some importance as a drought refuge.

4.15 Visual Amenity and Landscape

4.15.1 Study Area

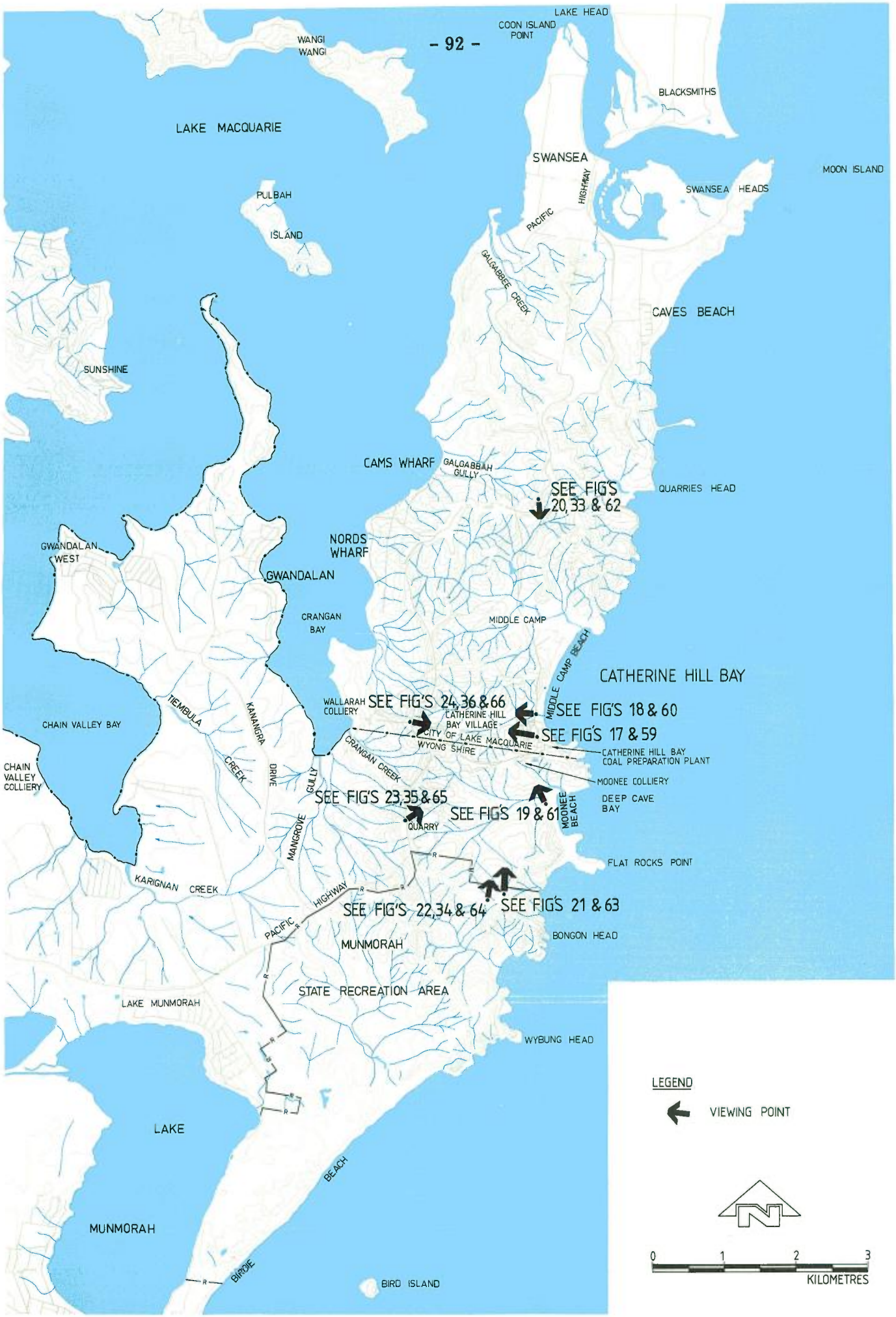
At present the Catherine Hill Bay study region is only developed in isolated pockets with the power station and mines being the most obvious in the landscape. Figures 17-24 are photographs of the existing developments at Catherine Hill Bay from viewing points identified on Figure 15. Other developments are generally small scale, low density housing clusters which are located near mines, power stations and at convenient points on Lake Macquarie. The Catherine Hill Bay village is one of four such settlements, which were built by mining companies to house workers. These houses are simple small scale weatherboard houses which are in keeping with the historic character of this mining town. A photograph of one example of these houses is shown in Figure 16. Apart from these forms of development, the study area is generally in its natural state.

The Catherine Hill Bay area is within the Swansea Unit of the Lower Hunter Landscape Improvement Study (Ref. 3), which identifies the landscape on the eastern side of the Pacific Highway, where the development is proposed, as 'Distinctive' adjacent to the Coal Preparation Plant and elsewhere as 'Common', where the proposed stockpiles and coal washery reject emplacements are proposed.

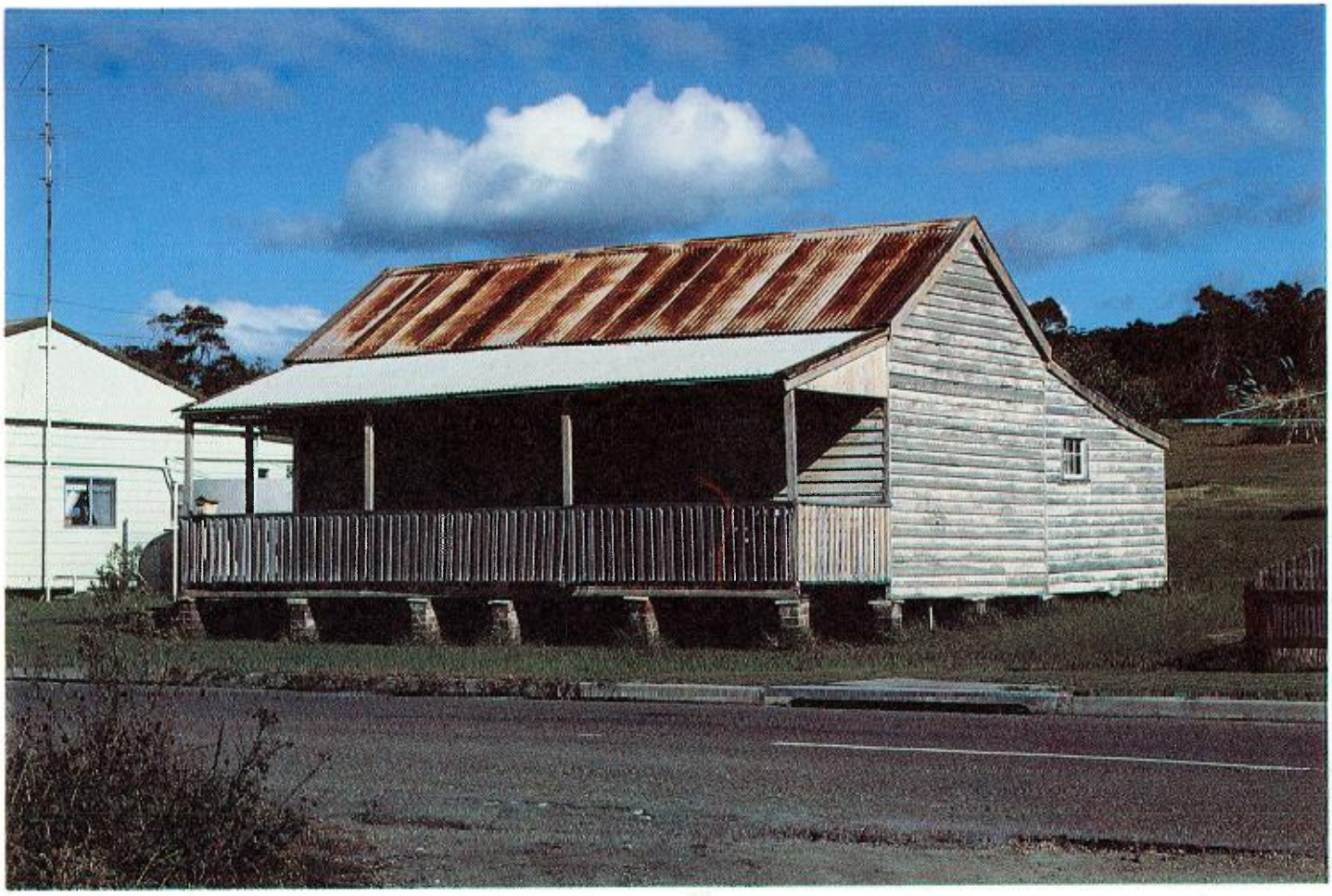
The conservation value of the area of the coal washery reject emplacements is ranked as having 'Regional Botanical Value' and 'Wildlife Habit Value' on a very broad brush evaluation in the same report. This should be considered in conjunction with the detailed surveys conducted for this environmental study which attribute a lower value for the restricted areas affected by the proposed developments.

The Lower Hunter Landscape Improvement Study also emphasises the importance of avoiding clearing on ridgelines. This constraint has been an integral part of the interactive environmental and engineering design, which has constrained the height of the Coal Preparation Plant building and restricted the extent and height of the coal washery reject emplacements.

The scenic and important landscape quality of the area is recognised in both planning instruments which apply. As described in Section 4.3, most of the area is zoned Environmental Protection, Coastal Lands Acquisition or Rural Scenic Protection.

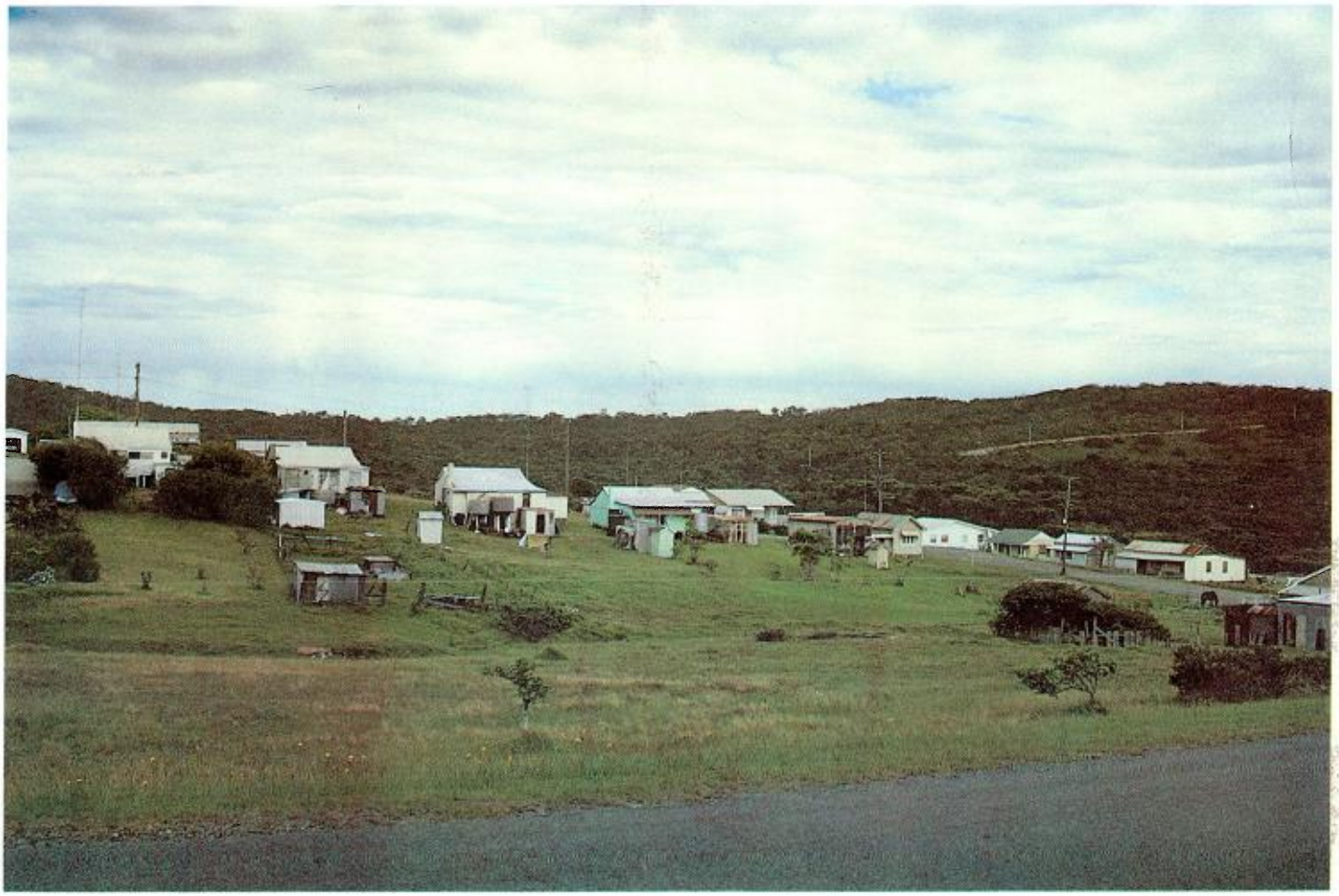


LOCATION OF VIEWING POINTS **FIGURE 15**



TYPICAL COTTAGE AT CATHERINE HILL BAY AND MIDDLE CAMP

FIGURE 16



VIEW FROM CATHERINE HILL
BAY VILLAGE

FIGURE 17

VIEW FROM CATHERINE HILL
BAY BEACH

FIGURE 18

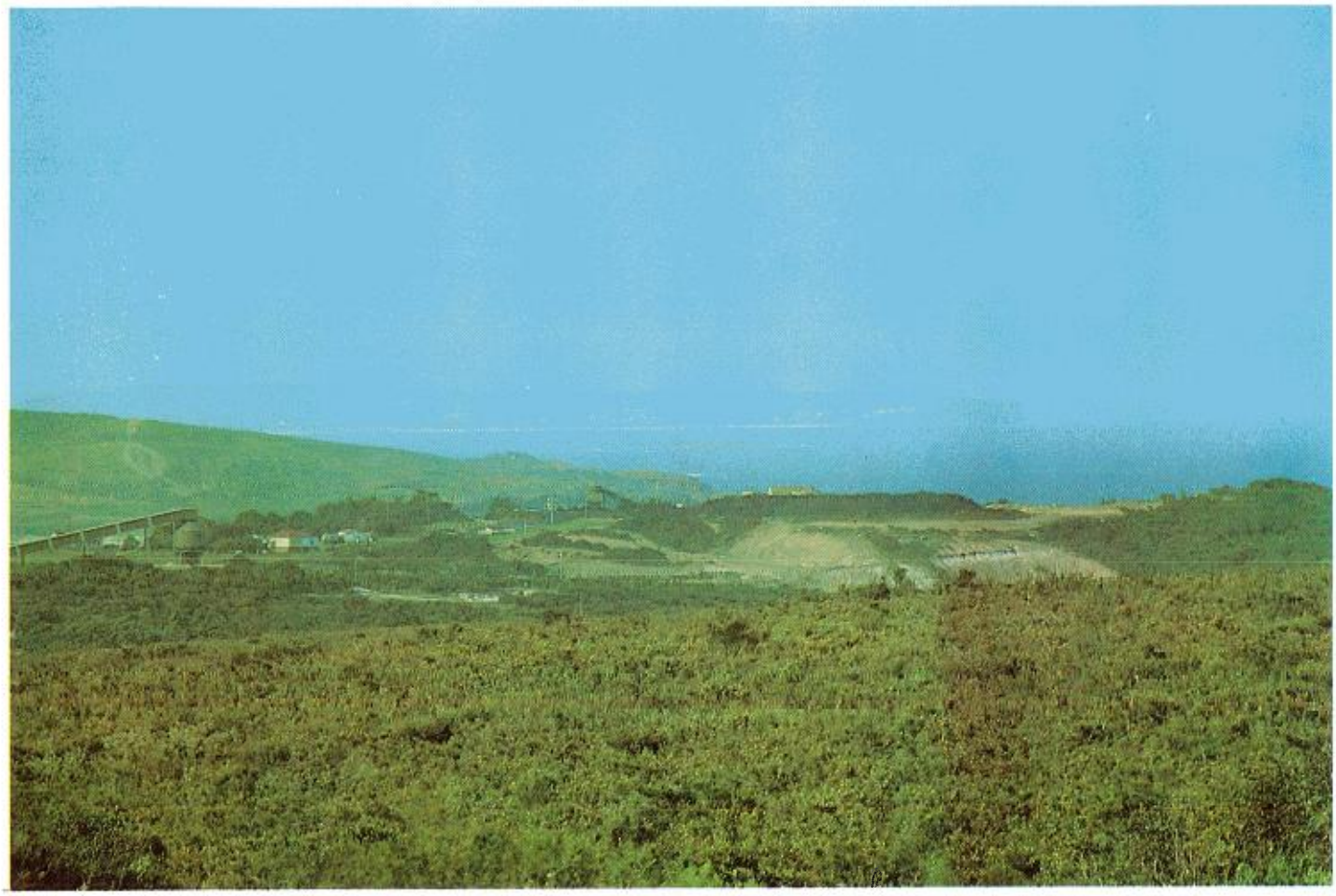
VIEW FROM MOONEE BEACH FIGURE 19

VIEW FROM PACIFIC HIGHWAY
LOOKING SOUTH

FIGURE 20

VIEW FROM BONGON LOOKOUT – MUNMORAH STATE RECREATION AREA

FIGURE 21

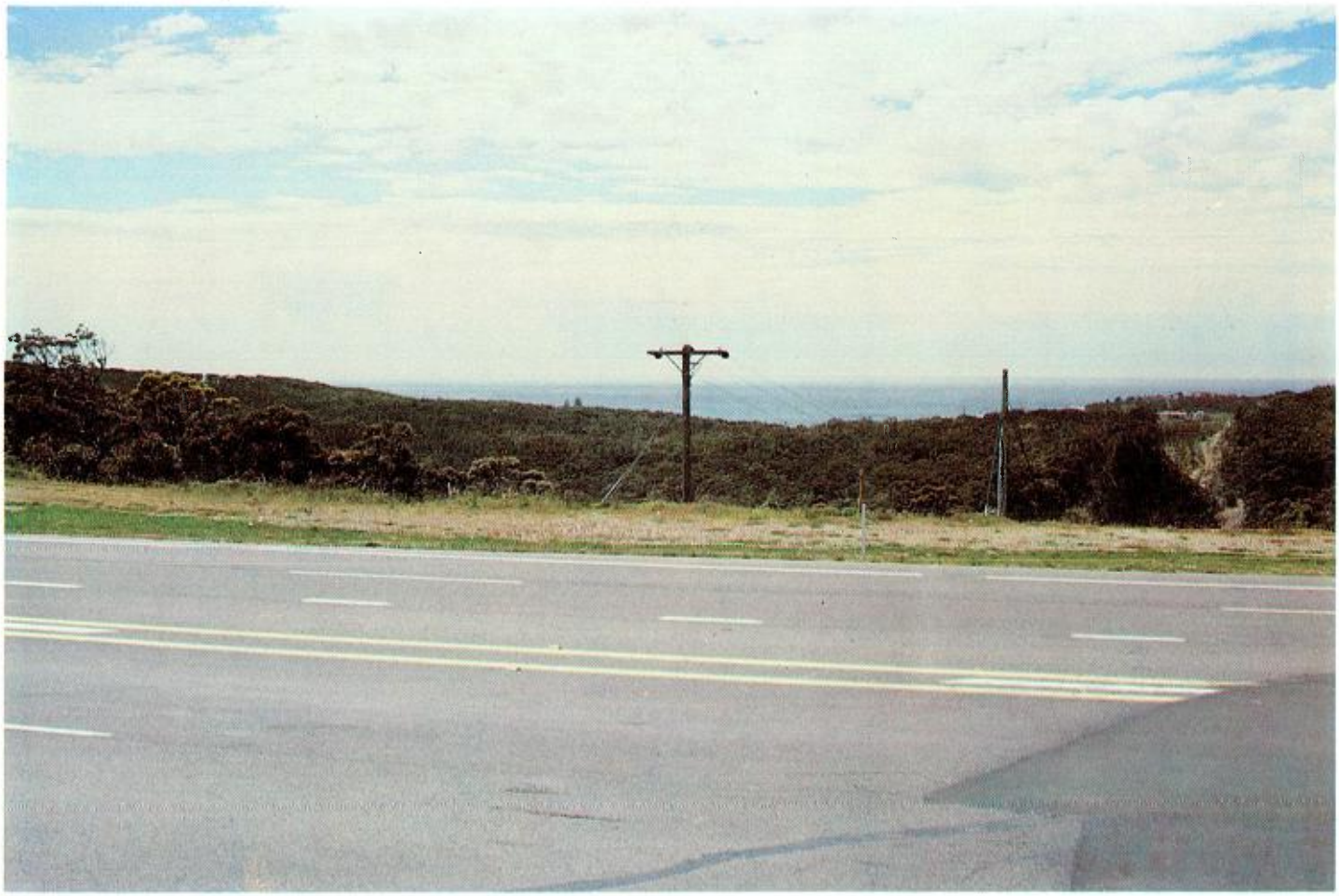


TELEPHOTO VIEW FROM MUNMORAH STATE RECREATION AREA (UP HILL FROM LOOKOUT)

FIGURE 22

VIEW FROM PACIFIC HIGHWAY
LOOKING NORTH-EAST

FIGURE 23



VIEW FROM PACIFIC HIGHWAY
ADJACENT TO CATHERINE HILL
CREEK VALLEY

FIGURE 24

4.15.2 Proposed Development Areas

The existing visual environment of the area proposed for development has been assessed from eight different viewing points. Two of these are located in the Catherine Hill Bay township (Figures 17 and 18) one in the vicinity of the Moonee Beach camping ground (Figure 19) three are located along the Pacific Highway (Figures 20, 23, and 24) and two are in the Munmorah State Recreation Area (Figures 21 and 22).

The views shown in Figures 17, 18 and 19 from Catherine Hill Bay village and the Moonee Beach campsite, are considered to be of regional and local significance. These views generally include some evidence of the existing mining operations, as well as large areas of natural vegetation.

The camping area at Moonee Beach is well used by tourists, especially on holiday weekends. In most cases, as with the housing in the area, the campsites are oriented so as to take advantage of the views of the ocean.

As the Pacific Highway is the main road following the east coast of Australia, views from this road are significant. Figures 20 and 23 show two examples of the view seen by travellers, which because of the 100 km/hr speed limit, change rapidly and are therefore less obvious than views which are in line with the highway and are visible for long periods. As the topography is generally low, (mostly less than 90 m above sea level), it is the water bodies, (both Lake Macquarie and the Pacific Ocean) that are the dominant elements in these views from the highway.

This is exemplified in the views shown in Figures 21, 22, 23 and 24. Although in some cases the water is only visible in a small portion of the photograph, it still remains the dominant element. Another characteristic of views of the landscape in this area is the consistently dense cover of natural vegetation which is broken only by the existing pockets of development, such as at the existing Coal Preparation Plant and mines, or along power transmission line easments. The man made elements are emphasised by the clearing of vegetation in their immediate vicinity, as may be seen on Figure 3 (aerial photo).

In the views from the lookouts in the Munmorah State Recreation Area, (Figures 21 and 22), exposed rocky headlands and small pockets of closed forest vegetation provide contrasts to the otherwise predominantly heath and woodland vegetation. However, it is the broad view of the Pacific Ocean and glimpses of Lake Macquarie which dominate these views. These views are also of regional significance.

4.16 Archaeological Survey

An archaeological survey of the area affected by the proposed developments at Catherine Hill Bay was undertaken by a registered archaeologist. The detailed report of this survey is included in Appendix E.

In summary, the survey included a review of other archaeological studies in the local area, discussions with representatives from the Bahtahbah Local Aboriginal Land Council, and a site survey to search for evidence of Aboriginal activities or sites which might be affected by the proposed development.

No archaeological material was identified during the survey, and it appears unlikely that archaeological material would be present in the soil or hidden by vegetation.

Few surfaces within the area would have been level and dry enough to be used as camp sites; they are small in extent and would in the past, as now, have been surrounded by areas of thick undergrowth which would have reduced visibility and access.

It is probable that Aborigines visited the area in the past to procure food and raw materials from the rich supply available here. However it is unlikely that they would have lingered to leave behind the food remains, artefacts and other debris typical of a camp site. The occasional tool or weapon may have been lost or left, if broken or blunt, but the chance that such a piece would be found is almost non-existent.

The rock in the exposures seen was invariably coarse-grained and quite unsuitable for the grinding of hatchets or as background for engravings. Nor were any shelters seen that were likely to have been used.

Scarred trees appeared to be the result of fires, storms, broken limbs and other non-human agents, or due to logging.

No sites of traditional significance to the local Aborigines are known in the area or in the neighbourhood.

It is concluded that it is improbable that archaeological material is present within the areas affected by the proposed development and that there is no archaeological reason for rejection of the proposed development.

4.17 Transport Network

The original main road through the study area passed through the settlements of Catherine Hill Bay and Middle Camp. This road was the main coastal route north but that section passing through the two settlements has now been by-passed and downgraded to a minor local road, used by local residents and people seeking access to the coastal beaches.

The Pacific Highway is now located along the main ridgeline through the study area and has recently been realigned to improve traffic flow for increasing numbers of vehicles. The 1984 figure for traffic in both directions (AADT) is 16,410 vehicles per day.

Rigid body multi-axle trucks transport coal from Wallarah Colliery to Catherine Hill Bay using the Pacific Highway and the Company's private haul road (shown on Figure 9) between the Highway and the Coal Preparation Plant at Catherine Hill Bay. Articulated

semi-trailers are used to transport coal from Chain Valley Colliery to Catherine Hill Bay using the Pacific Highway and the Company's private haul road, as for the Wallarah Colliery coal. Approximately 440 truckloads of coal per day come from these two collieries of which about 320 loads come from Wallarah Colliery. The coal transport route from Wallarah Colliery uses the Highway for 0.3 km, and the route from Chain Valley Colliery uses about 9.5 km. of the Highway. Entry onto the Highway and exit from it is facilitated by accelerating and decelerating lanes on the Highway.

5.0 DESCRIPTION OF THE EXISTING COAL PREPARATION PLANT, SURFACE FACILITIES AND MINING OPERATIONS

5.1 General

The Catherine Hill Bay Coal Preparation Plant is presently used to process raw coal from the three regional collieries operated by the Company that are mining coal from the Wallarah and Great Northern Seams. Approximately 750 persons are employed at the collieries and Coal Preparation Plant to produce coal for both export and local markets.

The extent of existing coal handling facilities and the location of the Catherine Hill Bay Coal Preparation Plant are shown on Figure 25.

5.2 Coal Reserves

A large resource (in the order of 306,000,000 tonnes in situ at measured/indicated category) is available in the Wallarah, Great Northern and Fassifern Seams within the Wallarah and Chain Valley Colliery Holdings, as shown on Figure 26. In addition, in situ resources of up to 360,000,000 tonnes of less than inferred category may be contained in a further eight seams underlying the Fassifern Seam within the Wallarah and Chain Valley Colliery Holdings. Figure 27 shows in section the depth of the Wallarah, Great Northern and Fassifern Seams and the other seams underlying the Fassifern Seam. At present only the Wallarah and Great Northern Seams are being worked by the Company.

In the Chain Valley Colliery Holding, an in situ measured reserve of 32,000,000 tonnes remain in the Wallarah Seam, with some 22,000,000 tonnes being indicated as recoverable.

Stratigraphically below is the Great Northern Seam with a reserve at measured status of 42,000,000 tonnes, with some 31,000,000 tonnes being estimated as recoverable. The economic potential of the lower

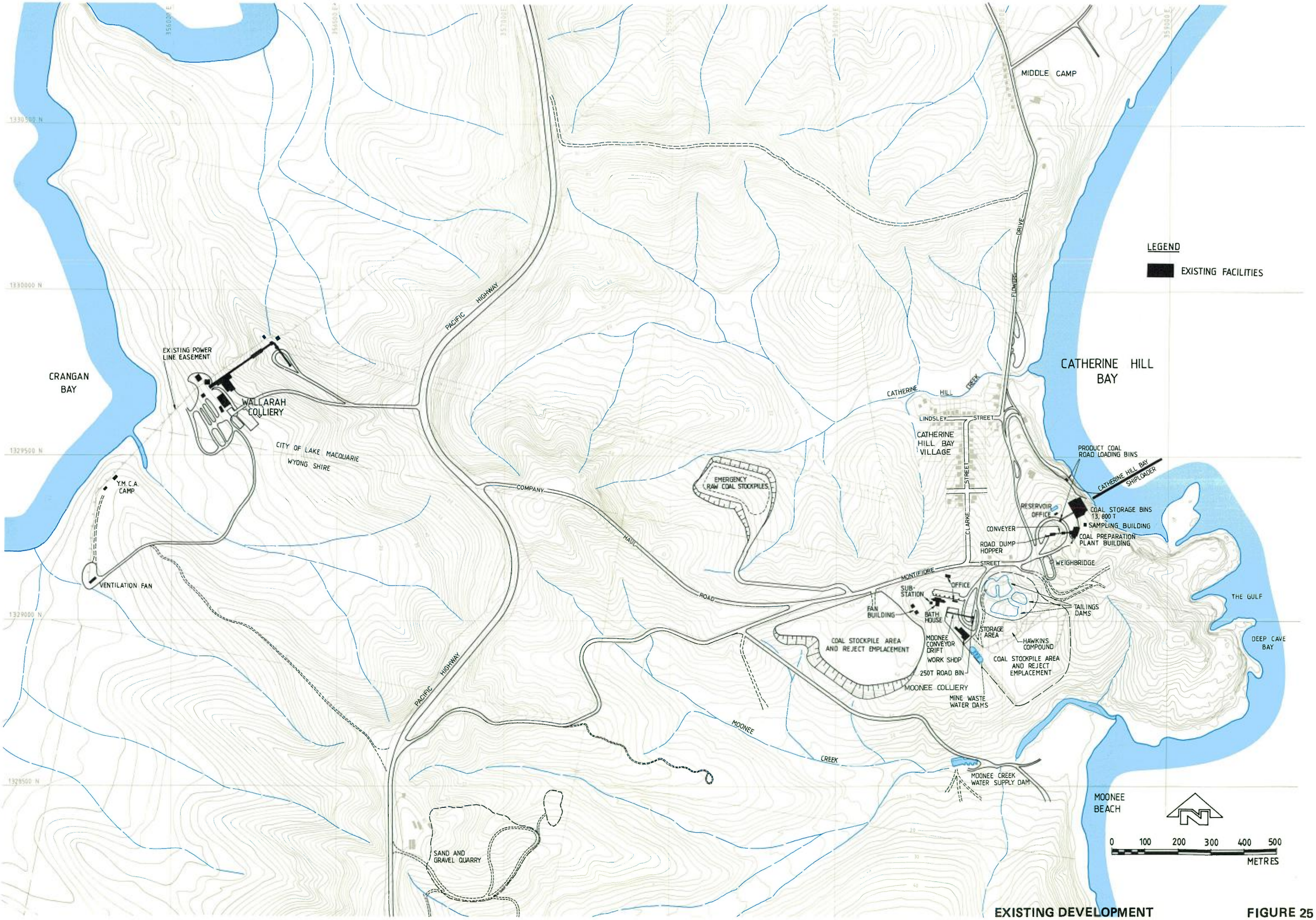
most seam, the Fassifern seam, has been reviewed. Of an in situ resource at measured category of 65,000,000 tonnes, 53,000,000 tonnes is estimated to be recoverable. The three seams of economic interest are continuous within the Chain Valley and Wallarah Colliery Holdings.

In the Wallarah Colliery Holding, the uppermost seam, the Wallarah Seam, has been subject to recent detailed re-appraisal. Whilst only limited areas of virgin coal remain available to the Moonee operation, very considerable areas of standing pillars are now considered accessible particularly to Wallarah Colliery. Total in situ reserves in the Wallarah Seam are now estimated to be 21,000,000 tonnes, with a recoverable reserve of 11,000,000 tonnes. Some 58,000,000 tonnes of an in situ reserve of 84,000,000 tonnes of Great Northern Seam is estimated to be recoverable. The economic potential of the lowermost seam, the Fassifern Seam, has been reviewed. Of an indicated in situ reserve of 62,000,000 tonnes, some 45,000,000 tonnes is estimated to be recoverable.

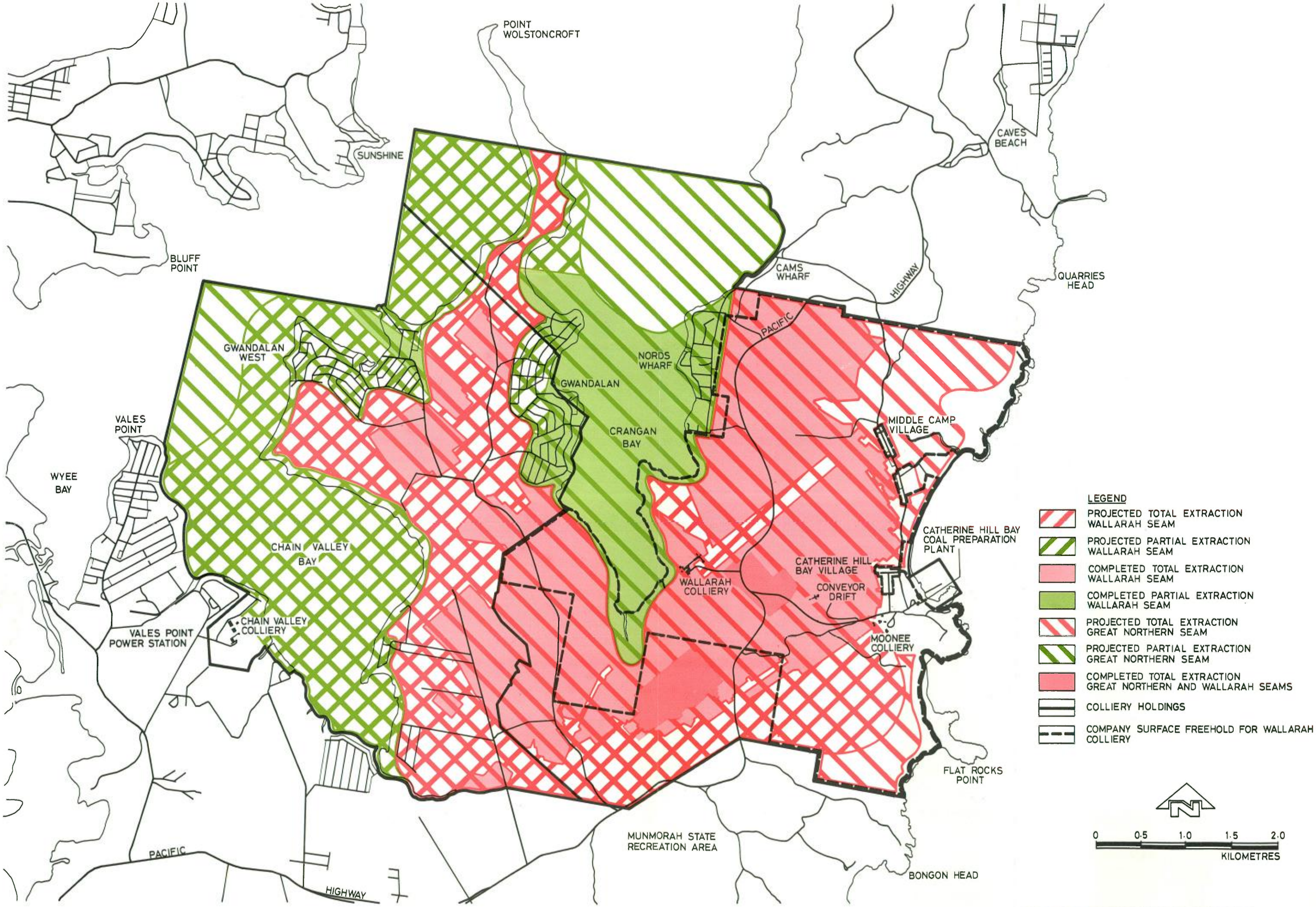
A number of seams of principally low yield steaming coal underlie the Fassifern Seam in both the Wallarah and Chain Valley Colliery Holdings.

Coal is one of the most valuable resources in N.S.W. and, being a diminishing, non-renewable resource, maximum coal recovery should be achieved to the benefit of the community. Maximum coal recovery is achieved by one of the total extraction techniques including pillar extraction or longwall mining methods. Maximum recovery is generally considered to be between 80 and 85% of available coal but generally only about 70% is recovered when pillar extraction is undertaken.

Extraction of coal by pillar extraction or longwall mining methods results in significant subsidence of the surface which may be inconsistent with the safety of some surface features. Both total extraction systems require the approval of the Minister for Industrial Relations, who is advised by the Chief Inspector of Mines.



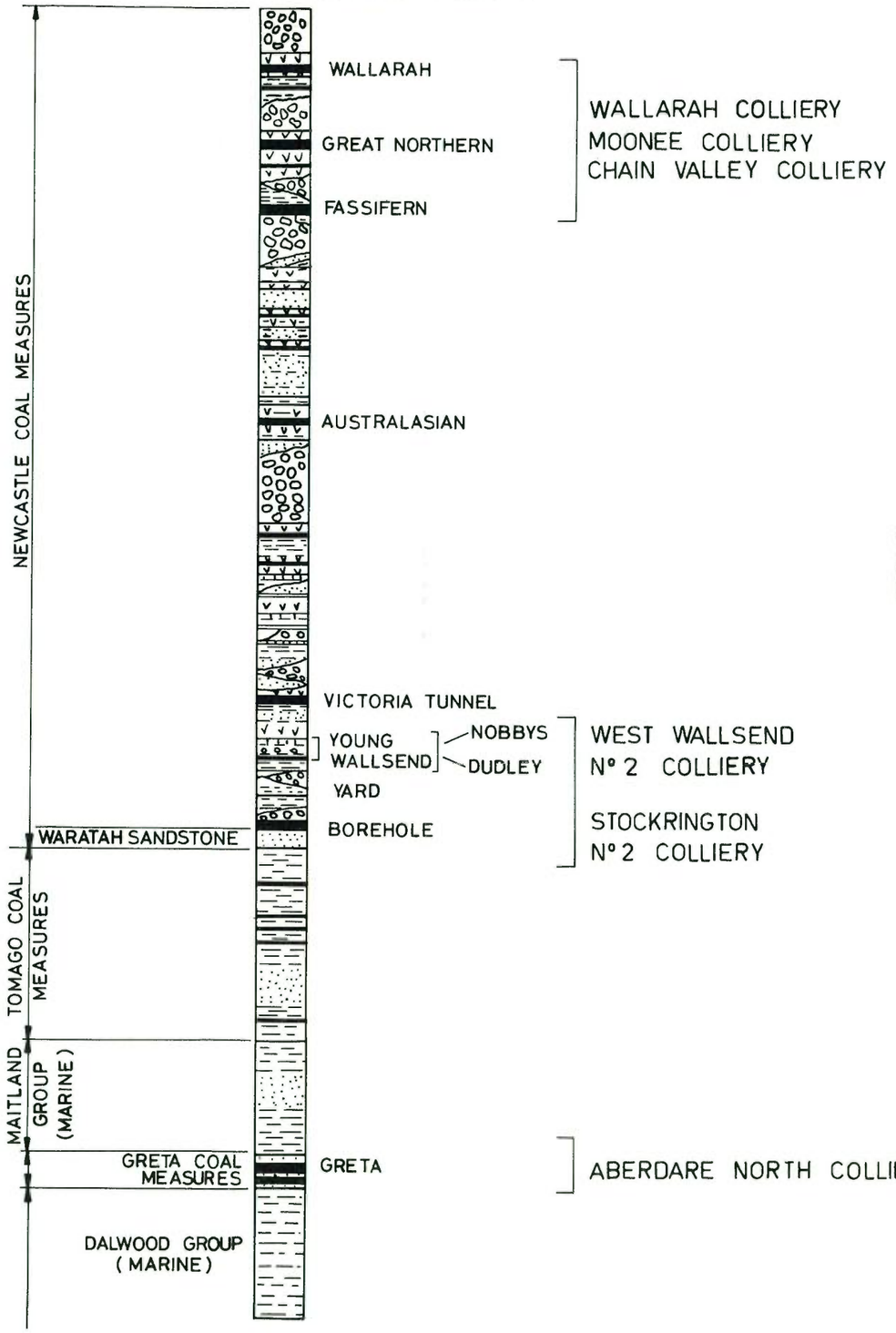
EXISTING DEVELOPMENT **FIGURE 25**

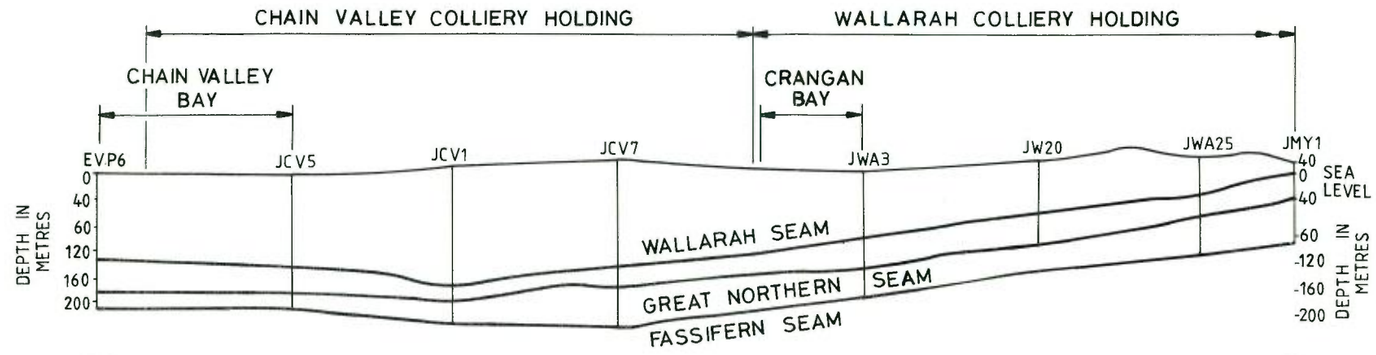


COAL RESOURCES AND EXTENT OF DEVELOPMENT

FIGURE 26

MAJOR SEAMS





SECTION THROUGH WALLARAH GREAT NORTHERN & FASSIFERN SEAMS

NOTE: LOCATION OF SECTION SHOWN ON FIGURE 26

WALLARAH, GREAT NORTHERN AND FASSIFERN SEAMS **FIGURE 27**

In order to protect surface structures, protect urban development and control subsidence, the Minister for Industrial Relations may allow partial extraction of coal only. This can enable up to 60% of the available coal to be extracted. Where important surface structures, installations or natural features require protection, pillar extraction may be refused and 'first workings' only allowed. In this situation recovery of available coal is typically only 40%.

Mining restrictions under Lake Macquarie and the lake foreshore limit recovery in these areas to about 50% of the available coal. The areas where extraction is currently limited due to minimum subsidence restrictions under Lake Macquarie are shown on Figure 26.

Potential maximum coal recovery is only available in the other parts of the lease area not under the lake. However extraction may be constrained there by the presence of significant surface developments, which may prevent total extraction of the coal if subsidence control is required.

If the Company's mining operations are to remain economic, the production from areas limited to partial extraction must be balanced by significant production levels from areas where maximum coal recovery is available. The Company is closely examining the feasibility of introducing longwall mining methods and large continuous miners with flexible coal transporters (which also can achieve maximum coal recovery) in the areas currently available for maximum extraction. The Fassifern Seam has yet to be developed but will not be economic to mine without the introduction of longwall mining methods.

Of the in situ resource of 306,000,000 tonnes available in the Wallarah, Great Northern and Fassifern Seams, it is estimated that approximately 220,000,000 tonnes is recoverable. This represents 72% of the available resource and reflects the limitation of extraction in some areas due to minimum subsidence restrictions.

5.3 Production of Coal

Underground mining operations in the Wallarah and Great Northern Seams at Wallarah Colliery currently produce about 1,000,000 tpa of raw (ROM) coal. Major underground development projects in recent years, including construction of a 1000 tonne capacity interseam bin together with upgrading and extension of the main drift conveyer from the Wallarah to the Great Northern Seam have improved the coal transport system. These improvements could enable the continuous miner operations in the Wallarah and Great Northern Seams to produce about 1,500,000 tpa of raw coal.

Raw coal is transported by the drift conveyer to the 1250 tonne capacity road loading bin at Wallarah Colliery, from where it is currently transported to the Catherine Hill Bay Coal Preparation Plant in 15 tonne rigid body trucks. On average 316 truck loads per day, peaking to 385 truck loads, of coal are taken to Catherine Hill Bay when the mine is in production.

Underground mining operations in the Wallarah Seam at Moonee Colliery currently produce about 300,000 tpa raw coal which is transported by the drift conveyer to the adjacent 250 tonne capacity road loading bin. Moonee colliery has the installed capacity to produce about 300,000 tpa raw coal, but installation of a large continuous miner and flexible coal transporter in mid 1987 will lift the installed production capacity to 900,000 tpa of raw coal.

The current 300,000 tpa raw coal production is trucked to the Coal Preparation Plant in 15 tonne trucks. On average there are 100 loads of coal per day, peaking to 150 loads, taken to the Coal Preparation Plant at present.

Underground mining operations in the Wallarah and Great Northern Seams at Chain Valley Colliery currently produce about 1,200,000 tpa raw coal. About 600,000 tpa of this is currently conveyed from Chain

Valley Colliery directly to the Vales Point Power Station. The 600,000 tpa not sent to the Vales Point Power Station is transported to the Catherine Hill Bay Coal Preparation Plant in 25 tonne capacity trucks. On average 116 truck loads per day, peaking to 160 truck loads, of coal is taken to Catherine Hill Bay.

On completion of development work in the Great Northern Seam, Chain Valley Colliery will have the capacity to achieve a production of about 1,500,000 tpa of raw coal.

5.4 Coal Stockpile Areas

Emergency coal stockpile areas are currently located to the north and south sides of the Company's private coal haul road. The northern area adjacent to the power line easement is in an environmentally suitable location and has a storage capacity of 300,000 tonnes of raw coal. Front end loaders are used to reclaim the raw coal for transport by truck to the Coal Preparation Plant at Catherine Hill Bay.

A well protected raw coal surge stockpile area of about 100,000 tonnes capacity is provided on the coal washery reject emplacement to the east of Moonee Colliery. During the study period for this environmental assessment, the raw coal stockpile located on the ridge adjacent to the Coal Preparation Plant was recognised as a source of fugitive dust pollution to the residents of Catherine Hill Bay and relocated to a less exposed location.

The coal stockpile area to the west of Moonee Colliery has a capacity of 750,000 tonnes, providing for raw and product coals. Coal washery reject material is being used to form the coal stockpile area to a level some 10 metres below the northern ridgeline. Over recent years some stockpiles have been relocated to remove coal from exposed locations on the ridgeline and these areas are being progressively landscaped and revegetated. This is shown on Figure 53.

5.5 Coal Preparation Plant

Figure 28 is a flow diagram of the existing Coal Preparation Plant.

Under normal operating conditions the raw coal, which is transported from the Company's three regional collieries, is dumped directly into the dump hopper, which feeds the Coal Preparation Plant. However, when the Coal Preparation Plant is shut down, or unable to handle the quantity transported to the Plant, the raw coal is trucked to one of the emergency raw coal stockpile areas. The quantity that is dumped and rehandled this way is approximately 1 truck load in 10.

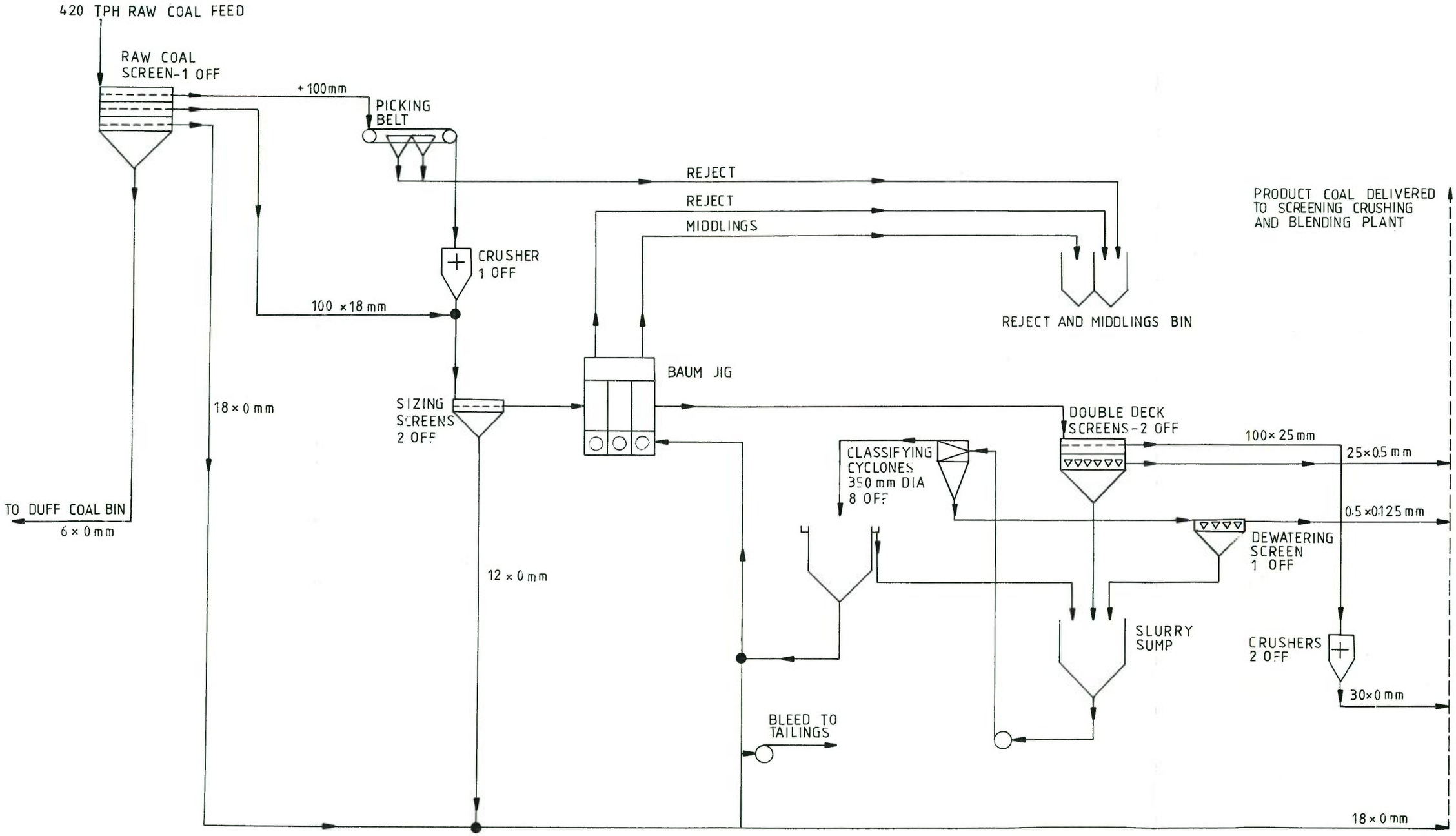
The coal enters the Coal Preparation Plant from the dump hopper where it is transported by conveyers through the plant via screens, crushers and washbox. The washed coal is then deposited in enclosed storage bins with a capacity of 13,800 tonnes. A road loading bin enables excess product coal to be stored in an open emergency product coal stockpile area if necessary. Product coal is reclaimed from these stockpiles by front end loaders for delivery by truck to the enclosed 13,800 tonnes storage bins for subsequent shipment.

The Coal Preparation Plant currently has a maximum throughput of 1,900,000 tpa raw coal feed. Approximately 40 men operate the plant on a 24 hour rotating shift basis.

5.6 Disposal of Coal Washery Reject Material

Reject material from the Catherine Hill Bay Coal Preparation Plant is discharged in two forms - a dry, relatively coarse material and fine material in the form of a slurry, which is known as tailings.

The coarse coal reject is presently transported by truck to coal washery reject disposal emplacements located on the southern side of the haul road adjacent to Moonee Colliery. One emplacement is located just to the east of Moonee Colliery and the other disposal area is the emergency coal stockpile to the west of Moonee Colliery, where



FLOW DIAGRAM FOR EXISTING COAL PREPARATION PLANT

FIGURE 28

the coal washery reject is being used to extend the stockpile platform area. On completion of filling the emplacement to the east of Moonee Colliery, all reject will be placed in the southern extension of the western emplacement/stockpile, extending approximately as far as the present access road to the Company's Moonee water supply system. It is estimated that it will be possible to place approximtely another 450,000 m^3 (600,000 tonnes) of coal wshery reject into this area, which is about 2 years disposal capacity at Stage 1 production rates.

On current planning, it is then intended to proceed to dispose of the coarse coal washery reject into the proposed new emplacement in the Catherine Hill Creek valley.

If development approval is not obtained prior to completion of extending the coal stockpile area to the west of Moonee Colliery, then the Company will proceed to a small gully to the west of the coal stockpile area under the Company's existing use rights in the area.

Tailings from the Coal Preparation Plant are currently piped to evaporation ponds where the fine material is dewatered. The dried material is removed from the ponds and stockpiled with the coarse reject tailings material.

Under current operating conditions with raw coal coming from both the Wallarah and Great Northern Seams, the quantity of reject material is approximately 10% of the raw coal throughput.

5.7 Water Supply

The water supply to the Coal Preparation Plant is obtained at present from a pumping pond on Moonee Creek. This water replenishes the water that is lost with the product coal and washery reject material. This water supply is also used as a domestic supply to the bathhouse and to control dust on stockpile areas and unsealed roads. A second water supply is obtained from a small dam north of Middle Camp.

The present water supply is adequate for the current usage of approximately 0.4 Ml per day in the Coal Preparation Plant and other usage for dust suppression, domestic use and in Moonee and Wallarah Collieries. This supply is sustainable even in drought conditions, but without spare capacity for additional demand.

The total availability of water from the present supply is estimated to be about 0.8 Ml/day.

5.8 Transport

As discussed in Section 5.3, raw coal is transported by truck to the Coal Preparation Plant from Moonee, Wallarah, and Chain Valley Collieries. Trucks from Chain Valley Colliery and Wallarah Colliery use the Pacific Highway and the Company's haul road from the Pacific Highway to the Catherine Hill Bay Coal Preparation Plant. Trucking is as follows:

	Average truck loads/day	Peak truck loads/day	Truck Capacity tonnes
Wallarah Colliery	316	385	15
Chain Valley Colliery	116	160	25
Moonee Colliery	100	150	15

Washery reject from the Coal Preparation Plant is also transported to the emplacements by truck. There are normally about 50 truck loads per day at present.

Product coal from the Catherine Hill Bay Coal Preparation Plant is held in concrete storage bins and loaded at Catherine Hill Bay Jetty into the Company's Colliers. About 1,000,000 tpa is shipped in the MV "Camira" and MV "Conara" to Coal & Allied's depot at Balls Head in Sydney Harbour, for transhipment overseas in vessels of up to 48,000 dwt.

The competitive world coal trade now requires larger shipments of up to 140,000 dwt and the Company's new vessel, the MV "Wallarah", is also being used to help assemble such cargoes at the Port Waratah Coal Services facility in the Port of Newcastle. With one round-trip per day, the MV "Wallarah" will deliver 1,000,000 tpa, and with two trips per day this vessel has the potential to deliver 2,000,000 tpa.

Approximately 300 tonnes per day of coal is delivered by road to Newcastle and Sydney. The majority of this coal is destined for hospitals and other Government Institutions under a State Government contract. The remainder is generally delivered in smaller quantities to industrial users in Newcastle and Sydney.

6.0 DESCRIPTION OF PROPOSED STAGE 1 COAL PREPARATION PLANT EXPANSION DEVELOPMENT

6.1 Production of Coal from Existing Mining Operations

Coal & Allied have three existing coal mines in the Catherine Hill Bay region, which are mining coal from the Company's existing approved mining leases. Moonee Colliery and Wallarah Colliery are working the Wallarah Colliery Holding and Chain Valley Colliery is working the Chain Valley Colliery Holding.

Coal to be mined at these collieries in the future does **not** require new development approval. The mining and increased output will only require continued approval by the Joint Coal Board and the Department of Mineral Resources. Coal mining to supply coal to the proposed Catherine Hill Bay Coal Preparation Plant expansion and associated works development does **not** form a part of the proposed development evaluated in this environmental impact statement and the subject of the Stage 1 Development Application.

Wallarah Colliery is currently producing about 1,000,000 tpa of raw coal and will continue to produce at this rate during the Stage 1 expansion.

Chain Valley Colliery is currently producing about 1,200,000 tpa of raw coal, of which about 600,000 tpa is processed at the Catherine Hill Bay Coal Preparation Plant. Production at Chain Valley Colliery will continue at the same rate during the Stage 1 expansion and about 600,000 tpa of raw coal from Chain Valley Colliery will continue to be processed at the Catherine Hill Bay Coal Preparation Plant.

Moonee Colliery is currently producing about 300,000 tpa of raw coal. This will be increased to about 900,000 tpa of raw coal by introduction of a large continuous miner and flexible coal transporter.

Total production of raw coal to be processed at the Catherine Hill Bay Coal Preparation Plant under the proposed Stage 1 development will be 2,500,000 tpa, an increase of 600,000 tpa over the current throughput of 1,900,000 tpa.

6.2 Additional Modules in Coal Preparation Plant

The proposed Stage 1 expansion of the existing Coal Preparation Plant at Catherine Hill Bay will increase throughput capacity to 2,500,00 tpa and increase the plant efficiency to beneficiate coal from the Wallarah and Great Northern coal seams. Figure 30 shows the proposed development in the general area of the Coal Preparation Plant.

At present raw coal is received at the raw coal road hopper and conveyed to a triple deck primary screen at a rate of approximately 420 tph. The +85 mm material from the first deck is passed to a picking belt for removal of large stone, timber and other rubbish prior to a single roll crusher. Product from the crusher is then combined with overflow material from the second deck of the primary screen (which has an aperture of 18 mm) and the mixture is then conveyed to a secondary screen for further fines removal prior to the overflow from this screen being fed to a SJL 100/5 Baum jig. Approximately half of the total raw coal feed to the preparation plant is washed in the jig. Product from the jig is dewatered over low head screens and conveyed to a separate crushing and screening operation remote from the plant.

The underflow from the secondary screen is combined with coal retained on the third deck of the primary screen (which has 25 mm x 7 mm apertures across the flow) and this blend of raw smalls is conveyed to the No. 1 product bin. Material passing the third deck of the primary screen is generally included in the coal bypassing the Baum jig (the unwashed coal).

A fines recovery system is also included in the jig circuit whereby underflow from the product dewatering screens is thickened in classifying cyclones prior to treatment in spiral separators. The product from the spiral separators is dewatered on a rapped sieve bend and then a Rheinveld fine coal centrifuge. The fine product is conveyed with the other products from the jig circuit to the product screening and storage area. The reject from the spirals is dewatered on a small screen prior to joining the coarse reject.

POR. 75
GWANDALAN VILLAGE
POR. 74
POR. 75
CRANGAN BAY
NORDS WHARF VILLAGE
POR. 24
POR. 16
MIDDLE CAMP VILLAGE
BROWNS POINT
POR. 9
POR. 22
HIGHWAY
OCEAN
Middle Camp Beach
CATHERINE HILL BAY
PACIFIC
POR. 29
KANANGRA DRIVE
4(b) Coal Mining
POR. 10
WALLARAH COLLIERY
EXISTING POWER LINE EASEMENT
7(a)
4(b) Coal Mining
CATHERINE HILL BAY COAL PREPARATION PLANT
CITY OF LAKE MACQUARIE
WYONG SHIRE
COMPANY
CATHERINE HILL BAY VILLAGE
SHIPLOADER
POR. 20
YMCA CAMP
7b
1b
POR. 54
1b
HALE
ROAD
POR. 144
POR. 132
VENTILATION FAN
POR. 136
7b
7a
POR. 57
PAPER ROAD
PACIFIC
7b
MOONEE COLLIERY
DP 515214
Power Station
WATER SUPPLY PIPELINE
POR. 145
6a
POR. 493
POR. 146 Pt. 1
QUARRY
POR. 146 Pt. 2
POR. 30
7e
Moonee Beach
DEEP CAVE BAY
DP 515213
POR. 141
POR. 465
POR. 31
DP 515212
POR. 223
POR. 492
PAPER ROAD
6b
7b
CROWN LAND
6b
POR. 7
7b
POR. 274
POR. 2
POR. 3
POR. 4
POR. 5
POR. 6
FLAT ROCKS POINT
POR. 339
POR. 276
CROWN LAND
POR. 511
POR. 512
1b
POR. 52
7a
7b
WATER SUPPLY RESERVOIR
POR. 1
MUNMORAH STATE RECREATION AREA
HIGHWAY
POR 104
CROWN LAND
POR. 223
1b
POR. 53
PACIFIC
DP 233754
POR. 494
POR. 58
POR. 516

LEGEND

CITY OF LAKE MACQUARIE ZONING

- 4(b) : SPECIAL INDUSTRY (COAL MINING)
- 7(a) : ENVIRONMENTAL PROTECTION (SCENIC)

WYONG SHIRE COUNCIL ZONING

- 1b : HIGHWAY PROTECTION
- 5a : SPECIAL USES (POWER STATION)
- 6a : OPEN SPACE (RECREATIONAL)
- 6b : OPEN SPACE (SPECIAL PURPOSES)
- 7a : RURAL CONSERVATION
- 7b : RURAL SCENIC PROTECTION
- 7e : COASTAL LANDS ACQUISITION

- EXISTING FACILITIES
- PROPOSED STAGE 1 DEVELOPMENT
- WETLAND PROTECTED UNDER S.E.P.P. 14

0 200 400 600 800 1000
METRES

PROPOSED STAGE 1 COAL PREPARATION PLANT DEVELOPMENT **FIGURE 29**

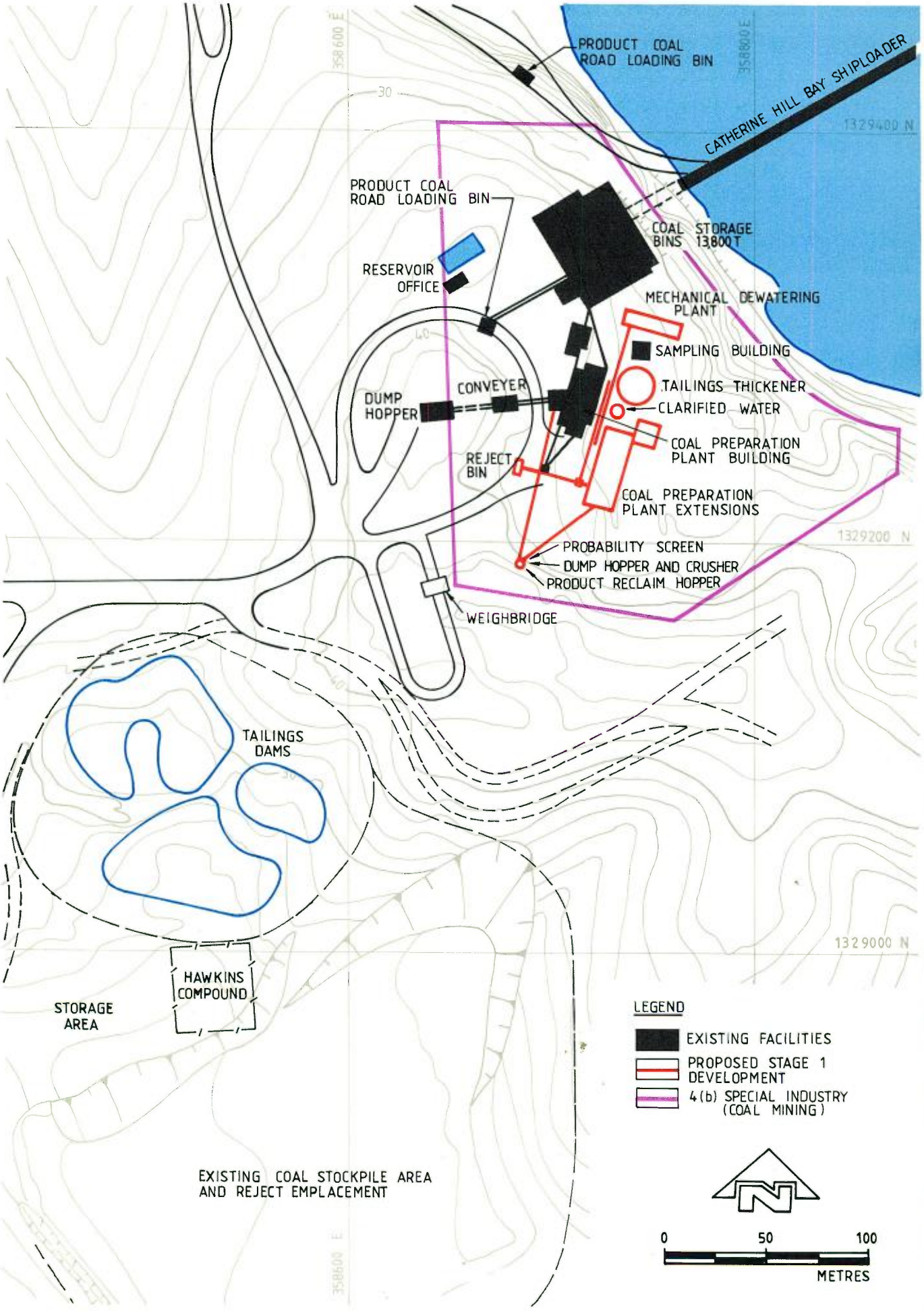
The Stage 1 development will increase the washing capacity of the Coal Preparation Plant from the present 200 tph to 600 tph. This will be achieved by the addition of two modules of dense medium cyclone/spiral separator plant, each of 200 tph capacity, together with appropriate modifications to the existing preparation, handling and storage plants.

Each of the new modules will include:

- Sieve bends and screens to separate fine material out of the raw feed to the cyclone circuit. This material will be fed to a spiral treatment circuit;
- Dense medium cyclones to provide a cyclone capacity of 150 tph;
- Fine coal spirals to provide a spiral capacity of 50 tph;
- A magnetite recovery circuit and density control system;
- A vibrating basket centrifuge for the dense medium cyclone product and a screen bowl centrifuge or other specialised equipment to dewater the fine product;
- Efficient dewatering of reject from the dense medium cyclones and spirals using screens and/or centrifuges;
- Efficient desliming cyclones for tailings removal;
- High rate tailings thickener;
- Mechanical dewatering equipment for the fine coal (tailings) to increase coal recovery where product coal specifications permit.

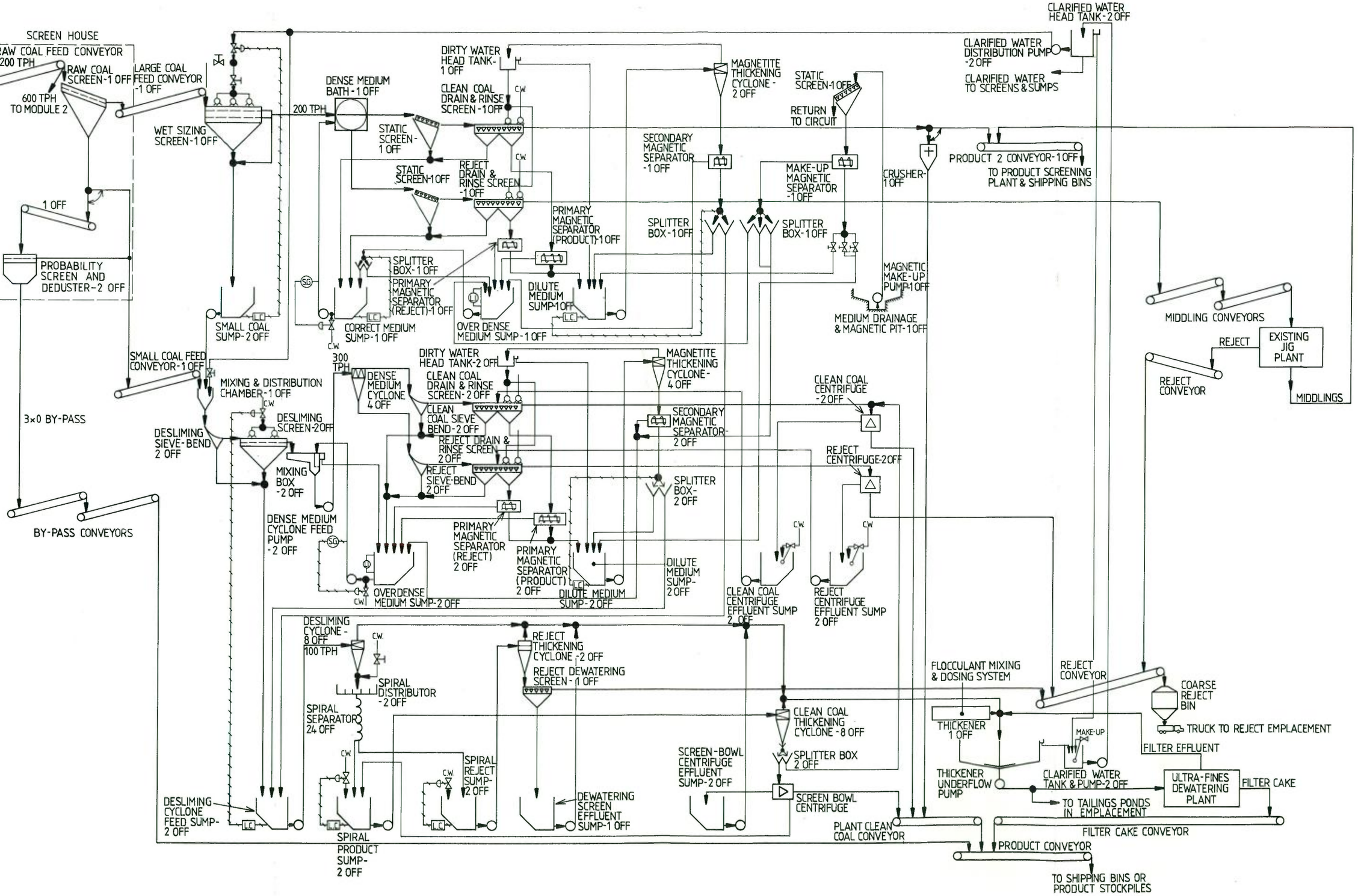
The mechanical dewatering equipment will be of the 'filter press' or 'belt press' type and will be used to increase the recovery of fine coal when the product coal specifications allow for the inclusion of ultra fine coal in the product coal.

For the Stage 1 development, all fines/tailings will be dewatered mechanically and the filter cake will be blended into the product coal or disposed of with the coarse coal washery reject as the raw coal quality and product specifications allow.



STAGE 1 DEVELOPMENT IN COAL PREPARATION PLANT AREA

FIGURE 3



FLOW SHEET FOR PROPOSED COAL PREPARATION PLANT **FIGURE 31**

6.3 Transport

For the Stage 1 development, all raw coal will continue to be transported by road to the existing raw coal dump hopper adjacent to the Coal Preparation Plant. As at present, some coal will be dumped into stockpiles on receival from the mine and will subsequently be recovered by front-end loader and trucked to the Coal Preparation Plant dump hopper to suit the processing requirements of the plant (see Section 5.5).

As the output of raw coal from Chain Valley and Wallarah Colliery will not change for Stage 1 of the proposed development, coal transport along the Pacific Highway to Catherine Hill Bay will not alter.

Output from Moonee Colliery will increase to about 900,000 tpa of raw coal and local truck transport from the 250 tonne Moonee road bin to the Coal Preparation Plant dump hopper will increase to an average of 253 truck loads/day (peaking to 293 truck loads per day).

6.4 Water Supply

The existing supplies from Moonee Creek and the dams near Middle Camp have an estimated sustainable yield of about 0.8 Ml/day, even in drought conditions. This presently supplies the Catherine Hill Bay Coal Preparation Plant, Moonee Colliery, Wallarah Colliery, various dust suppression requirements, including the jetty coal loader, and some limited domestic supplies.

For the Stage 1 expansion, the demand from Moonee Colliery, the coal loader and the Coal Preparation Plant will increase to an estimated 2.2 Ml/day, which is above the sustainable yield of the present supply system.

It is therefore proposed to install a reticulated supply from the 450 mm diameter Wyong Shire supply, which is presently located along Kanangra Drive. The point of connection will be the 'paper road' on the south side of Portion 57, and thence across Portions 57, 54 and 10, which are owned by the Company, to Wallarah Colliery. This is shown on Figure 29.

The supply pipeline will be sized for the full proposed development at Catherine Hill Bay (Stage 2) of 5,000,000 tpa raw coal throughput. This will require a 350 mm diameter pipe to supply the estimated maximum demand of about 7 Ml/day for the full proposed development.

The supply will be by gravity as far as Wallarah Colliery. Initially this will connect into the existing 100 mm diameter pipeline, which passes under the Pacific Highway between Wallarah Colliery and Catherine Hill Bay, but when the overland conveyer is constructed as a part of the Stage 2 development, the new supply pipeline will be extended beside the conveyer discharging into the Water Supply Dam to be built adjacent to the raw coal stockpiles. Pumps, as required, will be installed to lift the water from Wallarah Colliery over to Catherine Hill Bay.

The combination of new 350 mm diameter pipeline to Wallarah Colliery and existing 100 mm diameter pipeline from Wallarah Colliery to Catherine Hill Bay will be adequate to supply the estimated daily demand (from all sources) of 2.2 Ml/day for the Stage 1 development, although about 0.8 Ml/day will continue to be supplied from the present Moonee and Middle Camp systems leaving a demand of about 1.4 Ml/day on the Wyong supply (depending on rainfall).

Discussions with Wyong Shire Council have confirmed that Council's "current projections indicate that there is adequate hydraulic capacity to supply the expected demands from the headworks (dam etc.) system", but that "an assessment will be necessary to examine the impact, timing and costs associated with future headworks augmentation requirements" (Ref. 8) (see Section 8.5 and 12.2).

6.5 Workforce

Expansion of coal production from Moonee Colliery to about 900,000 tpa and strengthening of the workforce at Chain Valley Colliery will require an increase in workforce of about 80 employees. Expansion of the Coal Preparation Plant will also require an increase in operators from 43 to 63 employees.

Thus the increase in production workforce will be 100, but some additional job opportunities will also be created by the increased truck transport of 2500 tpd (153 loads) of coal from Moonee Colliery to the Coal Preparation Plant.

7.0 ENVIRONMENTAL SAFEGUARDS AND MONITORING FOR STAGE 1 DEVELOPMENT

7.1 Water Quality

The proposed expansion of the Coal Preparation Plant will be fully enclosed and the plant will be operated with a closed circuit water system.

All washdown water, dust suppression water and plant spillage will be contained within the plant and will be returned to the process circuits. Tailings will be mechanically dewatered and the water will be recovered.

There will be no discharge of contaminated water from the plant, and a bunded area will be constructed to contain any spillage or necessary drawdown from the new tailings thickener.

The existing bore into the old workings, which is adjacent to the present Coal Preparation Plant, will continue to be used for runoff water outside the actual plant, in case it should become contaminated with fine coal.

7.2 Noise

The new Coal Preparation Plant building will be constructed so that the noise level at 10 m from the building, or any part of the extension, shall not exceed 78 dBA on the northern and western sides.

The building will be constructed with Colorbond or similar cladding and with no permanent openings for access or ventilation on the northern or western side (including the roof) of the building. Additionally transparent sheeting, which would reduce noise attenuation by less than Colorbond sheeting, will not be incorporated

on the northern or western sides (including the roof) of the building. All cladding will be extended to ground level, and such other noise control procedures as are required to meet the target noise levels outside the buildings will be incorporated into the design. These will include installation of noise absorbing rockwool and liner under the roof; the use of a concrete suspended floor in the building for screens and similar vibrating equipment; isolating the amenities and control rooms from the main part of the washing plant to ensure adequate noise reduction, and where necessary, attenuating or isolating individual items of equipment to reduce internal noise to acceptable levels.

7.3 Visual

The development of the Stage 1 facilities has been designed so as to safeguard the existing visual amenity.

Two important features incorporated into the design of the facilities which serve to safeguard the visual amenity are:

1) Siting of facilities away from the highest point in the headland, and where possible in benches cut into the hillside, and

2) Painting of facilities in colours selected by industrial designers to make the structures appear smaller and less prominent in the coastal scenery. Colours such as 'Sand' for the roof and 'Mocha' (a light brown/grey colour) for the walls have been selected.

8.0 ASSESSMENT OF ENVIRONMENTAL IMPACT OF STAGE 1 DEVELOPMENT

8.1 Noise

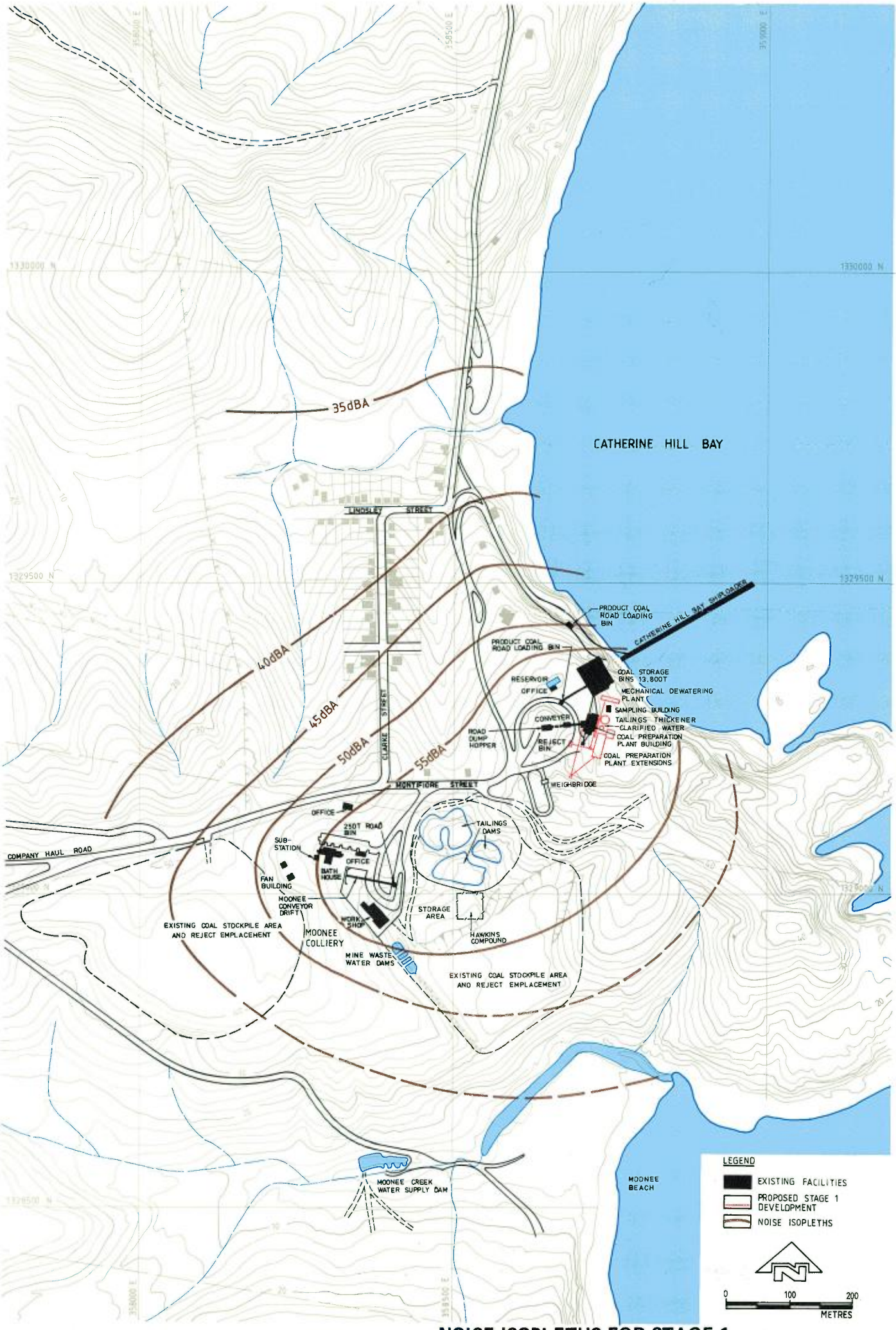
As discussed in Section 4.12, the village of Catherine Hill Bay has always been closely associated with the mining and transport of coal and consequently has always been affected by noise from such activities. The proposed Stage 1 development, consisting of the new 2-module Coal Preparation Plant and associated conveyers (which will increase production to 2,500,000 tpa) will contribute to the acoustic environment in the area. However, the Company will ensure that the additional noise sources do not increase noise levels in the village over those that presently occur.

The residential location which is most likely to be affected by the Stage 1 plant development is the southern-most house in Clarke Street. This house, which corresponds to background noise Sample Point No. 4, has been used as a reference point for the calculation of noise impact on the village. Other residential locations for which projected noise levels have been calculated and assessed include the western end of Lindsley Street (background noise Sample Point No. 5, at the lower end of the village) and the nearest or southern-most house at Middle Camp (background noise Sample Point No. 7). Expected noise levels have also been calculated for within Munmorah State Recreation Area - (at the Bongon Trig. Point Lookout) and for the Moonee Beach Picnic Area.

The maximum semi-continuous noise levels (which can be considered as L_{10} levels), which are expected to result at these points from the Stage 1 development are given in Table 16, and noise Isopleths for the village are presented in Figure 32. The estimated levels are derived from calculations based on noise levels measured at similar coal preparation plants, attenuation due to distance and shielding by topography.

TABLE 16 : PREDICTED MAXIMUM SEMI-CONTINUOUS NOISE LEVELS (L_{10}) FROM STAGE 1 DEVELOPMENT

(a)	At house adjacent to Hotel, Clarke St. Catherine Hill Bay (Sample Point No. 4)	45 dBA
(b)	Near houses at western end of Lindsley St., Catherine Hill Bay (Sample Point No. 5)	37 dBA
(c)	Southern-most house at Middle Camp (Sample Point No. 7)	29 dBA
(d)	Moonee Beach Picnic area	44 dBA
(e)	Bongon Trig. Point Lookout	38 dBA



NOISE ISOPLETHS FOR STAGE 1 DEVELOPMENT

FIGURE 32

The State Pollution Control Commission's Environmental Noise Control Manual gives acceptable limits for background noise levels for various residential environments. Row (e) in Table 21-1 in this manual refers to residential receiver areas located near industrial areas, which is considered to apply to the village of Catherine Hill Bay. The acceptable limits of L_{90} background noise for this category are 50 dBA for daytime and 40 dBA for night-time, with extreme limits 5 dBA higher in both cases.

However, the existing L_{90} noise levels at noise Sample Point No. 4 (see Tables 11, 12 and 13) are between 42 dBA and 53 dBA (with little variation according to time of day) and most of these levels are primarily produced by the present coal handling/preparation/ transportation activities, which will be supplemented by the proposed development. It is considered appropriate that any re-development of the colliery facilities should be designed to ensure that noise levels after the Stage 1 development is in operation are kept within the present range of ambient noise levels. The lower background levels here (around 42 dBA - 45 dBA) were measured when the existing Coal Preparation Plant was not operating. Typical background levels with the Coal Preparation Plant in operation are 46-53 dBA.

The projected noise levels given in Table 16 include the noise from the existing Coal Preparation Plant, which will be attenuated (reduced) as a part of the proposed Stage 2 development (see Section 11.4). The noise levels given in Table 16 do not include the intermittent effects of trucking. As the number of daily truck loads (between Moonee Colliery and the Coal Preparation Plant only) will increase by approximately 153 loads per day during the Stage 1 development, these intermittent noise effects will increase in frequency.

Table 16 indicates that the expected maximum continuous, or L_{10}, noise level at the closest part of the village (Sample Point No. 4) is 45 dBA, including noise from the existing Coal Preparation Plant. This is well within the range of background readings obtained. At other parts of the village, expected levels are much lower; the projected level of 37 dBA at the western end of Lindsley Street

(Sample Point No. 5) being equivalent to the lowest background levels obtained at that point. Levels expected at other parts of the village are indicated on Figure 32.

As the residents of Catherine Hill Bay live in an environment which is already substantially affected by noise from coal mining activity, it is not considered that the minor alternation to noise levels produced by the new Coal Preparation Plant is a significant impact. The increased numbers of truck movements (between Moonee Colliery and the Coal Preparation Plant area) will cause some increase in the frequency of intermittent noise levels during Stage 1, but will decrease substantially with the Stage 2 development.

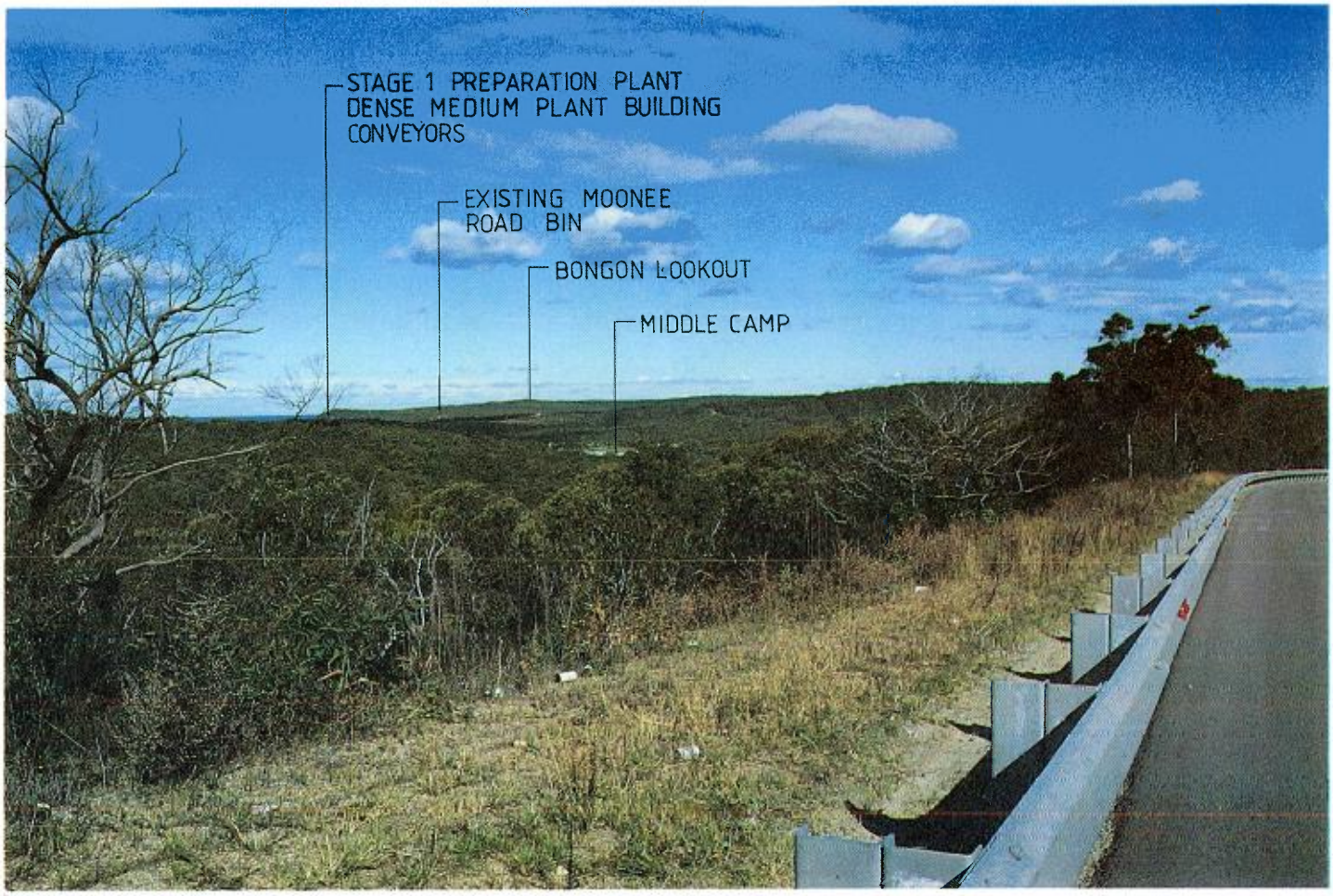
8.2 Visual

In order to assess the impact of the proposed new Coal Preparation Plant building on the existing environment, computer calculated structure sizes have been superimposed on photographs from viewing points to form photomontages. These are shown in Figures 33, 34, 35 and 36.

The montages show that the proposed structures, when viewed at close range or from the south as shown in Figure 34, will appear as a small addition to an existing industrial site. When viewed from the north-west and south-west as shown in Figures 33, 35 and 36, the structures are less prominent, and only the top of the Coal Preparation Plant breaks the ridgeline in these views.

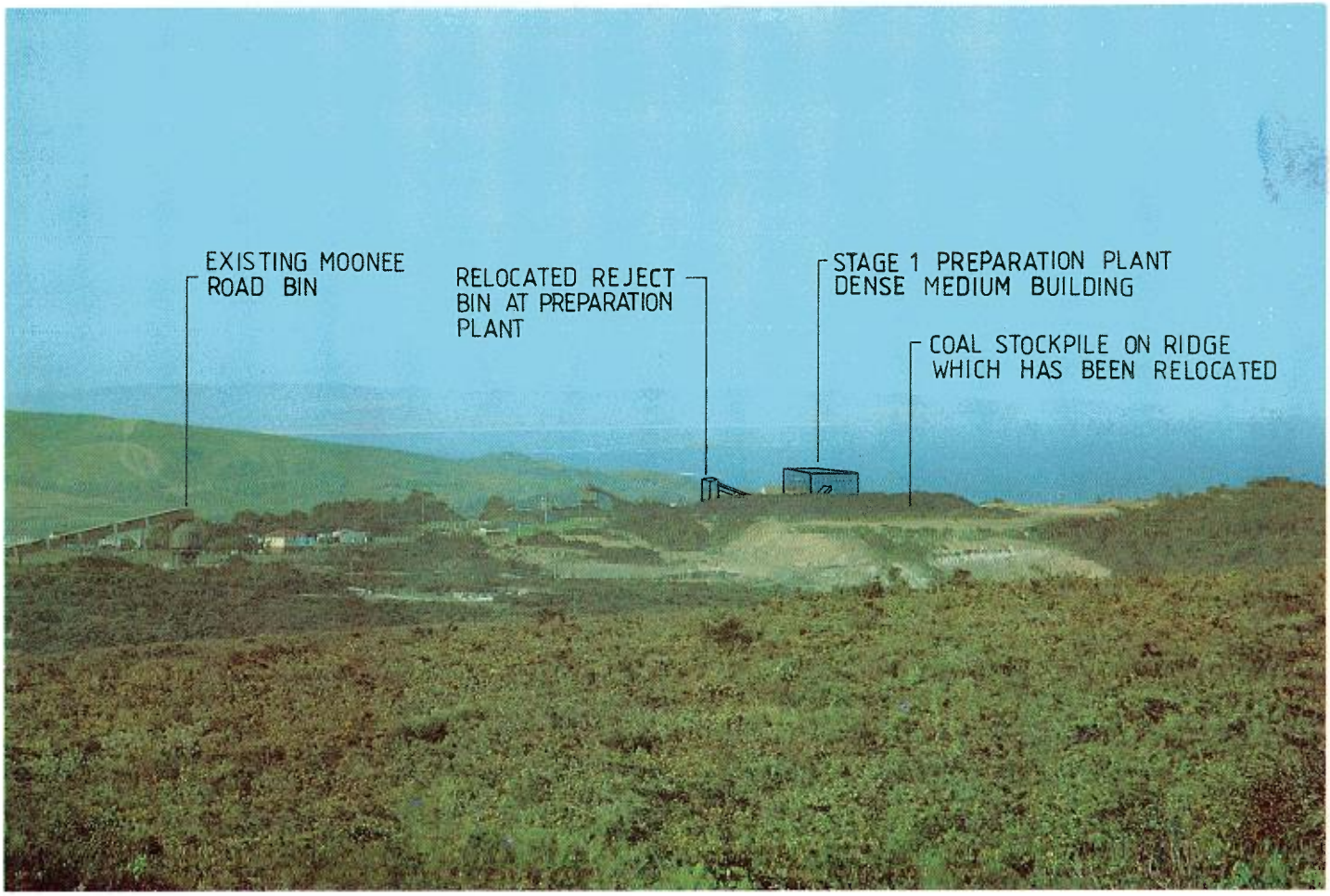
Although the colour schemes and painting arrangements for the new structures, as described in Section 7.3, will reduce their visibility in this setting it is considered that there will still be a minor impact on these views and especially from the Munmorah State Recreation Area.

As these views already contain industrial structures and as coal mining related activities have been associated with this area since the late 1800's it is considered that the additional impact on these views is not significant.



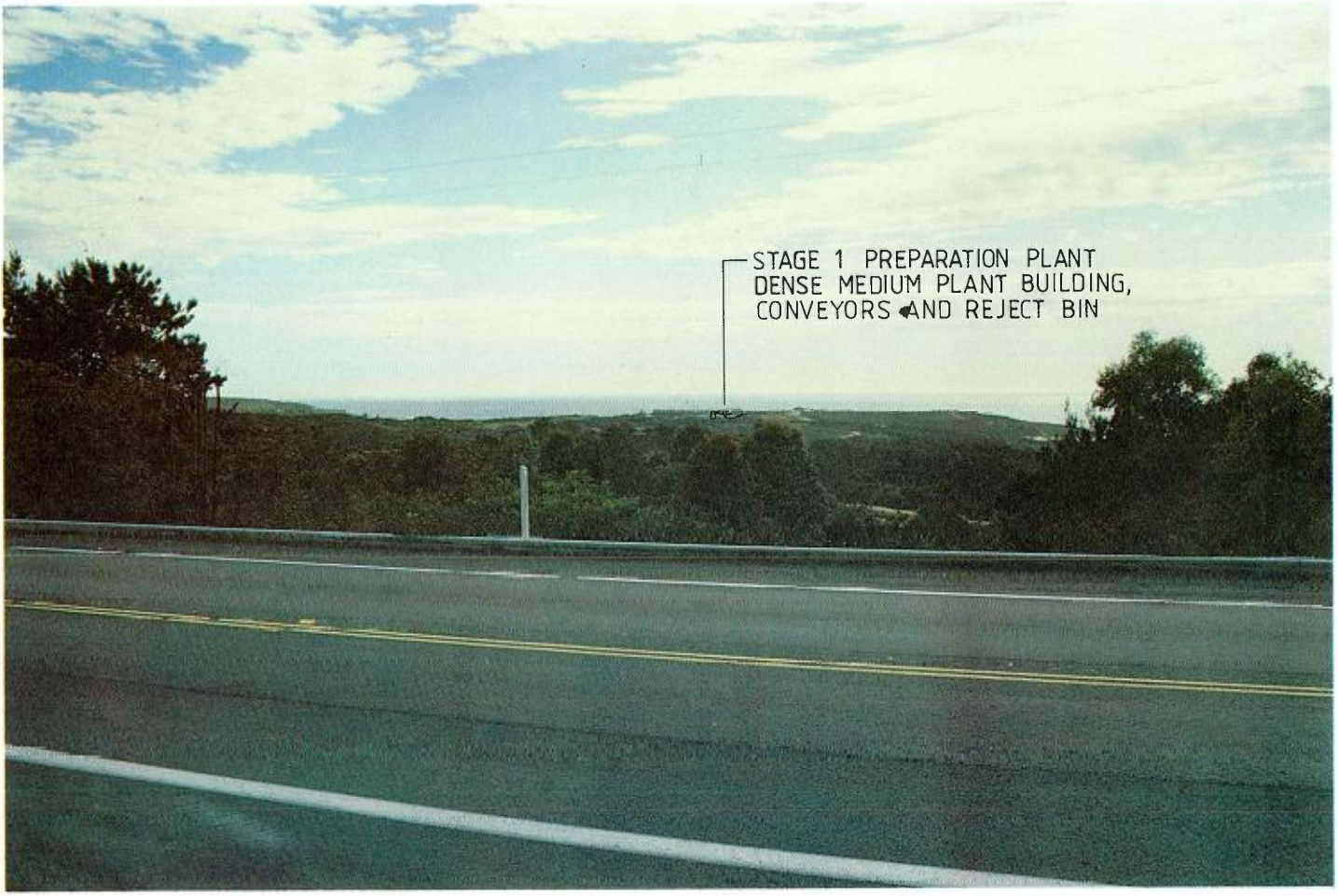
PHOTOMONTAGE OF PROPOSED
STAGE 1 DEVELOPMENT FROM
PACIFIC HIGHWAY LOOKING SOUTH

FIGURE 33



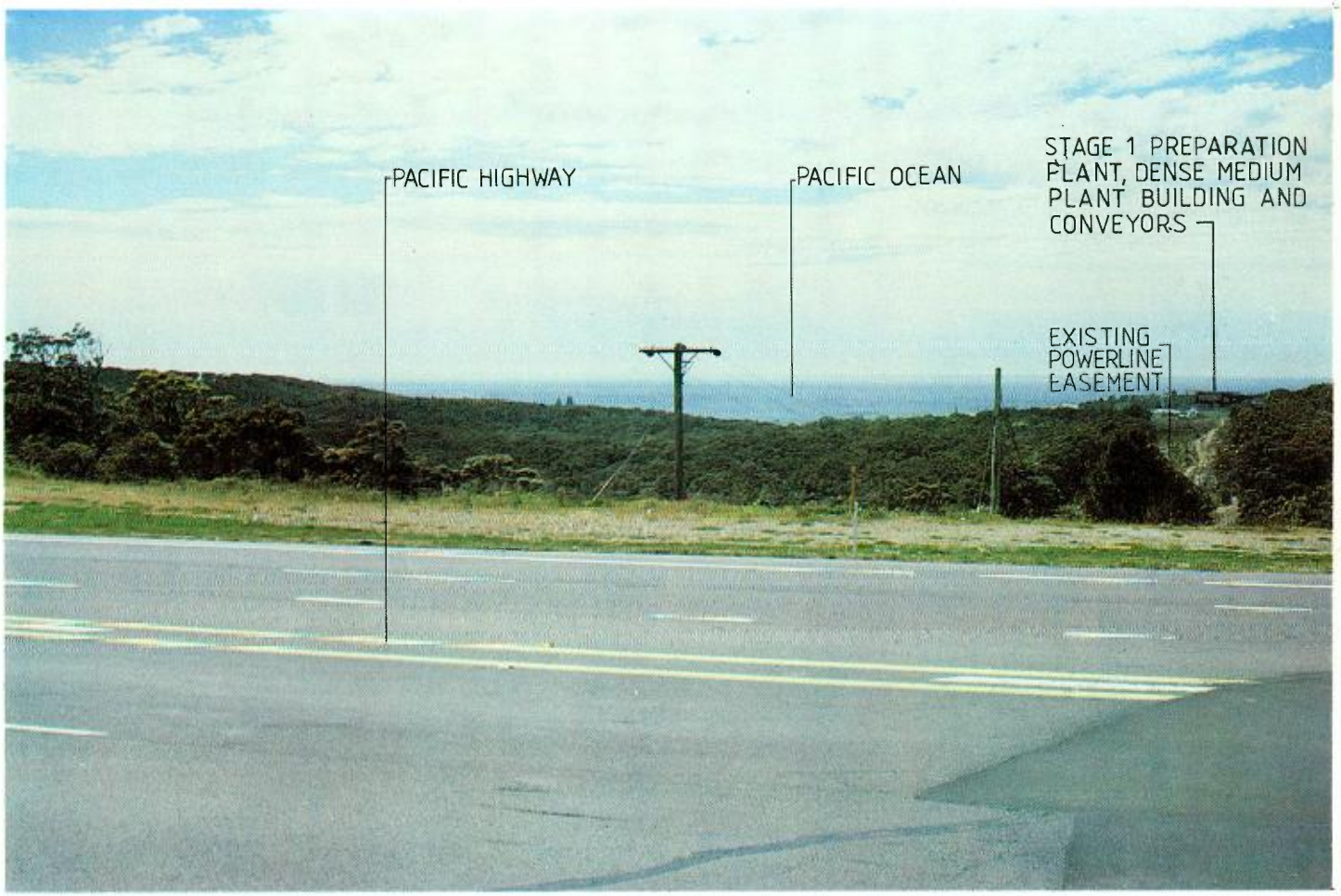
PHOTOMONTAGE OF PROPOSED STAGE 1 DEVELOPMENT FROM MUNMORAH STATE RECREATION AREA

FIGURE 34



PHOTOMONTAGE OF PROPOSED STAGE 1 DEVELOPMENT FROM PACIFIC HIGHWAY LOOKING NORTH-EAST

FIGURE 35



PHOTOMONTAGE OF PROPOSED STAGE 1 DEVELOPMENT FROM PACIFIC HIGHWAY ADJACENT TO CATHERINE HILL CREEK VALLEY

FIGURE 36

8.3 Air Quality

A greater quantity (32%) of coal will be washed at Catherine Hill Bay when the Stage 1 development is completed. This will be transported to the Coal Preparation Plant by truck as at present, but will only affect the short haul distance between Moonee Colliery and the Coal Preparation Plant dump hopper.

The new coal processing plant will be fully enclosed, and the coal will be damp both on entering the Coal Preparation Plant and on leaving.

A programme of fugitive dust suppression is already in operation at Catherine Hill Bay. This includes spraying dust emission control chemicals onto the coal as it is loaded at the jetty, cleaning and water spraying of haul roads, maintaining stockpile areas damp (by water cart) and enclosure of conveyers. These procedures will be continued.

Additionally, the dust deposition monitoring initiated for this environmental impact study will be continued to check on any excess fugitive dust emission. In general, a combustible material deposition rate of less than 4 g/m^2/month will be considered acceptable and if the combustible material (which includes any fugitive coal dust) rises above 2.5 g/m^2/month, the cause will be investigated and any necessary remedial action will be implemented.

It is expected that the proposed Stage 1 development will cause no measurable increase in fugitive coal dust emission and that carbonaceous material deposited will remain at similar levels to the present. This is generally below 2.5 g/m^2/month in the village of Catherine Hill Bay.

8.4 Drainage and Water Pollution

The Stage 1 development will be wholly within the area currently used for coal handling at the Catherine Hill Bay Coal Preparation Plant. All washdown, dust suppression and spilt process water will be contained and reclaimed into the process circuits.

Tailings will be dewatered and the water will also be recovered for reuse in the plant.

Any contaminated run-off water from areas adjacent to the new plant will be reticulated to the bore into the old workings. A bunded area will be provided to collect emergency drainage from the new thickener.

There will be no discharge of process water or surface run-off from the new plant, which will not cause any water pollution problem.

8.5 Water Supply

It is estimated that the Stage 1 development at Catherine Hill Bay, including water usage at Wallarah Colliery and Moonee Colliery, will require about 2.2 Ml/day. The present supply system from Moonee Creek and the dams at Middle Camp has an estimated maximum sustainable yield of about 0.8 Ml/day, though more water can be pumped in non-drought periods.

Consequently, the Company's existing supply would be inadequate and it is proposed to obtain a supply from the Wyong Shire System. This will be about 1.4 Ml/day maximum, depending on rainfall, for the Stage 1 development.

Wyong Shire have indicated that there is adequate hydraulic capacity to supply the Stage 1 development requirement from the Headworks system (Ref. 8).

Council have also indicated that there is adequate Headworks capacity for the Stage 2 development (see Section 12.2).

8.6 Transport

All raw coal will continue to be transported by truck to the Catherine Hill Bay Coal Preparation Plant for the Stage 1 development.

There will be no increase in production from Chain Valley Colliery or Wallarah Colliery and consequently the number of truck loads of coal per day will remain the same as at present. Coal will continue to be taken along the Pacific Highway and down the Company's private haul road to Catherine Hill Bay.

Output from Moonee Colliery will increase by 600,000 tpa of raw coal to 900,000 tpa. This will require an increase in truck transport of coal by an average of 153 loads/day to an average of 253 loads/day (peaking to 293 loads/day) in 15 tonne trucks. All of this increase will be for the short distance between the existing 250 tonne Moonee road bin and the Coal Preparation Plant dump hopper or the existing surge (emergency) stockpile areas to the west of Moonee Colliery.

There will be no increase in coal truck traffic on the Pacific Highway.

The road transport of coal for the Stage 1 development is given in Table 17.

The increase in truck movements will increase noise levels generally around the Coal Preparation Plant, but there will be no increase in peak levels (see Section 8.1). The extra traffic (about 300-580 truck movements/day) will cause no traffic problem as the transport route is largely on private roads and the short length of public road carries very little traffic.

TABLE 17 ESTIMATED COAL TRUCK TRAFFIC FOR STAGE 1 DEVELOPMENT

	Wallarah Colliery	Chain Valley Colliery	Moonee Colliery
Truck Capacity (tonnes)	15	25	15
Existing Traffic			
Average Truckloads/day	316	116	100
Peak Truckloads/day	385	160	150
Stage 1 Development			
Average Truckloads/day	316	116	253
Peak Truckloads/day	385	160	293

8.7 Social and Economic

The expansion of the Catherine Hill Bay Coal Preparation Plant and the increase in production from Moonee Colliery will require an investment of over $15 million (1987 prices) and create over 100 new direct job opportunities. This will bring significant advantages to the region. Indirect employment from capital expenditure and the additional direct jobs from the capital works programme will provide further employment.

Estimated unemployment in the Wyong area was 18% in June 1986 (Ref. 6) with an estimated 5418 people unemployed. Unemployment in the Lake Macquarie area was estimated at above 10% also.

The additional job opportunities are expected to be filled by people who presently live in the Lake Macquarie and Wyong areas and who currently commute to work elsewhere or who are unemployed.

8.8 Zoning

The whole of the proposed development is within land presently zoned 4(b) : Special Industry (Coal Mining) under the City of Lake Macquarie Local Environmental Plan. The proposed developments are permissible with the consent of Council, but are subject to a direction under Section 101 of the Environmental Planning and Assessment Act and will be determined by the Minister for Planning and Environment.

8.9 Energy Statement and Electricity Demand

The proposed development will increase production of washed coal, which will be used mainly as 'steaming coal'. Most of the product coal will be exported.

Each new module of dense medium cyclone and spiral in the Coal Preparation Plant will require an estimated 1100 kw of power. There is adequate capacity in the existing Shortland County Council reticulation system to supply one module only, and it will be necessary to augment the system for the second Stage 1 module and all the Stage 2 developments. This will require a new 66 kV transmission line from the Munmorah Zone Substation (in the Sydney County Council area) and a new substation at Catherine Hill Bay. This will make a 10 MVA supply available, which is estimated to be adequate for the complete Stage 1 and Stage 2 developments.

The increase in output from Moonee Colliery and the extra capacity in the Coal Preparation Plant will not otherwise affect the regional electricity distribution system.

Coal will be transported away from Catherine Hill Bay by coastal collier and there will be no additional energy requirement for road or rail transport.

The proposed development will not sterilise any coal resources.

9.0 DESCRIPTION OF PROPOSED STAGE 2 COAL PREPARATION PLANT EXPANSION AND CONSTRUCTION OF COAL HANDLING FACILITIES DEVELOPMENTS

The Stage 2 proposal is for a progressive multicomponent development that increases raw coal production from the Stage 1 level of 3,100,000 tpa of raw coal to 5,600,000 tpa of raw coal over a 10 or so year period. The development will provide for the full development potential of the Wallarah and Great Northern Seams and subsequently of the Fassifern Seam within the Wallarah and Chain Valley Colliery Holdings.

The development will be phased and the different components constructed to suit the market for the product coal and as they become necessary to suit the overall coal production programme. For this reason various components may be developed earlier or later than currently programmed and one section of the development may be completed before another earlier component has been commenced.

To enable an easier understanding of the proposed Stage 2 development (and as presently programmed), Stage 2 is presented as a 3,600,000 tpa phase and as the planned full development of 5,000,000 tpa of raw coal feed to Catherine Hill Bay Coal Preparation Plant.

9.1 Production of Coal from Existing Mining Operations

Coal & Allied have three existing underground coal mines in the Catherine Hill Bay region, which are mining coal from the Company's existing approved mining leases. Moonee Colliery and Wallarah Colliery are working the Wallarah Colliery Holding and Chain Valley Colliery is working the Chain Valley Colliery Holding.

Coal to be mined at these collieries in the future does **not** require new development approval. The mining and increased output will only require continued approval by the Joint Coal Board and the Department of Mineral Resources. Coal mining to supply coal to the proposed Catherine Hill Bay Coal Preparation Plant expansion and associated works Stage 2 development does **not** form a part of the proposed development evaluated in this environmental impact statement and the subject of the Stage 2 Development Application.

9.1.1 3,600,000 tpa Raw Coal Phase of Stage 2 Development

The 3,600,000 tpa raw coal phase of the Stage 2 development will exploit the full production potential (4,200,000 tpa) of Chain Valley, Moonee and Wallarah Collieries in the Wallarah and Great Northern coal seams. This phase of the development will also provide for the future establishment of development units in the Fassifern Seam, which is below the Great Northern Seam.

Increased production at each of the collieries will be achieved by increasing the number of continuous miners, introduction of larger continuous miners working in conjunction with flexible coal transporters (as is being installed in Moonee Colliery) or by the introduction of longwall mining systems. Use of both large continuous miners working in conjunction with flexible coal transporters and longwall mining systems can both give effective total extraction of coal (as discussed in Section 5.2).

Underground mining operations in the Wallarah and Great Northern Seams at Wallarah Colliery currently produce about 1,000,000 tpa of raw coal. Further development of the Great Northern Seam will enable ouput from Wallarah Colliery to be increased to 1,500,000 tpa of raw coal to supply additional throughput in the Coal Preparation Plant at the 3,600,00 tpa phase.

At the end of the Stage 1 development, Moonee Colliery will have the installed capacity to produce about 900,000 tpa of raw coal from the Wallarah Seam. The reserves of the Wallarah Seam accessible to Moonee Colliery are limited and consequently the existing Moonee drift is being deepened from the Wallarah into the Great Northern Seam to provide for men and materials access for development of the Great Northern Seam.

In the 3,600,00 tpa development, a new (Moonee Colliery) coal transportation drift will be driven from an area adjacent to the new raw coal stockpile area to the Great Northern and Fassifern Seams. This will be a conveyor drift and will enable Moonee coal to be transported directly by conveyer from the mine to the Coal Preparation Plant.

Production of coal from Moonee Colliery will increase slightly from 900,000 tpa to 1,200,000 tpa as the raw coal feed to the Coal Preparation Plant is increased to 3,600,000 tpa. 300,000 tpa will be produced from the Wallarah Seam and taken out of the mine by the Moonee Entry drift to the 250 tonne Moonee road bin. It will be transported to the Coal Preparation Plant by truck. 700,000 tpa will be produced from the Great Northern Seam and 200,000 tpa will be produced from the Fassifern Seam. Both the Great Northern Seam and Fassifern Seam coal will be taken out of the mine by the new (Moonee) coal transportation conveyor drift adjacent to the raw coal stockpile area.

At Chain Valley Colliery, the Stage 1 development production of 1,200,000 tpa of raw coal will be increased to 1,500,000 tpa by installation of additional high capacity mining equipment to extract coal from both the Wallarah and Great Northern Seams. With about 600,000 tpa being conveyed direct to Vales Point Power Station, 900,000 tpa will be delivered by road to Catherine Hill Bay in 25 tonne trucks.

For the 3,600,000 tpa phase of the Stage 2 development, the Company's three regional collieries will provide 3,600,000 tpa raw coal to the Coal Preparation Plant from a production of 4,200,000 tpa of raw coal.

9.1.2 5,000,000 tpa Raw Coal Phase of Stage 2 Development

The 5,000,000 tpa raw coal phase of the Stage 2 development exploits the full development potential (5,600,000 tpa) of the Great Northern Seam and Fassifern Seam in the Chain Valley and Wallarah Colliery Holdings. Production from both Chain Valley and Wallarah Collieries will remain at about 1,500,000 tpa from the Great Northern Seam, and production from Moonee Colliery will be about 700,000 tpa from the Great Northern Seam. This will all be taken out of the mine through the new coal transportation conveyor drift adjacent to the raw coal stockpile area and there will be reduced production from the existing Moonee Colliery drift, which will be retained for men and materials access. About 1,900,000 tpa of raw coal will be produced from the Fassifern Seam in the Wallarah and Chain Valley Colliery Holdings.

Entry for men and materials to the Fassifern Seam will be from Wallarah, Moonee and Chain Valley Colliery surface facilities. The feasibility of underground transport of Fassifern Seam production by conveyer direct to the proposed new Moonee Colliery conveyor drift adjacent to the raw coal stockpiles is being closely examined.

Of the total 5,600,000 tpa raw coal production from the Company's three regional mines, 5,000,000 tpa will be processed in the Catherine Hill Bay Coal Preparation Plant.

9.2 Coal Preparation Plant Additional Modules

The Stage 1 expansion of the Catherine Hill Bay Coal Preparation Plant (see Section 6.2) is for installation of two new 200 tph dense medium cyclone and spiral separator modules.

For the Stage 2 expansion, four new modules each of 200 tph capacity will be installed. Two modules will be dense medium baths and two will be dense medium cyclones with spiral separators, as for the Stage 1 development.

The Stage 2 development will further increase throughput in the Coal Preparation Plant and increase plant efficiency to beneficiate coal from the Great Northern and Fassifern Coal Seams. Both the Coal Preparation Plant and the proposed new materials handling facilities will be phased developments. Figures 37 and 38 show the main components of the proposed development at the nominal 3,600,000 tpa and 5,000,000 tpa phases of the development. Figures 39 and 40 show relevant sections through coal stockpiles, conveyor systems and the Coal Preparation Plant.

For Stage 2 of the development, the folowing additional equipment will be installed:

(1) two dense medium baths;

(2) four dense medium cyclones;

(3) additional fine coal spirals to increase the maximum installed capacity from 2,500,000 tpa to 5,000,000 tpa.

The existing jig plant (in the Coal Preparation Plant) will be retained in the Stage 2 development and will continue to be used as a "middlings" plant when the other Stage 2 additions are completed.

Section 6.2 describes the proposed extension of the Coal Preparation Plant, which is generally as follows:

> At present raw coal is received at the raw coal road hopper and conveyed to a triple deck primary screen at a rate of approximately 420 tph. The +85 mm material from the first deck is passed to a picking belt for removal of large stone, timber and other rubbish prior to a single roll crusher. Product from the crusher is then combined with overflow material from the second deck of the primary screen (which has an aperture of 18 mm) and the mixture is then conveyed to a secondary screen for further fines removal prior to the overflow from this screen being fed to a SJL 100/5 Baum jig. Approximately half of the total raw coal feed to the preparation plant is washed in the jig. Product from the jig is dewatered over low head screens and conveyed to a separate crushing and screening operation remote from the plant.
>
> The underflow from the secondary screen is combined with coal retained on the third deck of the primary screen (which has 25 mm x 7 mm apertures across the flow) and this blend of raw smalls is conveyed to the No. 1 product bin. Material passing the third deck of the primary screen is generally included in the coal bypassing the Baum jig (the unwashed coal).
>
> A fines recovery system is also included in the jig circuit whereby underflow from the product dewatering screens is thickened in classifying cyclones prior to treatment in spiral seprators. The product from the spiral separators is dewatered on a rapped sieve bend and then a Rheinveld fine coal centrifuge. The fine product is conveyed with the other products from the jig circuit to the product screening and storage area. The reject from the spirals is dewatered on a small screen prior to joining the coarse reject.

The Stage 1 development will increase the washing capacity of the Coal Preparation Plant from the present 200 tph to 600 tph. This will be achieved by the addition of two modules of dense medium cyclone/spiral separator plant, each of 200 tph capacity, together with appropriate modifications to the existing preparation, handling and storage plants. A further two 200 tph capacity dense medium cyclone and spiral separator modules will be installed for the Stage 2 development. Generally the dense medium cyclone/spiral plant will be required to achieve a product quality (before blending) of 10 - 13% ash from raw coal produced from the Great Northern and Fassifern seams and the total moisture of the product leaving the dense medium cyclone/spiral plant is not to exceed 8%.

Each of the new dense medium cyclone and spiral separator modules will include:

- Sieve bends and screens to separate fine material out of the raw feed to the cyclone circuit. This material will be fed to a spiral treatment circuit;

- Dense medium cyclones to provide a cyclone capacity of 150 tph;

- Fine coal spirals to provide a spiral capacity of 50 tph;

- A magnetite recovery circuit and density control system;

- A vibrating basket centrifuge for the dense medium cyclone product and a screen bowl centrifuge or other specialised equipment to dewater the fine product;

- Efficient dewatering of reject from the dense medium cyclones and spirals using screens and/or centrifuges;

- Efficient desliming cyclones for tailings removal.

In addition to the dense medium cyclones and spiral separator modules, two dense medium bath modules, each of 200 tph capacity will be installed.

Other equipment required will be an additional high rate tailings thickener and possible extra mechanical dewatering equipment.

Mechanical dewatering equipment isntalled for the Stage 1 development will be utilised in Stage 2 to serve the overall plant as required. When the Stage 2 development is proceeding, tailings will generally be pumped to the coal washery reject emplacement as a slurry and will **NOT** be mechanically dewatered as for Stage 1.

The mechanical dewatering equipment will normally only be operated when the product 'filter cake' can be included in the product coal and generally will not be used to dewater tailings prior to disposal in the new emplacements. The exception will be if it becomes necessary to place tailings into the Moonee Creek emplacement, where no tailings slurry is permitted. In this situation, any tailings placed into the Moonee Creek emplacement will be dewatered and the filter cake mixed with the coarse reject prior to disposal.

Operation of the mechanical dewatering equipment will improve coal recovery, reduce the amount of tailings placed into the emplacement in slurry form and will also conserve water.

The proposed Coal Preparation Plant flow sheet is shown on Figure 31 (page 124).

9.3 Bulk Handling Procedures and Road Transport

9.3.1 Raw (Run of Mine) Coal

A new dump hopper, Bradford breaker, connecting conveyers and 2000 tonne bin over the existing dump hopper at the Coal Preparation Plant will be built at the beginning of the Stage 2 development. This system will normally receive all road transported coal from Moonee, Wallarah and Chain Valley Collieries. It will be the only feed system for raw coal to the Coal Preparation Plant until the new mechanical system and raw coal stockpiles are commissioned. This is shown on Figure 41.

In the early stages of the 3,600,000 tpa development, all raw coal will be transported by road to the new dump hopper and Bradford breaker, although an alternative mobile coal crushing facility and stockpile area for raw coal from Moonee Colliery is planned for the area to the east of the 250 tonne Moonee road bin to provide additional surge capacity.

As the 3,600,000 tpa phase of the Stage 2 development is progressively constructed, the overland conveyer, new Moonee coal transportation conveyor drift (near the raw coal stockpiles) and new mechanised handling system will be built. This will reduce road transport of coal.

All Chain Valley coal will continue by road transport. Production will be increaed to 1,500,000 tpa of raw coal, which will be dumped in the new raw coal dump hopper adjacent to the Coal Preparation Plant or in the dump hopper adjacent to the new raw coal stockpile. This will require an average of 160 truck loads (320 truck movements) per day peaking at 180 truck loads (360 truck movements/per day). The trucks will be routed along the Pacific Highway and the Company's private haul road to Catherine Hill Bay, as at present.

Moonee coal brought to the surface through the existing Moonee Colliery drift will be trucked from the existing 250 tonne road bin to the new dump hopper adjacent to the Coal Preparation Plant or the mobile coal crushing and stockpile facility to the east of the 250 tonne road bin. An estimated 300,000 tpa of raw coal will be handled in this way. This will require an average of 100 truck loads per day, peaking to 150 truck loads, for the short haul distance.

The bulk of the production from Moonee Colliery (900,000 tpa raw coal) will be brought out of the mine through the new coal transportation conveyor drift adjacent to the raw coal stockpiles.

Wallarah Colliery production will be increased to 1,500,000 tpa of raw coal. This would require an average of 475 truck loads (950 truck movements) per day between the Wallarah Colliery bin and Catherine Hill Bay Coal Preparation Plant. As a part of the 3,600,000 tpa

development it is proposed to install an overland conveyer from Wallarah Colliery to Catherine Hill Bay. This conveyer will be loaded from the existing drift conveyer at Wallarah Colliery, pass under the Pacific Highway in a tunnel and connect to the raw coal stockpiles and proposed new coal handling equipment. As required a formation for the conveyer will be constructed from coal washery reject, particularly to the east of the Pacific Highway (see Section 10.7.2). Under normal operating conditions adequate surge capacity will be provided by the existing underground interseam bin feeding the drift conveyer and the 1,200 tonne surge bin near the Bradford breaker.

Installation of the overland conveyer will remove all Wallarah Colliery coal off road transport. Consequently there will be **no** increase in truck transport of coal with the increase in production and the Stage 1 coal traffic from Wallarah Colliery of an average 316 truck loads (632 truck movements/day) peaking to 385 truck loads (770 truck movements/day) on the Pacific Highway will be eliminated.

Figure 37 shows the components of the proposed new coal handling equipment for the 3,600,000 tpa phase of the Stage 2 development. The existing emergency coal stockpile in Catherine Hill Creek valley will be extended and converted to the new raw coal stockpile, which will have a rill tower for stockpiling Wallarah Colliery coal transported on the overland conveyer (if it is not sent directly to the Coal Preparation Plant). Coal stockpiled by the rill tower will be recovered by front-end loader to the adjacent dump hopper, which will also receive road transported coal from Chain Valley Colliery.

Wallarah Colliery coal will normally bypass the raw coal stockpile area, which will be used for surge control and as an emergency stockpile area.

During the 3,600,000 tpa phase of the development, in an emergency or when the Coal Preparation Plant is not operating, the Wallarah Colliery overland conveyer will discharge to a rill tower adjacent to the existing coal storage area. Excess coal from Moonee and Chain Valley Collieries will also be stockpiled on the existing stockpile area

adjacent to the rill tower. The stockpile area has the capacity to provide storage for 300,000 tonne of raw coal. Coal will be recovered to the road dump hopper by front end loader and then transported to the 1,200 tonne surge bin, Bradford breaker and Coal Preparation Plant by the extension of the overland and connecting conveyer system.

For the 5,000,000 tpa development, the raw coal stockpiles will be mechanised by installation of a mechanical stacking and reclaim system, which will handle coal in the raw coal stockpile and will be used for blending the feed to the Coal Preparation Plant and to store coal in an emergency or when the Coal Preparation Plant is not operating (as for the 3,600,000 tpa development). Separate (discreet) stockpiles for Great Northern and Fassifern Seam coals will be used so that the different ash coals do not become mixed in the stockpile area. The two coals will either be transported to the Coal Preparation Plant separately or be blended in the raw coal stockpile area mechanical handling system.

Coal stockpiled in the raw coal stockpiles will be recovered through a reclaim tunnel under the raw coal stockpiles, blended if required and transported from the raw coal stockpile by conveyer to the 1,200 tonne surge bin, Bradford breaker and thence into the Coal Preparation Plant.

For the 5,000,000 tpa phase of the Stage 2 development, coal from Chain Valley will be transported by truck to the road dump hopper adjacent to the Coal Preparation Plant or to the raw coal stockpile dump hopper. The tonnage and number of truck movements will be the same as for the 3,600,000 tpa development. Wallarah coal will continue to be transported by the overland conveyer to the Coal Preparation Plant, normally bypassing the raw coal stockpiles and Moonee coal from the coal transportation conveyor drift will be delivered by conveyer to the transfer tower and surge bin adjacent to the raw coal emergency stockpile from where it will either be transported by the overland conveyer to the 1200 tonne surge bin, Bradford breaker and Coal Preparation Plant or diverted (or diverted in part) to the raw coal stockpiles.

9.3.2 Product Coal

Product coal will be transported from the Coal Preparation Plant by conveyer either to the existing 13,800 tonne capacity enclosed coal bins above the Catherine Hill Bay shiploader jetty or to the new product coal stockpile(s) to the east of Moonee Colliery.

The usual procedure will be for the coal to go straight from the Coal Preparation Plant to the shiploader bins ready to be loaded into coastal colliers for shipment to Sydney and Newcastle for subsequent reloading to ship overseas.

When the enclosed storage bins are full, excess product coal will then be conveyed to the product coal stockpiles. For the 3,600,000 tpa development phase, front end loaders will be used to reclaim product coal to a ground level reclaim conveyer. The coal will be recovered from the single 50,000 tonne capacity stockpile and placed into mobile hoppers over the conveyer. Dust suppression sprays will be fitted in the hoppers.

For Stage 2, 5,000,000 tpa phase, dual mechanised stockpiles of 180,000 tonne and 220,000 tonne capacity will be used. Coal will be reclaimed by means of under-stockpile reclaim conveyers and transported to the shiploader enclosed storage bins as needed for shipment.

In this way interruption to shipments due to bad wather, non-availability of the coastal colliers and assembly of large cargoes can be handled easily.

In the event of the stockpiles to the east of Moonee Colliery being full or the need to store different qualities of coal, emergency stockpile capacity is available on the existing emergency stockpile area to the west of Moonee Colliery. Coal will be delivered to this emergency stockpile area by trucks and will be reclaimed by front-end loaders.

9.3.3 Coal Washery Reject

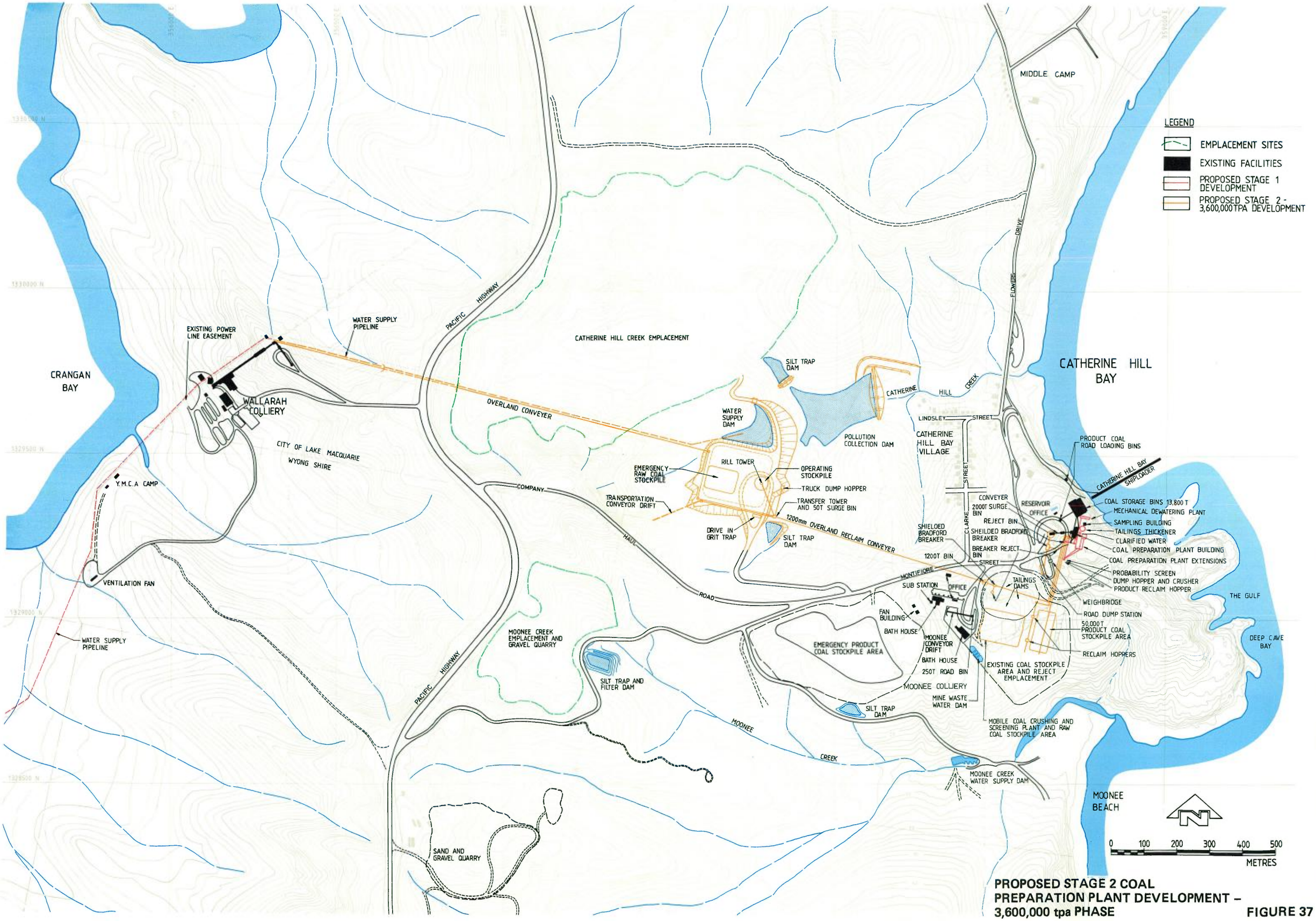
Coal washery reject will be disposed of in the Catherine Hill Creek and Moonee Creek emplacements, which are shown on Figure 42.

This reject material will be produced in two forms;

- a coarse material;
- a fine material (tailings) which can either be dewatered in the Coal Preparation Plant to produce a semi-solid material or which can leave the Coal Preparation Plant as a slurry containing about 33% solids by weight.

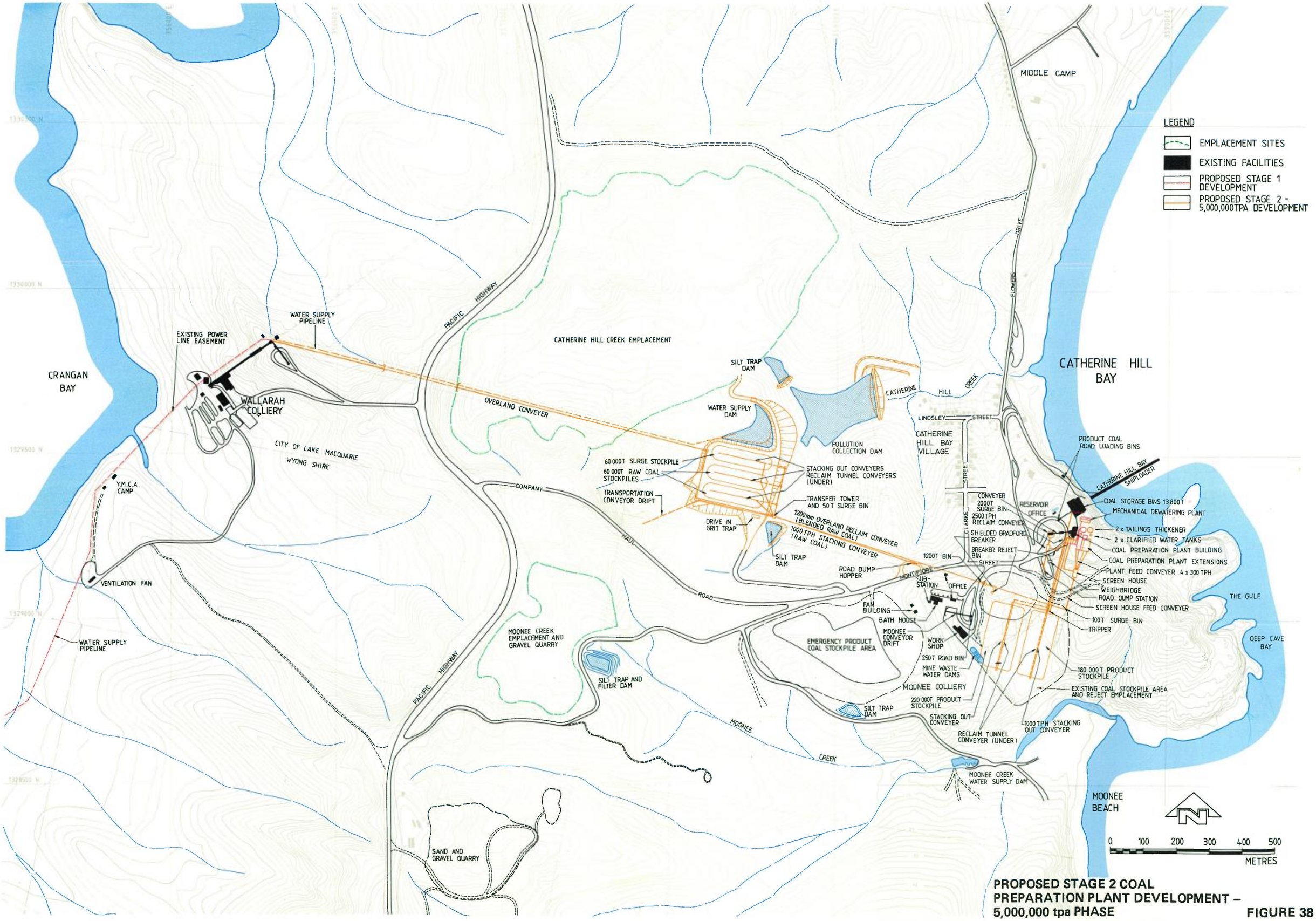
As discussed in Section 6.2, mechanical dewatering equipment to dewater tailings and fine coal will be installed as a part of the Stage 1 development. Once the Stage 2 development is approved and the Catherine Hill Creek coal washery reject emplacement (see Section 10) is developed, tailings will normally be pumped to the new emplacement as a slurry and will be dewatered there in the coarse coal washery reject cells to be constructed. When tailings are pumped to the emplacements as a slurry, the coarse coal washery reject will be transported to the reject emplacement separately in 15 tonne trucks. This will be the normal operating procedure.

The mechanical dewatering equipment (filter press type equipment) will normally only be used to produce dewatered filter cake for inclusion in the product coal and not for dewatering coal washery reject tailings to place in the emplacement. In particular situations dewatered filter cake may be produced from the tailings. The filter cake will then be well mixed with the coarse reject and transported to the emplacement for disposal.



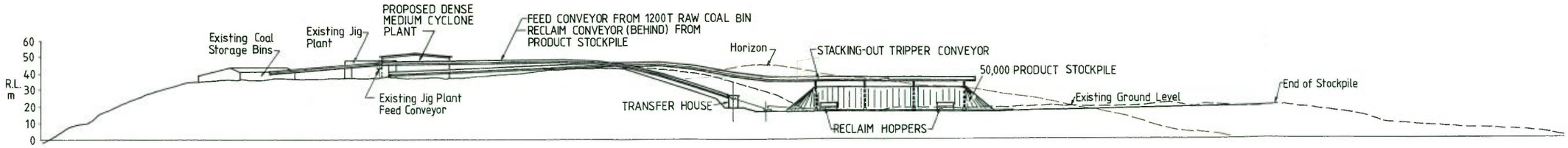
PROPOSED STAGE 2 COAL PREPARATION PLANT DEVELOPMENT – 3,600,000 tpa PHASE

FIGURE 37



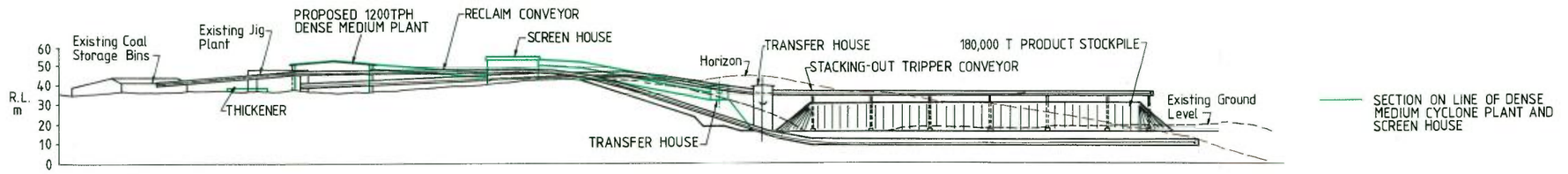
PROPOSED STAGE 2 COAL PREPARATION PLANT DEVELOPMENT – 5,000,000 tpa PHASE

FIGURE 38



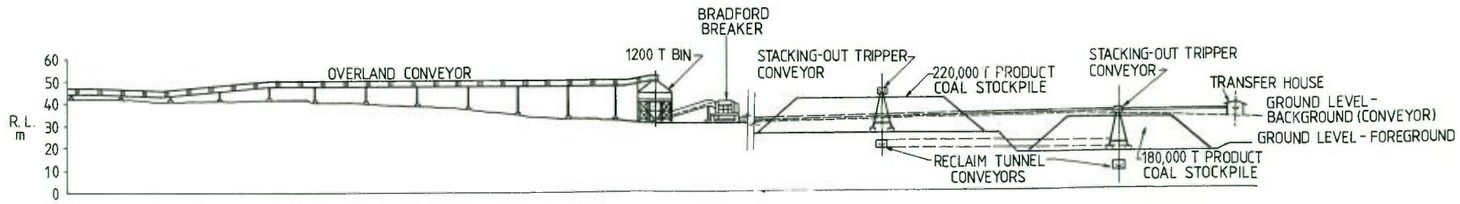
ELEVATION ON PRODUCT COAL STOCKPILE AND PREPARATION PLANT STAGE 2 - 3,600,000 TPA

0 50 100 150
METRES



ELEVATION ON PRODUCT COAL STOCKPILE AND PREPARATION PLANT STAGE 2 - 5,000,000 TPA

0 50 100 150
METRES

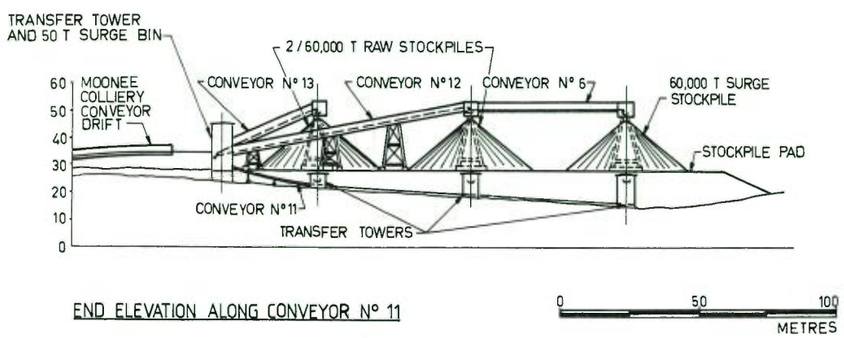


SECTIONS THROUGH PRODUCT STOCKPILES STAGE 2 - 5,000,000 TPA

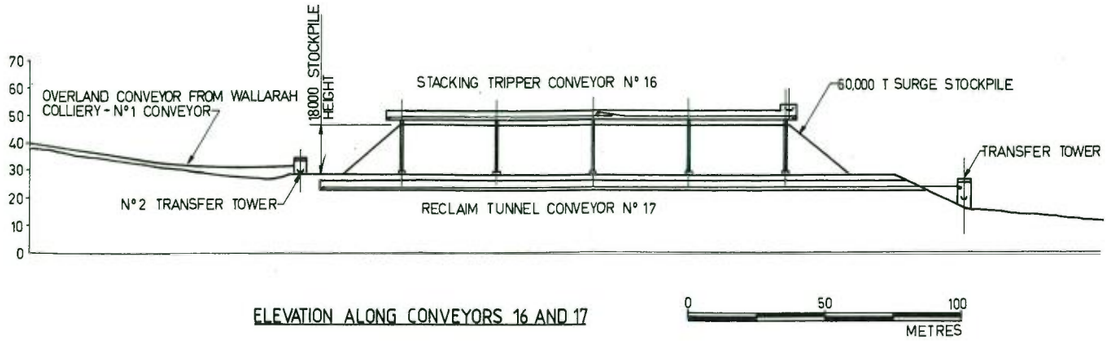
0 50 100 150
METRES

SECTION DRAWINGS OF CONVEYORS AND PRODUCT STOCKPILE AREAS – STAGE 2 DEVELOPMENTS

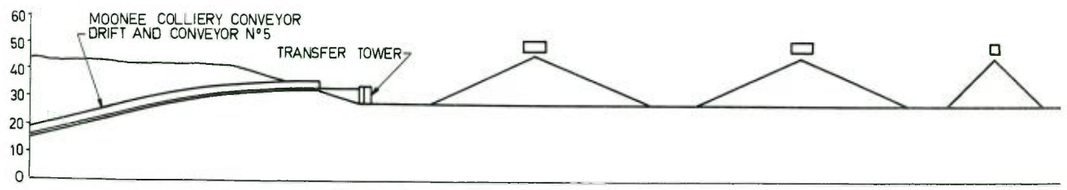
FIGURE 39



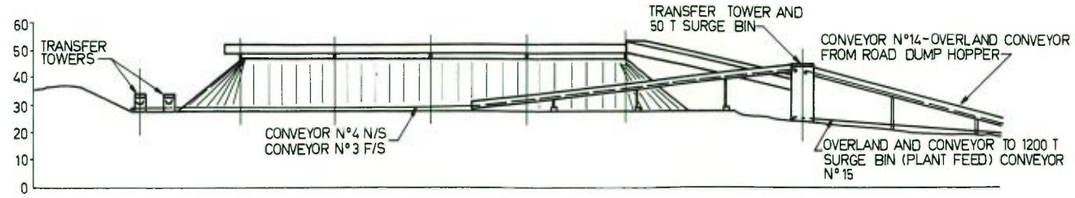
END ELEVATION ALONG CONVEYOR N° 11



ELEVATION ALONG CONVEYORS 16 AND 17

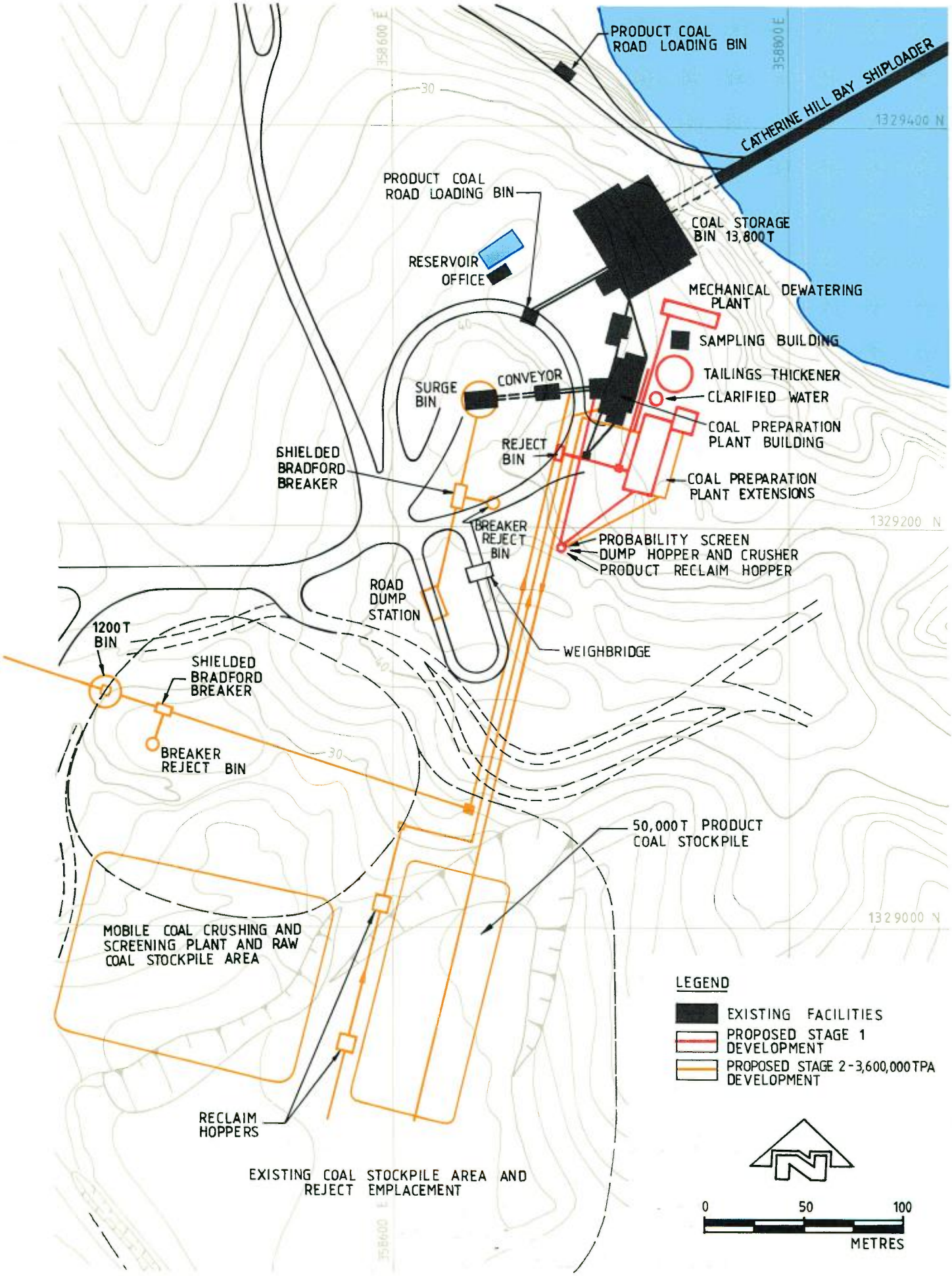


SECTION THROUGH DRIFT AND CONVEYOR N° 5



ELEVATION ALONG CONVEYORS 3 AND 4

SECTION DRAWINGS OF MECHANISED RAW COAL STOCKPILE AREA – STAGE 2 DEVELOPMENT 5,000,000 tpa PHASE **FIGURE 40**



PROPOSED 3,600,000 tpa STAGE 2 DEVELOPMENT AT COAL PREPARATION PLANT

FIGURE 41

9.4 Water Supply

The water supply for the Coal Preparation Plant and surface facilities will be obtained from several sources. The main source of supply will be the new 350 mm diameter pipeline from the Wyong Shire reticulated supply. This will be augmented by the existing Moonee Creek and Middle Camp supplies and water recovered by the Pollution Collection Dam below the emplacement and the Water Supply Dam adjacent to the raw coal stockpiles (see Section 10.8).

It is estimated that the total demand for the ultimate 5,000,000 tpa Stage 2 development will be 7 Ml/day (for a worst case situation). Of this demand, it is estimated that the existing supply will produce about 0.8 Ml/day, recovery of tailings water and catchment yield from the Pollution Control Dam and the Water Supply Dam (see Section 10.8) will be about 2 - 2.5 Ml/day and about 4 Ml/day will be supplied from the Wyong Shire supply.

On an annual basis, it is estimated that the total annual demand at 5,000,000 tpa Coal Preparation Plant throughput will be about 1450 - 1500 Ml, but that about 700 - 900 Ml/annum can be supplied from Moonee Creek, the Middle Camp dams and the new Pollution Collection Dam. The yield from local dams will be affected by drought conditions.

Where possible, recovered water and water supplied from the Company's own system will be used, and the shortfall made up from the Wyong Shire system. Consequently the Pollution Collection Dam will be kept pumped to near empty to maximise the yield from this source and also the maximum sustainable amount will be pumped from the Moonee and Middle Camp sources, depending on rainfall.

As a part of the Stage 2 development, the 350 mm diameter supply pipeline from the Wyong Shire system, installed as a part of the Stage 1 development, will be extended from Wallarah Colliery to the new Water Supply Dam adjacent to the raw coal stockpiles when the new overland conveyer is built (see Section 9.3.1). Water will be reticulated from the Water Supply Dam, which will have a capacity of 19 Ml. Pumps will be installed to lift the water from Wallarah Colliery to the Water Supply Dam, as required.

9.5 Workforce

In the Stage 2 development, employment levels at the Coal Preparation Plant will increase by 10, to about 73 persons. The Stage 2 development will also affect underground mining employment. There will be an increase in employment associated with the development of additional capacity in the Great Northern Seam at Wallarah and Chain Valley Collieries and development of the new coal transportation conveyor drift in Moonee Colliery to mine coal from the Great Northern and Fassifern Seams.

The workforce underground for the Stage 2 development will increase by about 390 persons above current operational levels at the end of the Stage 1 development.

The total increase in direct employment for the whole Stage 2 development will be about 400 job opportunities to a total of 1250 jobs for both the Stage 1 and Stage 2 developments.

10.0 DESCRIPTION OF PROPOSED STAGE 2 COAL WASHERY REJECT EMPLACEMENTS DEVELOPMENT

10.1 General

At present coal washery reject material from the Coal Preparation Plant is disposed of in existing reject emplacements adjacent to Moonee Colliery (See Section 5.6). These disposal areas are approaching maximum capacity, making a new emplacement site necessary for the continued operation of the Catherine Hill Bay Coal Preparation Plant.

An extensive survey of possible future emplacement sites has been undertaken (See Section 3.5), which has identified 17 potential sites, some of which do not meet the Company's criteria for aceptability. Of these 17 sites 8 do meet the Company's criteria and 7 are on land owned by the Company and are therefore available.

These 7 sites (No's 8,9,10,11,12,13 and 16 on Figure 8) are all within the envelope of land covered by the Minister for Planning and Environment's direction under Section 101 of the Environmental Planning and Assessment Act (see Section 4.3). Of these sites, the Company considers that Site No. 11, the Catherine Hill Creek emplacement with a capacity of 9,600,000 m^3 and the Moonee Creek emplacement with a capacity of 700,000 m^3 are the most suitable. Their combined capacity will meet the Company's coal washery reject disposal requirements for about 22 years.

This Stage 2 development proposal is for two coal washery reject emplacements; the Catherine Hill Creek emplacement and the Moonee Creek emplacement. Provided development approval is obtained soon enough, the Catherine Hill Creek emplacement and associated water collection dams (see Section 10.8) will be developed first followed by the Moonee Creek emplacement. In the event of the development approval being delayed, then the Moonee Creek emplacement will be developed first as the necessary lead time, before emplacement of

coal washery reject can commence will be less for the Moonee Creek emplacement than for the Catherine Hill Creek emplacement. This is because it will be necessary to construct the 49 Ml Pollution Collection Dam and silt trap dam prior to normal emplacement of the reject commencing in Catherine Hill Creek Valley.

If development approval is received (as planned) prior to completion of the construction of the emergency coal stockpile area to the west of Moonee Colliery (see Section 5.6); then completion of the stockpile area to the west of Moonee Colliery by emplacement of coal washery reject, construction of the 19 Ml Water Supply Dam and 49 Ml Pollution Collection Dam and preliminary works for the Catherine Hill Creek emplacement will proceed concurrently. The emplacement of coal washery reject in the emergency coal stockpile area to the west of Moonee Colliery will be completed before normal emplacement of reject commences in the new emplacements.

The location and final surface of the Catherine Hill Creek Emplacement and Moonee Creek Emplacement is shown on Figures 42 and 53.

No tailings slurry will be pumped to the Moonee Creek emplacement as will occur for the Catherine Hill Creek emplacement, but in other respects the proposed construction method will be the same for both.

Rainfall runoff from both emplacement sites will be collected in dams downstream of the filling areas. At the Moonee Creek emplacement area, a small filter dam will be constructed to prevent movement of fines into the swamp area. For the Catherine Hill Creek emplacement, temporary silt traps and filter dams will be progressively built as the emplacement is constructed. Runoff from the emplacement area, as well as from unaffected parts of the Catherine Hill Creek Valley will be collected in the 49 Ml Pollution Collection Dam and reused in the Coal Preparation Plant. The Water Supply Dam will also collect run-off from the Catherine Hill Creek catchment.

LEGEND

- EMPLACEMENT SITES
- EXISTING FACILITIES
- PROPOSED STAGE 1 DEVELOPMENT
- PROPOSED STAGE 2 - 5,000,000TPA DEVELOPMENT

CRANGAN BAY

CATHERINE HILL BAY

THE GULF

DEEP CAVE BAY

MOONEE BEACH

MIDDLE CAMP

ALTERNATIVE SITE 16

ALTERNATIVE SITE 12

ALTERNATIVE SITE 14

ALTERNATIVE SITE 17

CATHERINE HILL CREEK EMPLACEMENT SITE 11

MOONEE CREEK EMPLACEMENT AND GRAVEL QUARRY SITE 13

SAND AND GRAVEL QUARRY

PACIFIC HIGHWAY

FLOWERS DRIVE

HAUL ROAD

COMPANY

CATHERINE HILL CREEK

MOONEE CREEK

LINDSLEY STREET

CLARKE STREET

MONTEFIORE STREET

WATER SUPPLY PIPELINE

EXISTING POWER LINE EASEMENT

WALLARAH COLLIERY

CITY OF LAKE MACQUARIE

WYONG SHIRE

Y.M.C.A CAMP

VENTILATION FAN

OVERLAND CONVEYOR

SILT TRAP DAM

WATER SUPPLY DAM

POLLUTION COLLECTION DAM

60 000T SURGE STOCKPILE

60 000T RAW COAL STOCKPILES

TRANSPORTATION CONVEYOR DRIFT

STACKING OUT CONVEYERS RECLAIM TUNNEL CONVEYERS (UNDER)

TRANSFER TOWER AND 50T SURGE BIN

DRIVE IN GRIT TRAP

1200mm OVERLAND RECLAIM CONVEYER (BLENDED RAW COAL)

1000 TPH STACKING CONVEYER (RAW COAL)

SILT TRAP DAM

ROAD DUMP HOPPER

CATHERINE HILL BAY VILLAGE

PRODUCT COAL ROAD LOADING BINS

CATHERINE HILL BAY SHIPLOADER

CONVEYER 2000T SURGE BIN 2500TPH RECLAIM CONVEYER

RESERVOIR

OFFICE

COAL STORAGE BINS 13,800T

MECHANICAL DEWATERING PLANT

2 x TAILINGS THICKENER

2 x CLARIFIED WATER TANKS

COAL PREPARATION PLANT BUILDING

COAL PREPARATION PLANT EXTENSIONS

PLANT FEED CONVEYER 4 x 300 TPH

SCREEN HOUSE

WEIGHBRIDGE

ROAD DUMP STATION

SCREEN HOUSE FEED CONVEYER

100T SURGE BIN

TRIPPER

SHIELDED BRADFORD BREAKER

BREAKER REJECT BIN

1200T BIN

SUB-STATION

OFFICE

FAN BUILDING

BATH HOUSE

WORK SHOP

250T ROAD BIN

MINE WASTE WATER DAMS

MOONEE CONVEYOR DRIFT

EMERGENCY PRODUCT COAL STOCKPILE AREA

MOONEE COLLIERY

220 000T PRODUCT STOCKPILE

180 000T PRODUCT STOCKPILE

EXISTING COAL STOCKPILE AREA AND REJECT EMPLACEMENT

SILT TRAP AND FILTER DAM

SILT TRAP DAM

STACKING OUT CONVEYER

RECLAIM TUNNEL CONVEYER (UNDER)

1000 TPH STACKING OUT CONVEYER

MOONEE CREEK WATER SUPPLY DAM

0 100 200 300 400 500 METRES

CATHERINE HILL CREEK AND MOONEE CREEK COAL WASHERY REJECT EMPLACEMENTS

FIGURE 42

10.2 Characteristics of the Coal Reject Material

Extensive laboratory testing has been carried out to characterise the coal washery reject materials. Materials originating from both the Great Northern Seam and the Fassifern Seam were tested separately to investigate potential seam dependent variations. Samples of coarse reject and tailings were also tested separately for each of these seams. The Wallarah Seam will only contribute a very small percentage of the reject material to be generated, and consequently this reject was not tested.

10.2.1 Chemical Properties

Leach testing of both the coarse and tailings reject was carried out to determine whether a leachate or acid generation problem may develop with the proposed new emplacements. This is particularly important in the Moonee Creek valley to avoid possible damage to the wet heath and swamp vegetation there.

Tailings and coarse reject from the Great Northern Seam and the Fassifern Seam (obtained by laboratory scale washing of samples of Fassifern Seam coal) were tested to establish:

(a) Leachability of a 100 g sample when subjected to cyclic wetting and drying at 35° C. : "Accelerated Weathering Testing";

(b) Saturation extract of finely crushed 100 g sample after various times: "Saturated Leachability Testing";

(c) Acid Neutralising Capacity (self neutralising capacity) of the reject;

(d) Nett acid producing potential;

TABLE 18 : ACCELERATED WEATHERING TESTING

GREAT NORTHERN SEAM COAL

	Coarse Reject		Tailings	
	10 cycles	20 cycles	10 cycles	20 cycles
pH	7.4	6.4	7.2	7.2
Conductivity (uS/cm)	155	186	190	220
Sulphate (mg/l)	35	29	27	29
Iron (mg/l)	LT 0.02	NT	LT 0.02	NT
Hardness (mg/l $CaCO_3$ Equivalent)	25	NT	100	NT

FASSIFERN SEAM COAL

	Coarse Reject		Tailings	
	10 cycles	20 cycles	10 cycles	20 cycles
pH	7.5	6.9	7.7	7.2
Conductivity (uS/cm)	110	174	175	250
Sulphate (mg/l)	30	23	25	5
Iron (mg/l)	LT 0.02	NT	LT0.02	NT
Hardness (mg/l $CaCO_3$ Equivalent)	5.4	NT	100	NT

NT Not tested

LT Less than

TABLE 19 : SATURATED LEACHABILITY TESTING

GREAT NORTHERN SEAM COAL

	Coarse Reject			Tailings		
	1 wk	2 wks	4 wks	1 wk	2 wk	4 wk
pH	7.5	8.1	7.8	7.8	8.0	NT
Conductivity (uS/cm)	205	250	450	278	320	NT
Sulphate (mg/l)	10	15	NT	16	15	NT
Iron (mg/l)	0.1	0.1	0.1	0.6	0.8	1.6
Hardness (mg/l $CaCO_3$ Equivalent)	270	170	220	790	900	950

FASSIFERN SEAM COAL

	Coarse Reject			Tailings		
	1 wk	2 wks	4 wks	1 wk	2 wk	4 wk
pH	8.2	8.7	8.1	4.9	5.5	NT
Conductivity (uS/cm)	493	573	970	719	743	NT
Sulphate (mg/l)	6	17	NT	14	16	NT
Iron (mg/l)	3.7	0.5	24	18	23.5	0.1
Hardness (mg/l $CaCO_3$ Equivalent)	360	63	185	2310	2370	2510

NT Not tested

TABLE 20 ACID NEUTRALISING CAPACITY AND NETT ACID PRODUCING POTENTIAL

	% Sulphur		Acid Neutralizing Capacity (% $CaCO_3$)		Nett Acid Producing Potential (% $CaCO_3$)	
	GN	**FS**	**GN**	**FS**	**GN**	**FS**
Coarse Reject	0.13	0.09	0.52	5.9	-0.11	-5.6
Tailings	0.28	0.28	1.3	15	-0.4	-14.0

TABLE 21 : 1:5 (COAL WASHERY REJECT:WATER) EXTRACT TESTS

Sample	**Coarse Reject**		**Tailings**	
	GN	**FS**	**GN**	**FS**
pH	8.3	9.6	8.0	6.2
Conductivity (uS/cm)	490	830	460	1230
Sulphate (mg/kg)	55	LT 5	70	100
Chloride (mg/kg)	250	200	310	1680
Iron (mg/kg)	2.3	-	0.4	0.2
Hardness (mg/kg $CaCO_3$ Equivalent)	102	640	520	2070

NOTE: **GN** Great Northern Seam
FS Fassifern Seam
IS Insufficient Sample
LT Less Than

TABLE 22 : BATCH SHAKE TESTS (after neutralisation of self neutralising capacity by acid wash)

GREAT NORTHERN - COARSE REJECT

				WEEKS						
DATE	**10/6**									**7/11/86**
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
pH	3.4	3.8	4.3	3.8	3.8	3.4	3.7	3.6	3.9	4.0
Conductivity (uS/cm)	-	-	-	110	91	-	122	147	100	103

GREAT NORTHERN - TAILINGS

				WEEKS						
DATE	**10/6**									**7/11/86**
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
pH	4.7	5.0	6.0	5.8	5.8	6.2	6.2	6.3	7.1	7.0
Conductivity (uS/cm)	-	-	-	97	85	-	95	130	110	106

FASSIFERN COARSE - REJECT

				WEEKS						
DATE	**10/6**									**7/11/86**
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
pH	3.6	4.8	5.1	6.5	6.6	6.6	6.2	6.2	7.1	6.8
Conductivity (uS/cm)	-	-	-	1,850	1,880	-	2,200	2,400	2,300	2,300

FASSIFERN - TAILINGS

				WEEKS						
DATE	**10/6**									**7/11/86**
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
pH	3.7	3.8	4.3	3.8	3.8	3.5	3.8	3.4	3.8	3.9
Conductivity (uS/cm)	-	-	-	103	65	-	83	135	105	104

NOTE: - Test samples seeded with acid emplacement leachate and bacteria after 6 weeks.
- 100 ml samples extract from each test sample every week for analysis.

(e) Leachability (batch shake test) after neutralisation of the self neutralising capacity by an acid wash. This gives a measure of the long term potential of the reject emplacement to become acidic and generate an acid leachate.

The results of this testing are summarised in Tables 18, 19, 20, 21 and 22 which show that the self neutralising capacity of the reject exceeds the acid making capacity and therefore an acid leachate problem will not occur. Even where the reject (both coarse and tailings) was seeded with acid forming bacteria, the test samples have not gone acid after the self neutralising capacity had been expended (neutralised) by the addition of acid. Indeed the reject either becomes progressively neutral (rising pH) or remains at substantially the same pH, which for this untreated coarse reject and tailings is about pH 6-7.

The test work shows that an acid leaching problem will not occur, even in the long term from the coal washery reject to be emplaced and that the level of other soluble materials, including sulphate, is very low.

10.2.2 Physical Properties

The design values for both the coarse coal washery reject and the tailings have been derived from laboratory testing of selected samples of material. For the Fassifern Seam, samples of reject were made by laboratory washing samples of coal, while for the Great Northern Seam, samples approximating future reject to be generated by the new Coal Preparation Plant were selected (by the Company).

The results of the laboratory testing are set out in Appendix I. A summary of the material parameters adopted for design purposes is given in Table 23.

TABLE 23 : PHYSICAL PROPERTIES OF COAL WASHERY REJECT MATERIAL

		Coarse Reject	Tailings
Geotechnical Description:		Gravel with sand (GW)	Silt(ML/MH)
Plasticity:	- Liquid Limit:	Non-plastic	50
	- Plasticity Index:	Non-plastic	9 - 22
Particle Specific Gravity:		2.09 (mean)	1.51 - 1.72
Maximum Dry Density (Standard Compaction):		1.55 t/m^3	N/A
Shear Strength :	c '	25 kPa	0
	ø '	37°	20° (Fassifern)
			37° (Great Northern)
Permeability:		3×10^{-3} to 5×10^{-5} cm/sec	10^{-8} cm/sec
Consolidation Characteristics Compression Index:	(C_c)	N/A	0.18 - 0.32
Coefficient of Consolidation:	(c_v)	N/A	2.6 - 87 m^2/ year

For stability analyses, the shear strength characteristics (cohesion (c) and the angle of internal friction (Ø) of the various component materials are required. Table 23 indicates that an angle of internal friction $\emptyset = 20^{o}$ was obtained from the shear strength test on the sample of Fassifern Seam tailings. This value is considered to be unrealistically low for tailings having the grading and plasticity characteristics of this sample. This value will be checked by additional testing of tailings from the Fassifern seam when washing of this material commences at Catherine Hill Bay.

Despite the above reservations with respect to the accuracy of this value, it has been considered prudent to use it in the analysis of emplacement stability.

Apart from this, the parameters given in Table 23 are considered representative of the material which will be used to form the emplacement. For the Stage 2 development, tailings will usually be placed into the emplacement as a slurry at a moisture content of around 150% and will be retained by a perimeter bank of compacted coarse coal washery reject. Such slurry material would have zero shear resistance at the time of placement, but the shear strength of the tailings will increase as consolidation of the material occurs. The high values of the coefficient of consolidation for the tailings ensure that consolidation will occur rapidly under increasing heights of fill, hence enabling the full drained shear strength to be mobilized. If dewatered tailings cake is mixed with the coarse reject, low initial shear strength values will not occur.

The target in-situ dry density of the coarse reject will be 95% of Standard Compaction (as determined by Australian Standard 1289, Test E1.1.) over the bulk of the emplacement. Consequently the strength and permeability of the coarse material has been determined for this degree of compaction.

10.3 Reasons for Site Selection

The sites of the proposed emplacements were selected following a review of a number of sites in the locality. Major reasons for selecting the Catherine Hill Creek and Moonee Creek emplacement sites were:

(i) the sites are a short haulage distance from the Coal Preparation Plant;

(ii) the sites have coal washery reject storage capacity for over 20 years operation of the Coal Preparation Plant at projected outputs;

(iii) the sites have access from the Coal Preparation Plant along private haul roads, without crossing a main public road;

(iv) field investigations have shown that the proposed developments on the sites will not disturb rare plant communities or faunal habitats in an area where no archaeological evidence was found;

(v) the sites are geotechnically stable;

(vi) the sites can be developed with minimum impact on the local environment; and

(vii) the Company own the freehold title to the sites.

Of these reasons, proximity was a major consideration as it will be necessary to use trucks to transport the coal washery reject from the Coal Preparation Plant to the emplacement sites.

10.4 Emplacement Constraints

The emplacement development will include two emplacements for coal washery reject, a 49 Ml capacity Pollution Collection Dam downstream of the Catherine Hill Bay Creek emplacement and pollution control dams downstream of the Moonee Creek emplacement. Additionally silt trap dams and filter ponds will be constructed as the Catherine Hill Creek emplacement is developed.

The constraints on emplacement development can be divided into engineering constraints imposed by the development and environmental constraints imposed by the selected site.

The environmental constraints on the emplacements are:

(i) visibility of the emplacements from the Pacific Highway, Catherine Hill Bay village and the Munmorah State Recreation area;

(ii) water quality control downstream from the emplacements;

(iii) effects on the wet heath areas of the Moonee Creek valley;

(iv) a progressive rehabilitation programme for completed surfaces of the emplacement.

The engineering constraints on the emplacements are:

(v) the characteristics of the coal washery reject material and the foundation material strength;

(vi) emplacement stability during construction and after filling operations have been completed;

(vii) the drainage requirements to isolate catchment runoff from the emplacement zone;

(viii) the staging of the emplacement. The extent of each development stage of the emplacement was determined by the active working area required to handle the coarse reject and tailings placed as a slurry directly into the emplacement, as well as the necessary drainage provisions to isolate the filling operation from local catchment runoff.

10.5 Outline of Emplacement Design

The emplacement landform has been designed to conform with the surface profile of the local topography. The design includes a drainage network to isolate the emplacement from catchment runoff and to control seepage through the final surface of the emplacement as well a system of ponds and filters to contain fine carbonaceous material or other silt washed off the emplacement area. The development has also been staged to minimise disturbance of the site at any one time.

Within each stage, the emplacement has been designed with four filling zones as follows:

Zone (1) a coarse coal washery reject blanket over the filling area, (for foundation drainage) to be placed after the surface has been cleared of vegetation and unsuitable foundation material;

Zone (2) a coal washery reject filling zone, where either reject is placed in 1 m deep alternate layers of coarse and tailings slurry reject (for dewatering fine tailings) in a cellular structure (the normal procedure) or mixed coarse and dewatered tailings cake is placed in 500 mm layers and compacted;

Zone (3) a subsurface zone, where only mixed coarse and dewatered tailings reject is placed to provide a 5 m deep cover above the last layer of slurry tailings;

Zone (4) a surface zone of subsoil and topsoil for rehabilitation of the emplacement surface.

10.6 Geotechnical Design Considerations

The geotechnical design is primarily concerned with the stability of the emplacement, both during and after construction. This requires consideration of the geometry of the emplacement, material strength parameters, the water table which will develop within the emplacement in the long term, and an assessment of likely "external" loads which may be applied (including earthquakes).

In determining whether the proposed emplacements will be completely stable, even under earthquake conditions, the following parameters were evaluated:

* emplacement geometry;
* material properties;
* water table (or piezometric surface);
* external forces.

10.6.1 Emplacement Geometry

The design slopes of the emplacements have a maximum inclination of around 1 vertical to 4 horizontal or about 14 degrees. These slopes have been chosen primarily from criteria related to landform and rehabilitation. From a geotechnical viewpoint, these slopes are relatively flat and hence tend to assist the stability of the emplacement.

10.6.2 Material Properties

The stability of the final landform is dependent on the strength parameters of foundation material and the coal washery reject being disposed of in the emplacement. The characteristics of the washery reject materials are discussed in Section 10.2.

Tailings will normally be pumped as a slurry to the Catherine Hill Creek emplacement without prior dewatering. There they will be placed in coarse reject cells in the emplacement in layers so that after drying by drainage through the coarse reject and the crusting effect of evaporation, the residual thickness of the partially dewatered tailings will be about 1 m. When the top crust of the tailings has gained sufficient strength, a layer of coarse reject will be placed over it.

Further dewatering of the tailings will occur due to drainage into the sandwiching layers of coarse reject. Consequently, in the completed emplacement, it is expected that the tailings will be in an essentially normally consolidated condition and their strength parameters have been assessed on this basis. As discussed in Sections 6.2 and 9.2, mechanical dewatering equipment will be installed as part of the Coal Preparation Plant development to dry some of the tailings to a 'filter cake'. If this material is not mixed with the product coal, it may be disposed of in the emplacement. In this case, it will be intimately mixed with the coarse reject so that the properties of the dewatered tailings and coarse reject mixture will be better than the consolidated tailings strength parameters used in analysing the emplacement stability.

Only coarse reject will be placed in the toe of the emplacement and this zone will be compacted to 100% Standard Compaction (as per AS 1289, Test E.1.1).

Only dewatered tailings cake to a maximum of 25% and intimately mixed with the coarse reject will be placed within the top 5 metres of the emplacement, so as to ensure sufficient consolidation of tailings material and adequate stability.

The strength of the compacted coarse reject has been assessed on the basis of compaction to 95% Standard Compaction (as per AS 1289, Test E1.1). It is expected that somewhat higher strengths will be obtained in the toe area of the emplacement where 100% Standard Compaction will be required, but these have not been included explicitly in the stability analysis.

10.6.3 Water Table

The strength parameters of the emplacements have been based on effective stress conditions for long term stability. To minimise water infiltration into the emplacements, they will be isolated from catchment runoff by using diversion drains and from rainfall infiltration by including a 300 mm thick compacted clay layer in the final surface of the coal washery reject emplacement. Control of catchment runoff is described in Sections 10.7.3 and 10.9.3.

Foundation subsurface seepages are not expected because of the nature of the sites; however, to ensure that subsurface drainage is controlled, the following measures will be adopted:

* topsoil and underlying residual clay soil will be removed from all surfaces to be filled over;

* the stripped surface will be inspected by an appropriately qualifed engineer to assess the presence of possible wet zones, seepages, or zones where slippage is likely to occur;

* additional drainage will be provided as necessary.

If tailings material (as a slurry) is pumped to the site, it will be placed in drainage cells of coarse reject material. The laboratory tests results show that in winter, tailings in 1 metre thick layers will require about 3 months to drain sufficiently before overlaying with a 1 metre layer of coarse reject. In the summer months drying will be faster. The winter and wet weather drainage requirement has determined the surface area required during a filling stage.

Dissipation of excess pore-water pressure generated within the tailings layers by continued filling is expected to occur at a rate concordant with the rate of filling. Consequently, excess pore-water pressures in the tailings layers are not expected to occur.

10.6.4 External Forces

The emplacement has been designed to be stable under an equivalent horizontal earthquake loading of 0.10g.

10.7 Description of Catherine Hill Creek Emplacement

The Catherine Hill Creek emplacement will be constructed in two separate zones of the Catherine Hill Creek valley to minimise the area disturbed at any one time. The Catherine Hill Creek valley emplacement area contains 3 channels, a northern, middle and southern channel. The emplacement will be constructed by progressively filling these channels 'uphill'. Figures 45-51 describe the staging of the emplacement.

10.7.1 Strength of Foundation Material in the Emplacement Area

The sub-surface clays of the Catherine Hill Creek emplacement area have been assessed as being firm to stiff or better. Accordingly, based on correlations given in Australian Standard 1726 - 1975 (SAA Site Investigation Code) it may be expected that this material would have a short term or undrained strength of not less than 100 kPa.

With respect to long term stability, a shear box test was carried out to assess the strength parameters for the foundation clay soils. (See Appendix F). The clays are overconsolidated and thus exhibit an effective cohesion parameter (c') and angle of internal friction (ϕ'). However, owing to the uncertainty in determining the value of c', the conservative approach of adopting $c' = 0$ has been chosen for the stability analysis of the emplacement. Accordingly, the effective strength parameters adopted in the stability analyses were $c' = 0$ kPa and $\phi' = 23^{o}$ for the foundation clays.

Strength parameters have not been determined for the bedrock strata. In general, these will have a shear strength well in excess of the overlying clay layers, and will increase with depth as the degree of weathering decreases. The critical potential failure surfaces will be associated with the weaker clay layers, and hence detailed determination of rock strengths has not been considered necessary.

10.7.2 Emplacement Construction Procedure

Initially the embankment for the overland conveyer from Wallarah Colliery to the raw coal stockpile area will be constructed with a cut-off drain for catchment runoff above RL 50 m.

The valley will then be filled to RL 20 m using coarse reject and tailings, with a perimeter drain to divert tributary flows around the filling zone into the Pollution Collection Dam. This will form the toe of the emplacement. Filling will then proceed up the southern tributary to final levels leaving an active northern face that will be filled against during emplacement operations in the northern and middle valleys.

Within each stage, the emplacement will be constructed progressively in a series of horizontal layers behind an eastern perimeter embankment which will be progressively raised as filling operations proceed. The sequence for surface preparation will be:

(i) the stripping and stockpiling of topsoil and subsoil for later reuse;

(ii) foundation preparation;

(iii) the extension of the temporary drainage culvert required during Stages I - VI;

(iv) the development of cut-off drains using perimeter embankments constructed from compacted coarse coal washery reject; and

(v) the provision of a drainage blanket for surface drainage beneath the next phase of the filling area.

Any unstable foundation areas or groundwater springs will require special attention during foundation preparation. Any areas of instability identified during clearing work will be excavated and replaced by compacted coarse reject. This drainage blanket will be a minimum thickness of 0.3 m over the stripped surface.

The Catherine Hill Creek Emplacement has been designed so that all tailings from the Catherine Hill Bay Coal Preparation Plant can be pumped as a slurry directly to the emplacement without prior dewatering. The tailings will then be placed directly into the emplacement and will dewater insitu. The Company also propose to install mechanical dewatering equipment to process some of the tailings prior to leaving the Coal Preparation Plant. As discussed in Sections 6.2 and 9.2, this will be primarily to enable recovery of fine coal in the tailings for inclusion in the product coal, but the equipment may be used to dewater the tailings and produce a 'filter cake' when this is required for disposal of the tailings. The filter cake will be mixed with the coarse reject prior to leaving the Coal Preparation Plant and this mixture will be placed into the emplacement.

Thus there will be two different methods of operating the Catherine Hill Creek emplacement depending on whether the tailings dewatering equipment is being used to treat the tailings prior to placement in the emplacement or not.

If tailings (as a slurry) are placed into the emplacement (the normal operating procedure) filling behind the perimeter bank will be zoned so that coarse and tailings reject are placed separately to maximise drainage from the tailings prior to compaction of coarse reject over the fine material. This will be achieved using banks of coarse reject 2 m high, which will subdivide the filling area into cells for containing the tailings (see Figure 43). As each zone is filled and drained, it will be covered by compacted coarse reject. Placement of tailings will then proceed in the adjacent zones before the dividing embankments are raised a further 2 m above the completed filling platform. The filling operation will then proceed over the new filling platform level. This is shown diagrammatically on Figure 44.

When tailings, either as a slurry or wet filter cake, are placed directly into the emplacement, the upper 5 m of the emplacement will be constructed from compacted coarse reject, or a compacted mixture of coarse reject and dewatered tailings (maximum 25%) and will not include any slurry tailings. This will result in the wet tailings consolidating beneath this zone to a relative density sufficient to prevent liquefaction effects under earthquake loadings.

If the tailings dewatering equipment is being used to dewater tailings prior to placement in the emplacement, the mixture of coarse reject and dewatered tailings filter cake will be placed behind the perimeter bank in 0.5 m layers and compacted.

The target in situ dry density for the bulk of the coal washery reject material will be 95% of Standard Compaction as determined by Australian Standard 1289 Test E1.1. This compaction will be achieved by the use of a vibratory roller towed behind the dozer which spreads the reject after dumping out of the haul trucks bringing the reject from the Coal Preparation Plant, by movement of the haul trucks themselves and by other reject handling equipment on the emplacement as it works the area in accordance with the handling procedures previously described.

As the coarse reject (and dewatered tailings if being produced) is emplaced, the outer perimeter bank will always be constructed first, followed by infilling of the zone behind. This procedure enables rehabilitation of the outer face to proceed as fast as possible and provides maximum noise and visual shielding. It also assists in control of water quality. This filling sequence is shown diagramatically on Figure 44.

Each activity of the emplacement development will move progressively over the emplacement site. At each part of the site, a cyclic development of clearing, reject emplacement and rehabilitation will occur. Thus the completion of a cycle represents the complete construction of one layer of the emplacement. A typical cycle of emplacement operations will be as follows:

(i) determine the extent of the additional emplacement area and set this out on the emplacement site;

(ii) extend drains, haul roads, etc., as required to enable access and filling of the marked area;

(iii) clear trees and shrubs from the area;

(iv) strip the grass and topsoil from the area. These will be stockpiled if required or (preferably) spread on the surface of previously completed units;

(v) strip subsoil and weathered rock material to required depth, and stockpile or spread over previously completed units as required;

(vi) inspect foundation area for springs or seepages, soft areas, etc. If required, treat these areas by installing extra drainage, over excavation, etc.;

(vii) place and compact a 0.3 m layer of coarse coal washery reject material over stripped surfaces up the side and across the base of the valley;

(viii) place and compact coarse reject to construct tailings cells, pump tailings into cells and progressively raise level by covering tailings cells with coarse reject and constructing new cells. Shape top surface to final landform requirements;

(ix) if mixed coarse reject and dewatered tailings filter cake are being emplaced, place and compact mixture in layers to designed height and final landform requirements;

(x) place clay or other substrata material and topsoil over final landform of emplacement;

(xi) construct or extend final surface drainage features as required;

(xi) revegetate the area, including grass, shrub and tree planting and maintain as described in Section 10.12.

This represents the full cycle of operations which may be necessary to complete a layer of fill. It should be appreciated that not all of these operations may be necessary in every case.

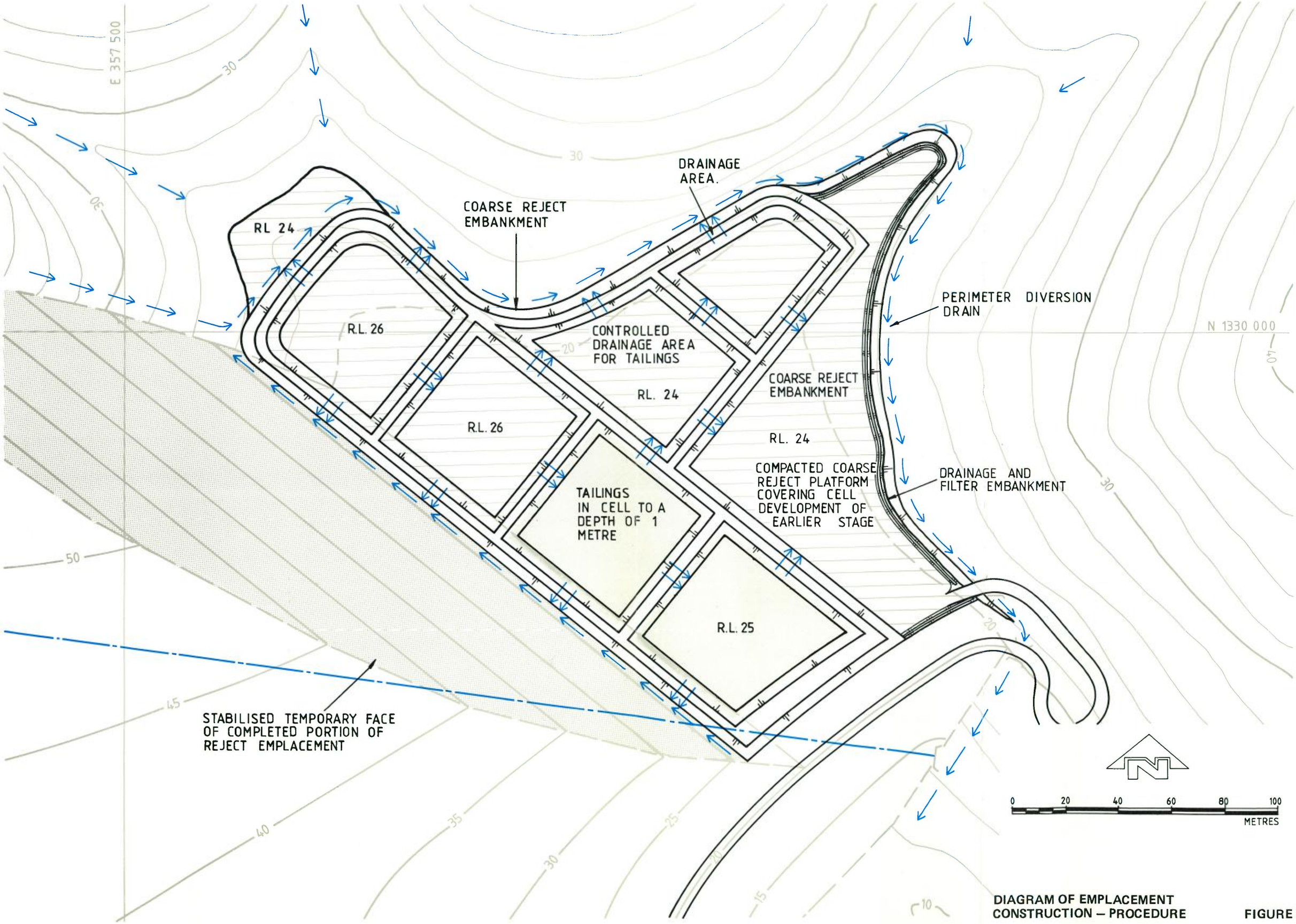
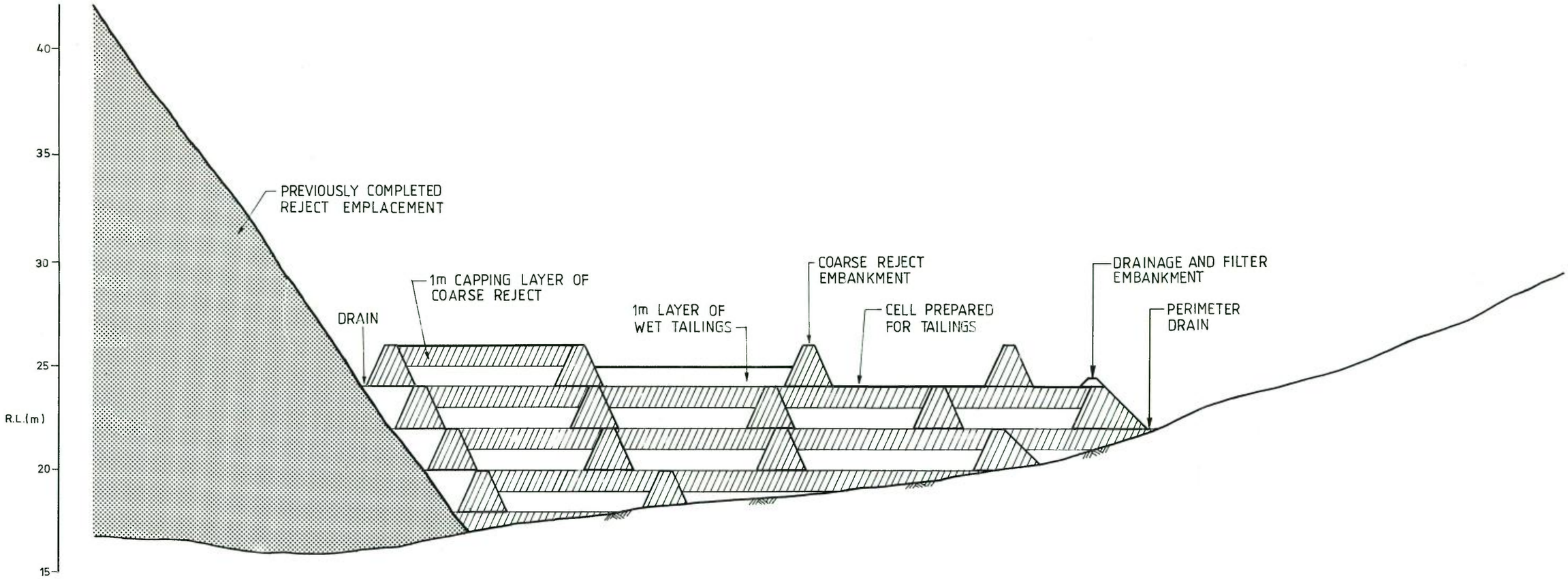
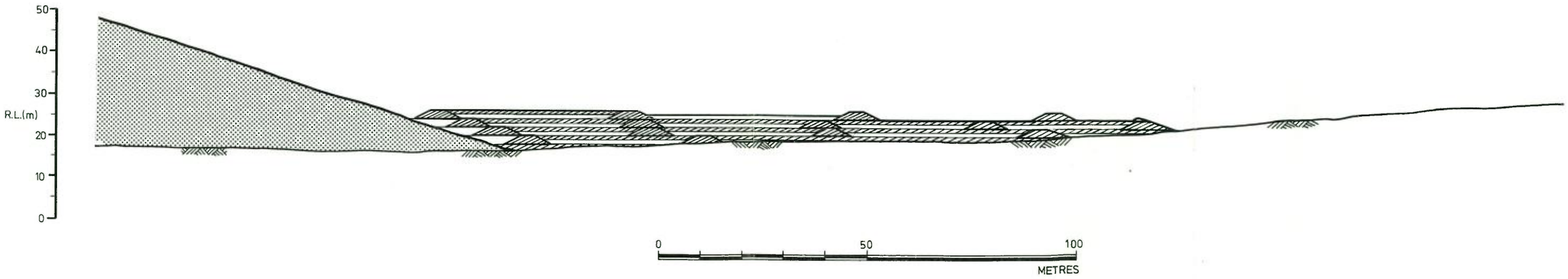


DIAGRAM OF EMPLACEMENT CONSTRUCTION – PROCEDURE

FIGURE 43



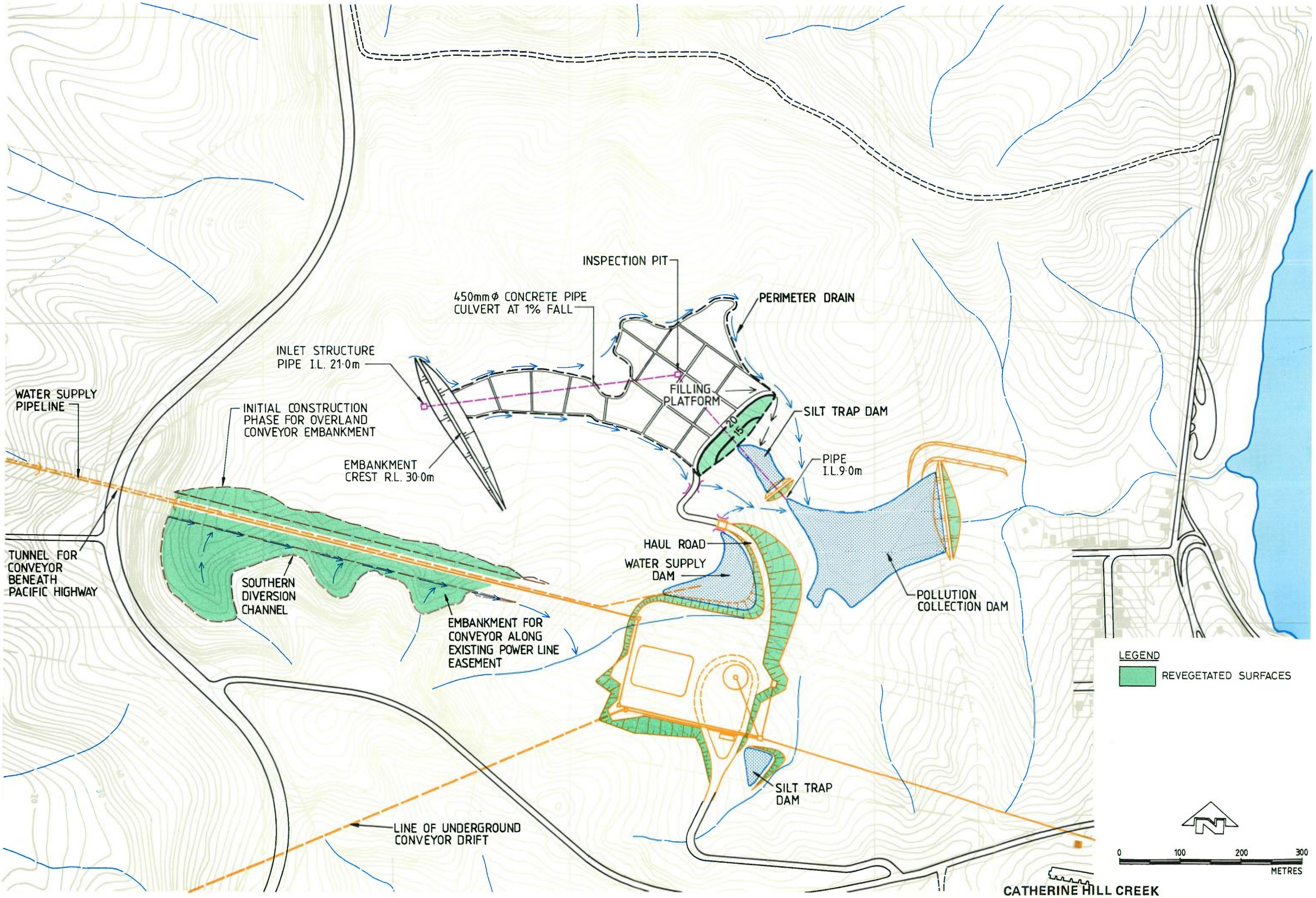
SECTION - shown with exaggerated vertical scale



SECTION - shown at natural scale

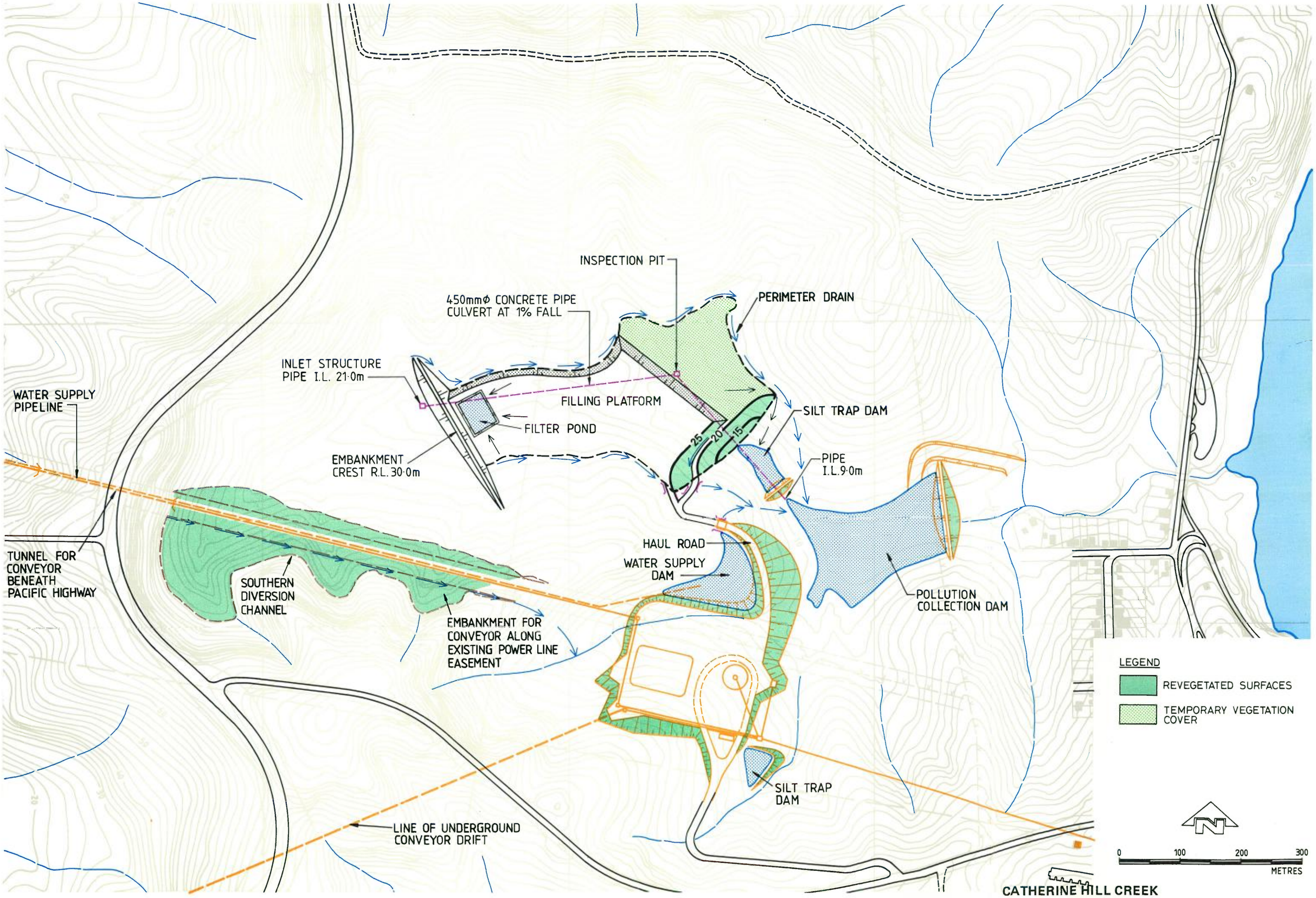
DIAGRAM OF EMPLACEMENT CONSTRUCTION – SECTIONS

FIGURE 44



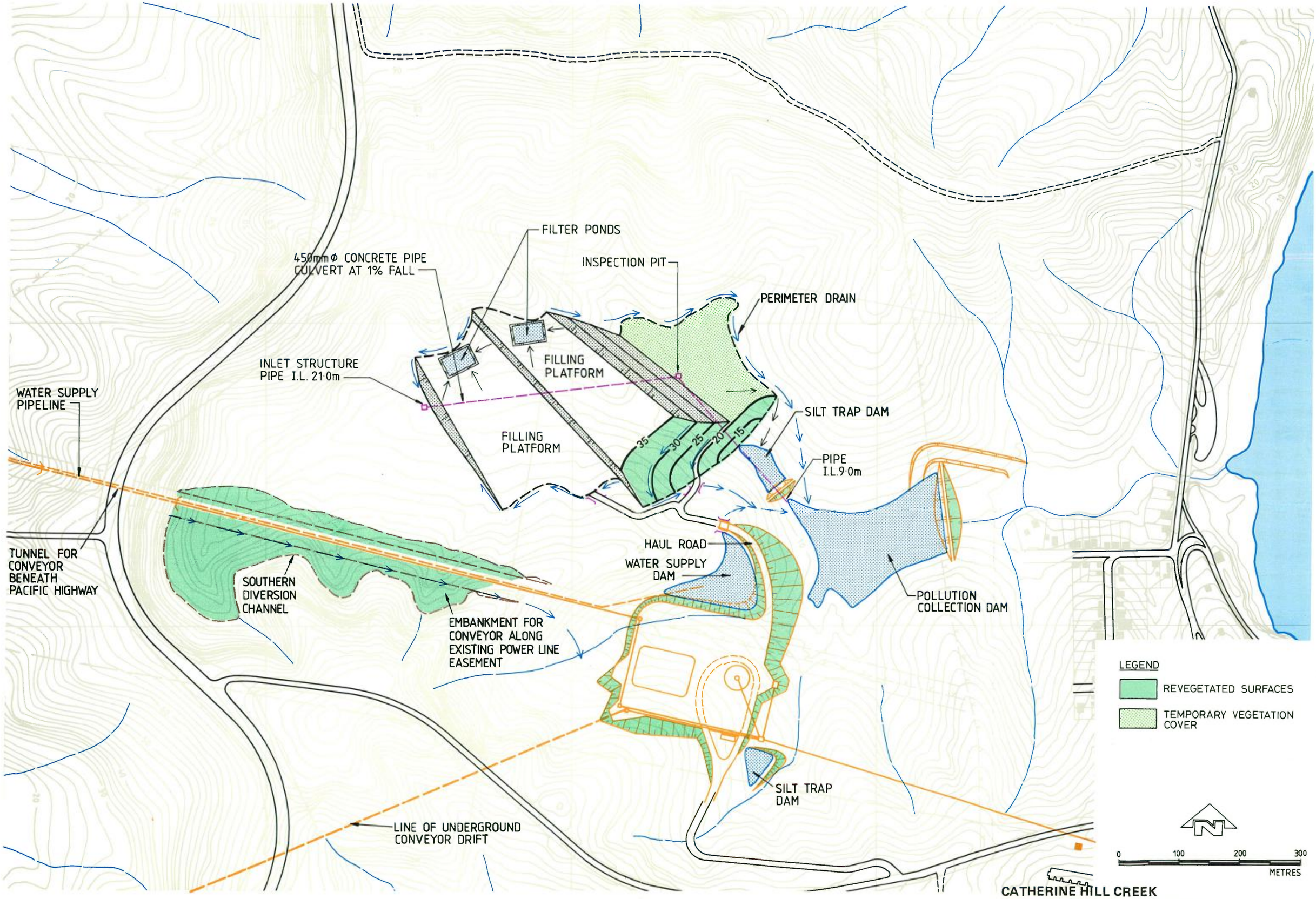
CATHERINE HILL CREEK
EMPLACEMENT CONSTRUCTION –
STAGE I

FIGURE 45



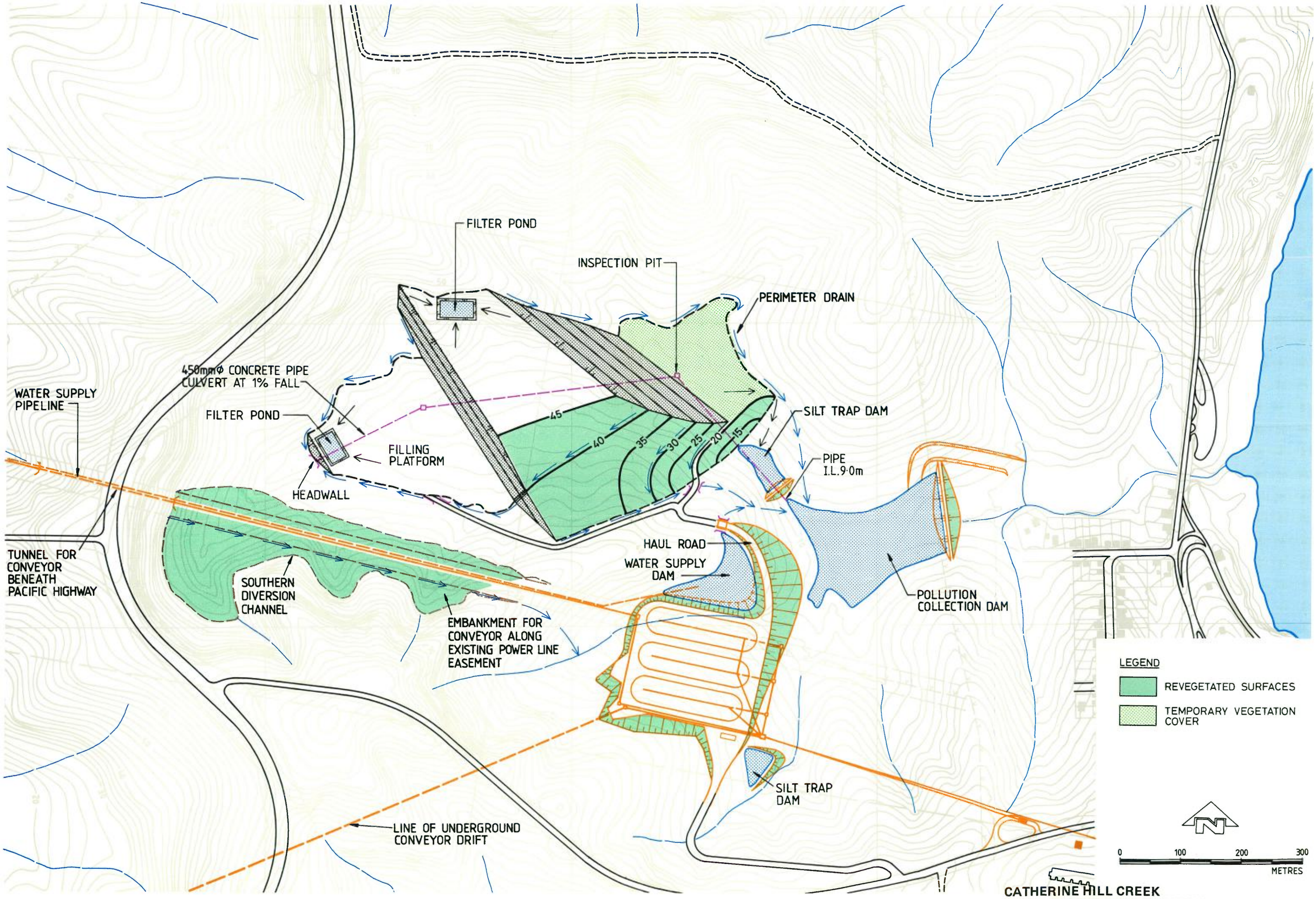
CATHERINE HILL CREEK EMPLACEMENT CONSTRUCTION — STAGE II

FIGURE 46



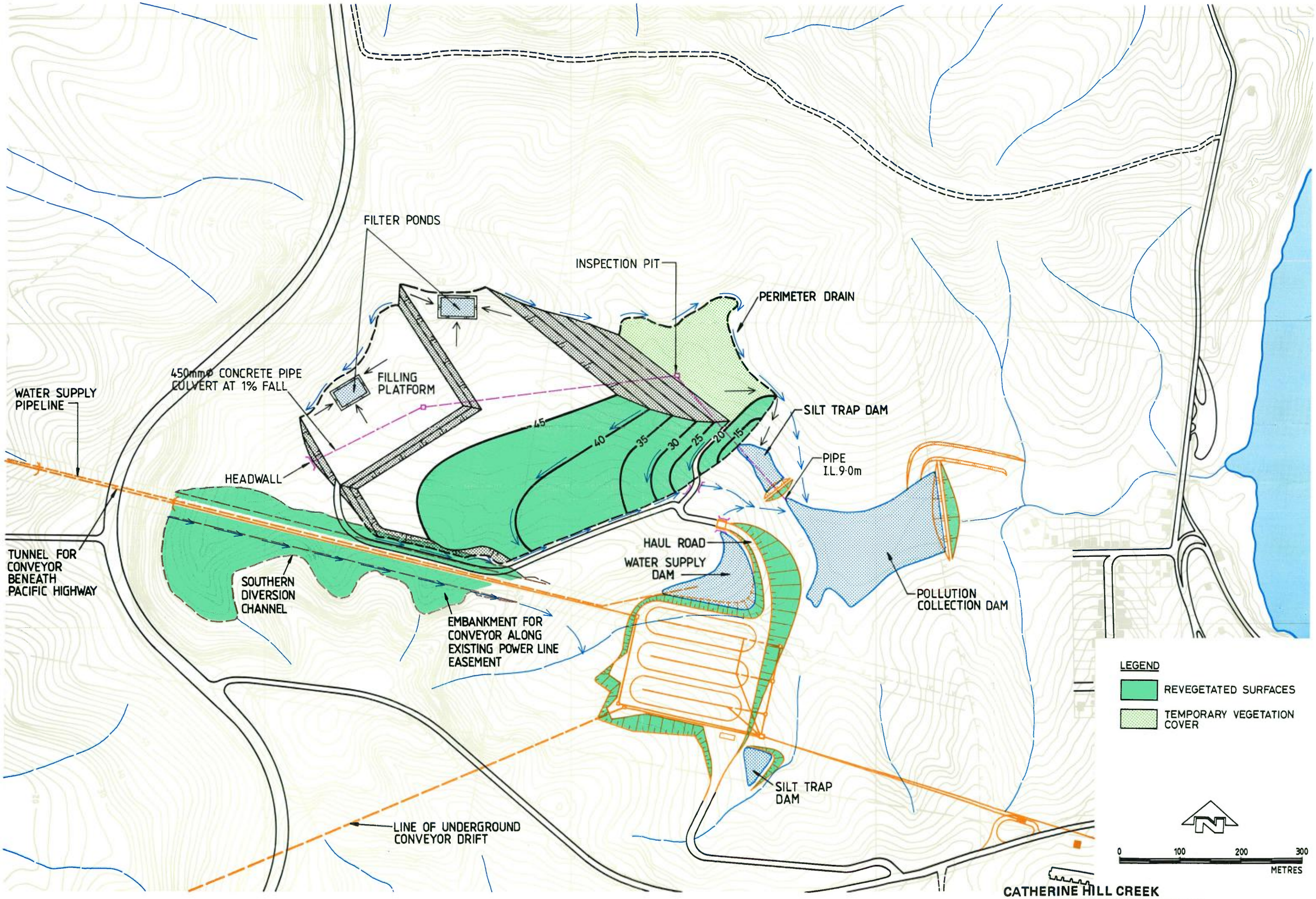
CATHERINE HILL CREEK EMPLACEMENT CONSTRUCTION – STAGE III

FIGURE 47



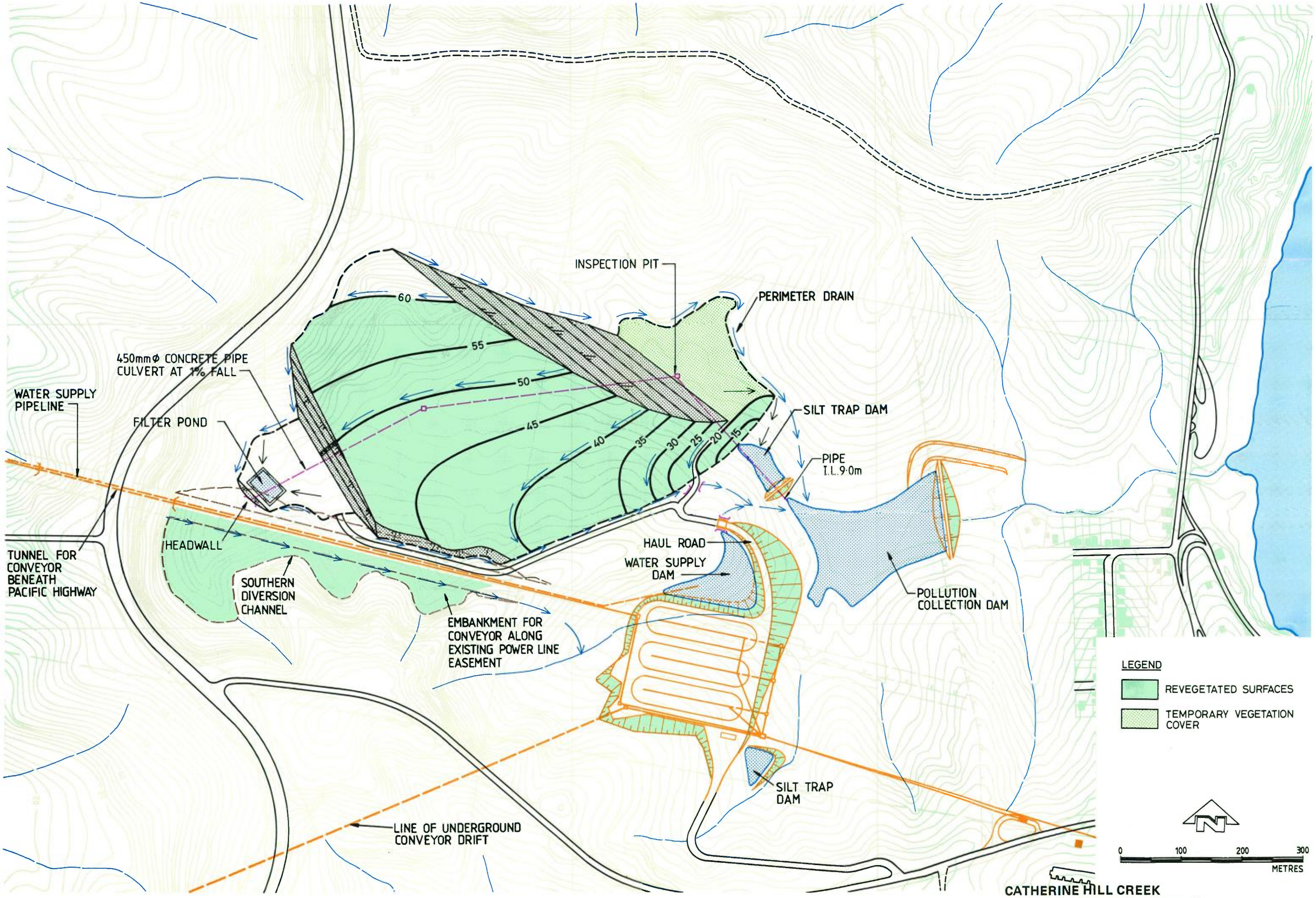
CATHERINE HILL CREEK EMPLACEMENT CONSTRUCTION – STAGE IV

FIGURE 48



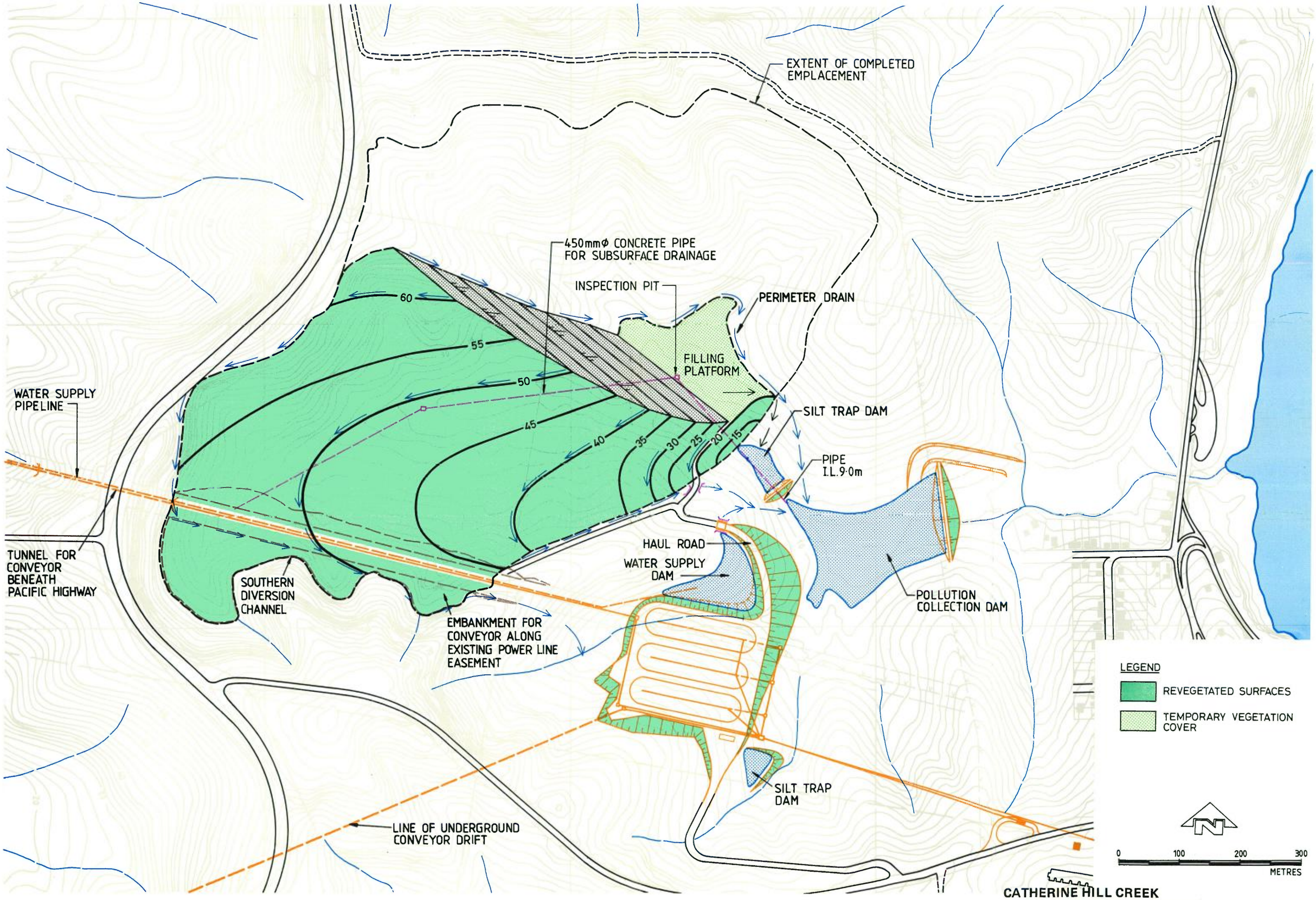
CATHERINE HILL CREEK EMPLACEMENT CONSTRUCTION – STAGE V

FIGURE 49



CATHERINE HILL CREEK EMPLACEMENT CONSTRUCTION – STAGE VI

FIGURE 50



CATHERINE HILL CREEK EMPLACEMENT CONSTRUCTION – STAGE VII

FIGURE 51

10.7.3 Drainage

Drainage of the emplacement area has been designed to isolate catchment runoff from active filling areas and to control drainage beneath the emplacement so as to ensure that an elevated water table does not develop in the emplacement.

Prior to commencement of the emplacement, a cut-off drain at RL 50 m will be incorporated with the embankment for the conveyor route, as shown on Figure 45, and both the silt trap dam and the Pollution Collection Dam will be constructed.

The catchment of Catherine Hill Creek affected by the emplacement is drained by 3 channels, which join together upstream of the toe of the proposed emplacemen at RL 11 m. The Pollution Collection Dam has a designed top water level (T.W.L.) of RL 9 m and the top water level of the major silt trap dam below the emplacement is RL 11 m, which avoids flooding the toe of the emplacement.

Catchment runoff from above the filling zone will be diverted into a perimeter drain around the filling platform and a 450 mm internal diameter culvert. The perimeter drain, which will take the 1 in 10 year storm, will be progressively raised.

The 450 mm internal diameter culvert, as shown on Figure 45, will be installed during Stage I to divert catchment runoff from the southern gully upstream of Stage I. This culvert will discharge below the the silt trap dam into the Pollution Collection Dam at RL 9 m. As the filling platform is raised, the culvert, which has been designed to take flows from the 1 in 10 year storm, will be extended until it reaches RL 21 m, where it will be temporarily terminated with an embankment crest at RL 30 m. Excess runoff will flow along the rear drainage path as shown on Figure 45.

As the filling of Stage II proceeds to RL 30 m, (the height of the embankment crest) this culvert will have the capacity to take a 1 in 100 year storm, with ponding behind the filling zone. The culvert will

subsequently be extended and raised to RL 40 m, where a culvert to handle catchment runoff above the emplacement is no longer required. The 450 mm diameter culvert will then act as a subsurface drain only.

Once the filling platform reaches RL 40 m in the final lift of Stage VI, a perimeter drain will divert catchment runoff above RL 40 m into a contour perimeter drain, which is progressively raised as filling proceeds to final levels.

During Stage VII, filling operations will proceed in the middle and northern gullies. In these areas, fill platforms will be drained using perimeter drains discharging to a side collection drain, which will be progressively raised as the filling platform is raised.

Final surfaces of the emplacement will be drained using contour drains at 10 m intervals to collect surface runoff and divert flow into collection drains along the edge of the emplacement.

10.7.4 Water Pollution Control

The emplacement development will include a silt trap dam downstream from the toe of the emplacement. This dam will collect silt from the initial stages of the emplacement and any soil or suspended material washed off the finished surface of the emplacement during the early stages of the rehabilitation programme.

During later stages of the emplacement construction, active filling areas will be separated from undisturbed catchment by an embankment or dam of coarse coal washery reject, which will filter all rainfall run-off from active areas of the emplacement. Rainfall on the emplacement will seep into the emplacement (with the tailings water) or flow off the emplacement and through the filter dam/embankment into the clean water perimeter drain or pipe under the emplacement.

10.8 Water Supply and Pollution Collection Dams

It is proposed to utilise catchment runoff in Catherine Hill Creek to augment the water supply for the Coal Preparation Plant at Catherine Hill Bay. Two dams will be built. The Water Supply Dam will be located adjacent to the coal washery reject haul road from the raw coal stockpiles to the emplacement, as shown on Figure 42. The Pollution Collection Dam will be located below the Catherine Hill Creek emplacement and will collect both rainfall runoff and seepage (including tailings dewatering water). The location of this dam is also shown on Figures 42.

Using information from a nearby gauged catchment and rainfall data from Wyee, a catchment yield was determined. This data was used to determine a maximum yield from the dams for various probabilities of not meeting the maximum yield with available catchment runoff. The available yield is discussed in Section 9.4.

A preliminary site assessment was then carried out to determine the feasibility of building the Pollution Collection Dam (capacity of 45 - 50 Ml) to supply the Coal Preparation Plant. The necessary fieldwork to enable this assessment comprised borehole drilling with relevant insitu testing, backhoe test pits, and a series of seismic traverses. Appendix G contains the detailed report on the dam site geotechnical investigation and its conclusions.

In summary, it was concluded that a dam embankment with a crest level of RL 11 m and a crest width of 5 m would be appropriate. The maximum height of the dam embankment is around 5 m. The recommended upstream and downstream slopes are 2.5 : 1 (H : V) and 3 : 1 (H : V), respectively. The Pollution Collection Dam will have a capacity of 49 Ml.

The Water Supply Dam, which will have a capacity 19 Ml, will be constructed in conjunction with the earthworks for the raw coal stockpiles. It will have a crest level around RL 25 and a maximum height of around 13 m. The dam has a limited catchment area, and will primarily be used as an "off-stream" storage for excess flows

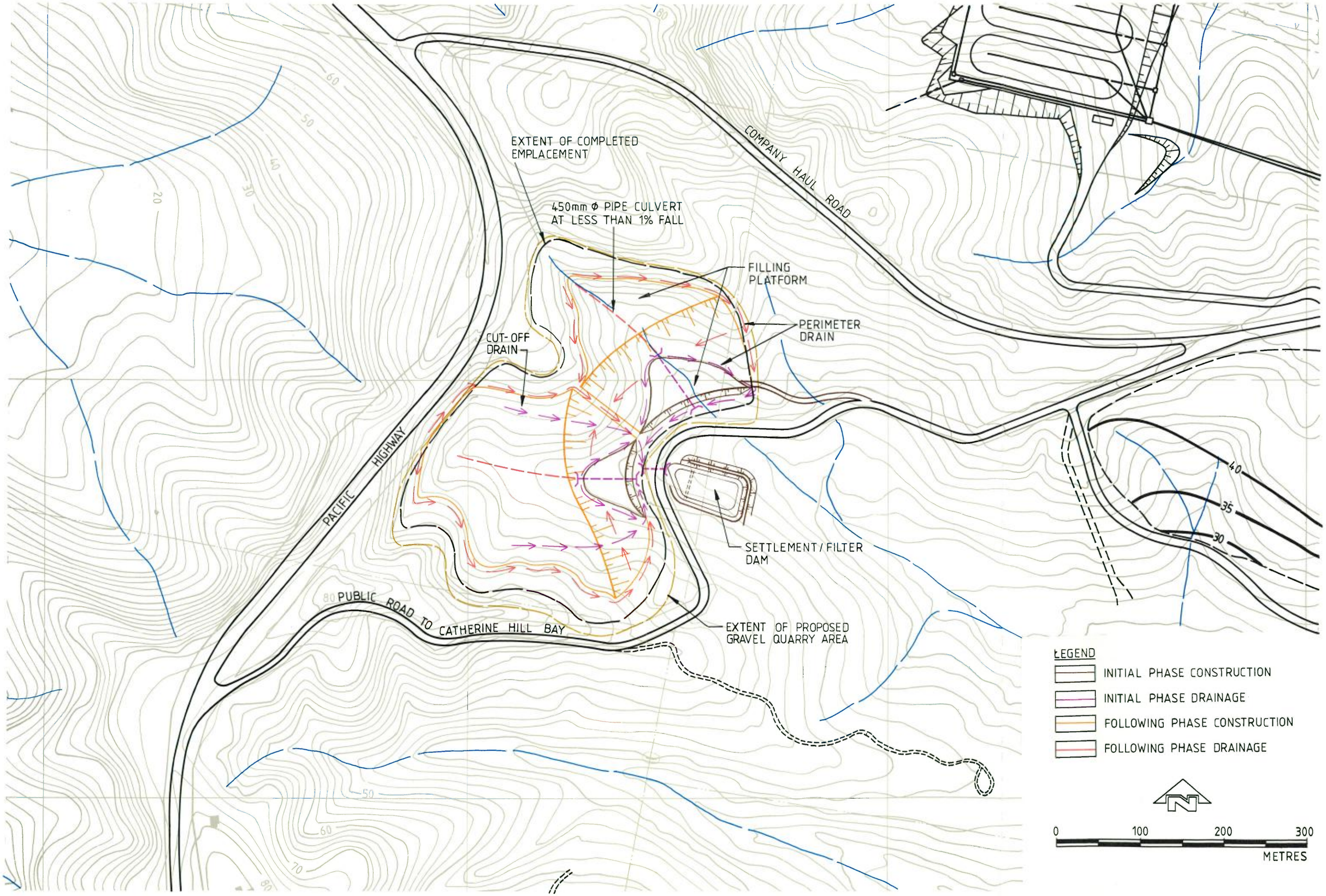
pumped from the Moonee Creek catchment and as the termination point for the new 350 mm diameter water supply pipeline from the Wyong Shire reticulation system. The preliminary design for this dam also envisages an homogenous earthfill embankment having nominal upstream and downstream slopes of 3 : 1 (Horizontal : Vertical).

10.9 Description of Moonee Creek Emplacement and Gravel Quarry

The Moonee Creek emplacement will be constructed progressively to minimise the area disturbed at any one time (as for the Catherine Hill Creek emplacement). It will have a capacity of some 700,000 m^3 (1,100,000 tonnes) excluding the additional volume to be created by quarrying ridge gravel and will cover an area of 11.5 ha. It is shown on Figure 52.

Moonee Creek emplacement area is underlain by ridge gravels of commercial importance. It is planned to extract these gravel resources prior to commencing emplacement of coal washery reject so as to avoid sterilisation of the gravel, which will be extracted within the area shown as the gravel quarry on Figure 52. Gravel will be extracted to the limit of the commercial resource within this area and the whole void will be back filled with coarse coal washery reject, prior to extending the coal washery reject emplacement above the present surface as shown on Figure 5.2. Consequently gravel extraction will be commenced prior to emplacement commencing. No processing of the gravel would occur on site and the gravel would be transported away by road.

Provided development approval is given in time, the Moonee Creek emplacement will be used as the main coal washery reject disposal emplacement after the Catherine Hill Creek emplacement is constructed. In the event of delay in granting development approval, the Moonee Creek emplacement will be constructed before the Catherine Hill Creek emplacement as the time for preparatory works at this emplacement is less (see Section 10.1). However extraction of ridge gravel from the Moonee Creek emplacement area will be progressive over the life of the development and as the gravel quarry is worked out, the void will be progressively backfilled and the coal washery reject emplacement constructed to the final (and rehabilitated) profile.



MOONEE CREEK EMPLACEMENT CONSTRUCTION

FIGURE 52

10.9.1 Foundations

The emplacement site lies on the eastern side of the main ridge line which contains outcrops of Munmorah Conglomerate of the Narrabeen Group. Quaternary sand deposits overlay the conglomerate on the site and they form the basis of the sandy soils that exist there. Prior to filling operations, the surface of the site will be progressively stripped down to the conglomerate to provide a stable foundation for the reject emplacement, if gravel extraction is not undertaken prior to commencement of coal washery reject emplacement.

10.9.2 Description of the Emplacement

The Moonee Creek emplacement has been designed within the upper regions of two shallow valleys between the Pacific Highway and the public road access to Catherine Hill Bay from the south, with surface grades conforming with adjacent natural surface contours. Using these constraints, the emplacement has a capacity of about 700,000 m^3 (excluding additional capacity created by gravel extraction). Filling will be by the 'uphill' method and proceed behind an outer bank, which will be constructed prior to infilling behind. This is generally similar to the Catherine Hill Creek emplacement and is as shown on Figure 44. The coarse coal washery reject or mixture of coarse reject and dewatered tailings filter cake will be spread in horizontal layers approximatley 0.5 m thick behind the outer bank and compacted.

10.9.3 Drainage

During filling of the emplacement, perimeter drains will be provided to isolate the filling platforms from local catchment runoff. Perimeter drains will discharge into permanent downslope catchdrains beyond the emplacement. A temporary culvert along the base of each valley will be provided to control seepage beneath the filling zone.

10.9.4 Pollution Control Dam

All catchment runoff from the emplacement area and the gravel quarry will be collected in a settlement pond and filter dam, which has been sized to collect runoff from a 2 hr duration, 1 in 10 year storm over the local catchment area. The settlement and filter dams will effectively collect any silt and reject fines, which may be washed off the emplacement area, prior to discharge into the Moonee Creek Valley, and will prevent adverse effects on the wet heath areas downstream. They will allow the continued flow of clean water down the creek to replenish the swamps in the valley floor.

10.10 Transport

Coarse coal washery reject material will be produced as a relatively dry, coarse material while tailings will be produced as a slurry having a nominal solids content of 33% (by weight), or occasionally as a dewatered filter cake.

Tailings will be pumped to the Catherine Hill Creek emplacement by pipeline, but no tailings will be placed into the Moonee Creek emplacement in slurry form.

All solid reject will be transported by truck along the Company's haul road and the old public road adjacent to the emplacement area. Access to the Catherine Hill Creek emplacement will be along an access road located through the raw coal stockpile area to minimise the use of public roads and keep trucks away from residential areas. Access to the Moonee Creek emplacement will be off the old Highway road adjacent to the site.

If dewatered tailings filter cake is produced in the Coal Preparation Plant for disposal in the emplacment, it will be intimately mixed with the coarse reject and the mixture trucked to the emplacement.

The Company estimates that there will be 300,000 tpa of coal washery reject material generated by the Stage 1 (2,500,000 tpa raw coal) redevelopment. This will be transported to the emplacement by 15 tonne trucks and will require approximately 90-100 truck loads (180-200 truck movements) per day.

For the Stage 2 development, when coal will be mined from the Fassifern Seam, the proportion of waste in the coal will increase as well as the throughput of coal in the Coal Preparation Plant. The Company estimates that during Stage 2 there will be 1,200,000 tpa of reject material generated. When tailings are pumped to the emplacement, the estimated number of truck loads between the Coal Preparation Plant and the emplacement area will increase to 260-280 (520-560 truck movements) per day. However if tailings are dewatered, then the truck transport of mixed coarse reject and tailings filter cake may increase to 360-380 truck loads (720-760 truck movements) per day.

10.11 Hours of Operation

Apart from transporting coal washery reject to the site, there will be periods when the emplacement will require manpower for surface preparation, consolidation of reject placed on site, and surface rehabilitation. Compaction of reject will be a continuous daytime operation, but other operations at the site will be intermittent, requiring additional manpower for 1 or 2 weeks at a time.

Disposal of coal washery reject is required on a 24 hour basis while the Coal Preparation Plant is operational. However, compaction, site preparation, and surface rehabilitation will only occur during daylight hours on weekdays.

10.12 Rehabilitation and Landscape Design

The emplacement design, the configuration of the contours, the extent of the emplacement and the proposed rehabilitation procedure for the final land surface have been designed to encourage natural regeneration of a Scrub-Woodland formation, which will ultimately blend back into the existing landscape. Important considerations in the design process included:

(i) restrictions to the height of the emplacement so as to not exceed the height of the main topographical features;

(ii) restrictions to the extent of the emplacement to allow for a buffer zone of vegetation to remain along the ridgelines so as to help screen the emplacement operations;

(iii) restrictions have been applied on the slope angles of the proposed landform to reduce the potential for scour and assist in the establishment of vegetation.

Due to the extremely exposed saline conditions of the study area, special procedures will be adopted for revegetation in order to ensure satisfactory and rapid growth of plant material. Alternatives to be used will either be hydromulching of the surface with seeds gathered from the surrounding woodland communities or chipping the foliage of the existing vegetation, and respreading over the surface of the seeded emplacement. Either method will be used to provide cover for the emplacement areas and dam face so as to control surface erosion, to help retain moisture in the soil which will assist the germination process and to retain the seed bank which is contained in the existing vegetation on the site. Figure 53 shows the areas to be landscaped and rehabilitated. Figures 54 and 55 show sections through particular areas of rehabilitation.

The dam face and other ares where a rapid cover of stabilising vegetation will be required to protect steep slopes from erosion, will be hydraulically seeded using a slurry of seed, bituminous emulsion and fertilisers. Spray irrigation will be installed until the vegetation is established.

The choice of plant species in the proposed seed mix has been influenced by the experience of Coal & Allied to date in this location, as the exposed nature of this site and wind born salt spray combine to create an extremely difficult environment for vegetation. Recent planting operations in and around the existing mine facilities have indicated the most appropriate choice of plant species to ensure an acceptable level of survival. As well, different soil treatments and rehabilitation methods used in other mined areas have also been considered in this final rehabilitation procedure proposal which is as follows:

1. spread and compact nominal 300mm of clay over the surface of the emplacement;
2. evenly spread 400mm subsoil and weathered rock over the clay;
3. cover subgrade material with 300mm of topsoil (as available);
4. water thoroughly and cover evenly with cleared vegetation/mulch material as available;
5. broadcast seed with the following seed mixture over the top of the mulch/vegetation:

Japanese Millet/Spring sowing	10.0 kg/ha
Rye Corn/Autumn sowing	10.0 kg/ha
Acacia longifolia	3.0 kg/ha
Acacia suaveolens	3.0 kg/ha
Angophora costata	0.5 kg/ha
Leptospermum laevigatum	1.0 kg/ha
Casuarina littoralis	1.0 kg/ha
Eucalytpus piperita	0.2 kg/ha
Eucalyptus gummifera	0.1 kg/ha
Eucalyptus haemastoma	0.2 kg/ha
Dillwynia floribunda	0.5 kg/ha
Kennedia rubicunda	0.5 kg/ha
Hardenbergia violaceae	0.5 kg/ha

Acacias will be treated by scalding with boiling water and soaking for 24 hours prior to innoculation with rhyzobium bacteria and sowing;

6. additional watering may be required if no rainfall occurs within 3 days of sowing;

TABLE 24 : ANALYSIS OF TOPSOIL SAMPLES FROM STUDY AREA

Sample No.	S1	S2	S3	S4	S5	S6	S7	S8	S9
pH (paste)	4.5	5.0	4.8	4.2	5.6	5.2	5.5	5.4	5.4
Ec umhos/cm	4.4	4.3	3.8	4.6	3.5	3.2	3.6	3.5	3.7
Total N Percent	0.115	0.079	0.092	0.146	0.063	0.059	0.062	0.084	0.071
Total P mg/kg	2.3	2.4	6.5	2.7	2.6	2.4	4.7	2.6	2.6
K mg/kg	63	33	62	59	79	51	60	74	62
Na mg/kg	74	31	45	73	53	50	36	38	40
Ca mg/kg	132	94	78	69	40	23	128	120	116
Organic Content mg/kg	5.1	6.3	6.1	5.6	6.6	6.1	4.1	3.8	7.5

NOTE: The location of the topsoil samples is shown on Figure 53.

Methods Used

pH and conductivity by meter on saturation paste
Nitrogen - Dept. of Agriculture - Kjeldahl digestion
Phosphorus - Dept. of Agriculture - Bray # 1 test
K, Na, Ca - extraction: 1 Molar Ammonium Acetate - analysis: A.A.S.
Organic Content - AS 1289 D1.1.

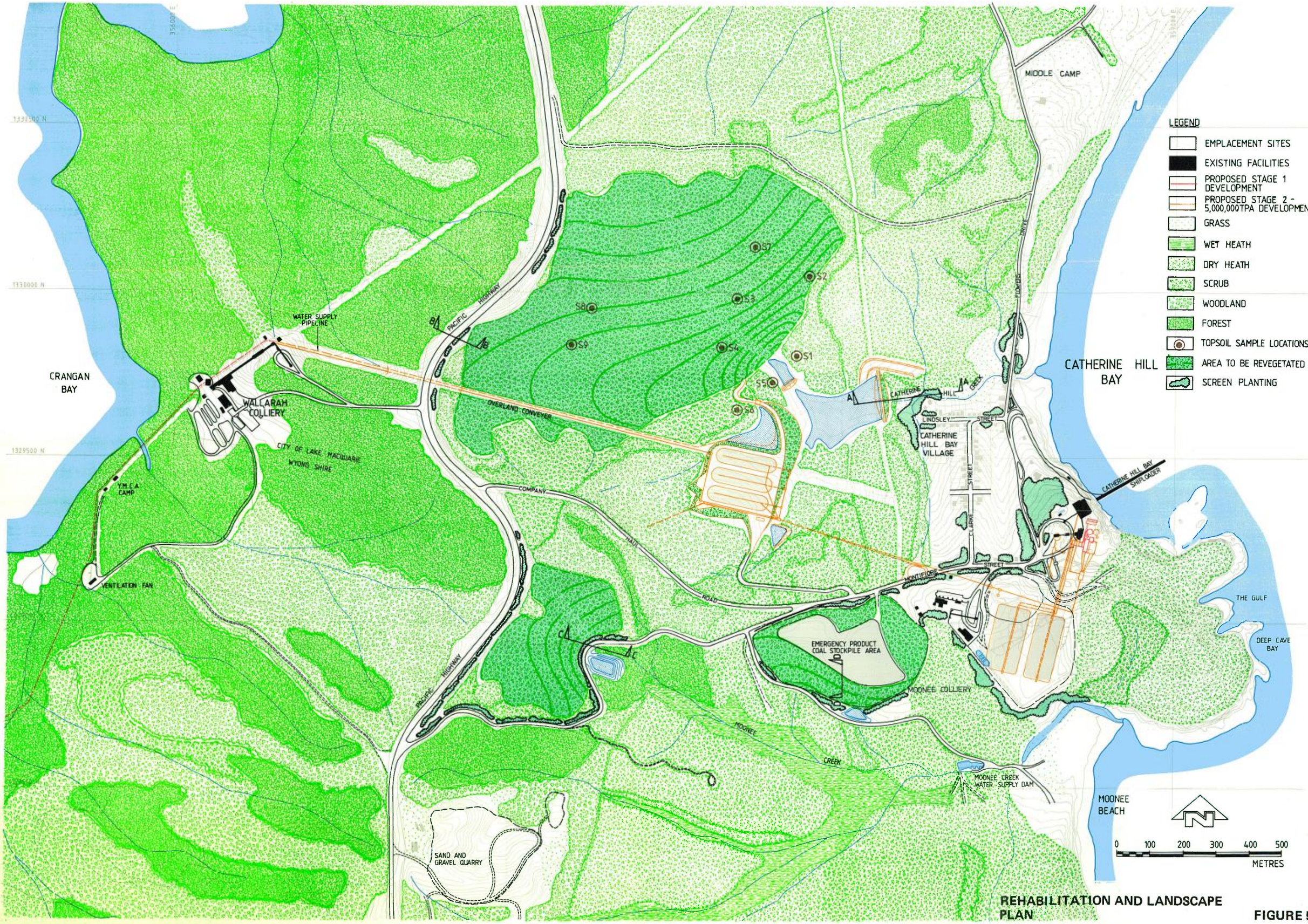
7. initial application of fertiliser and subsequent applications as recommended by the Soil Conservation Service of N.S.W. To check on the nutrient level of the existing top soil in the area, nine topsoil samples were collected and analysed. The location of the samples is shown on Figure 53 and the analytical results are given in Table 24.

In those areas shown on the landscape plan (Figure 53) to be screen planted, topsoil, subgrade and clay will be used to build a stable elevated profile. This will be covered with the cut foliage or mulch of the existing vegetation and planted with advanced size plants (200 mm pots) of the following species at the spacings shown:

	Spacing
Casuarina littoralis	3 m
Acacia longifolia var. sopherae	3 m
Eucalyptus gummifera	5 m
Eucalyptus haemastoma	5 m
Leptospermum laevigatum	3 m
Banksia integrifolia	3 m
Banksia ericifolia	2 m
Kennedia rubicunda	2 m
Hardenbergia violaceae	2 m

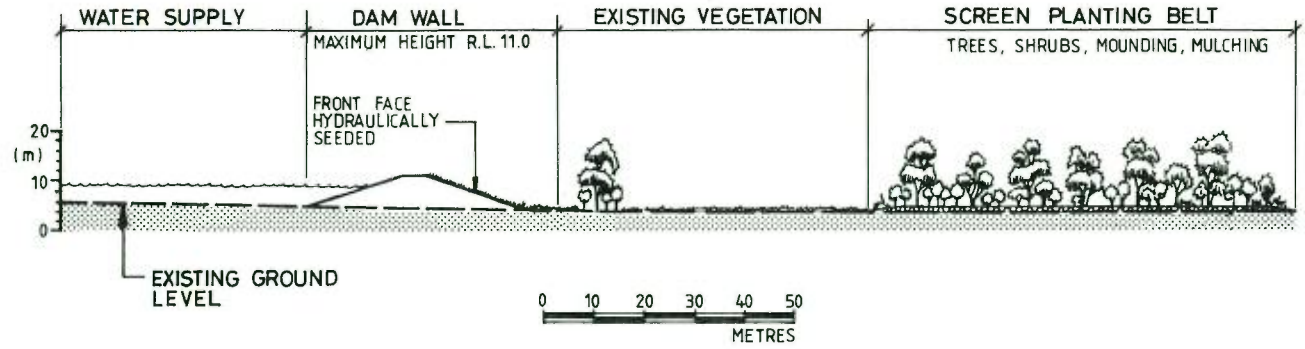
10.13 Final Land-Use

On completion of filling operations and surface rehabilitation, the emplacement areas will be managed to become part of the open space and "natural area" surrounding Catherine Hill Bay in accordance with planning objectives for the region set out in the Hunter Regional Environmental Plan No. 1 (Ref. 4) and the existing Local Environmental Plan zoning.

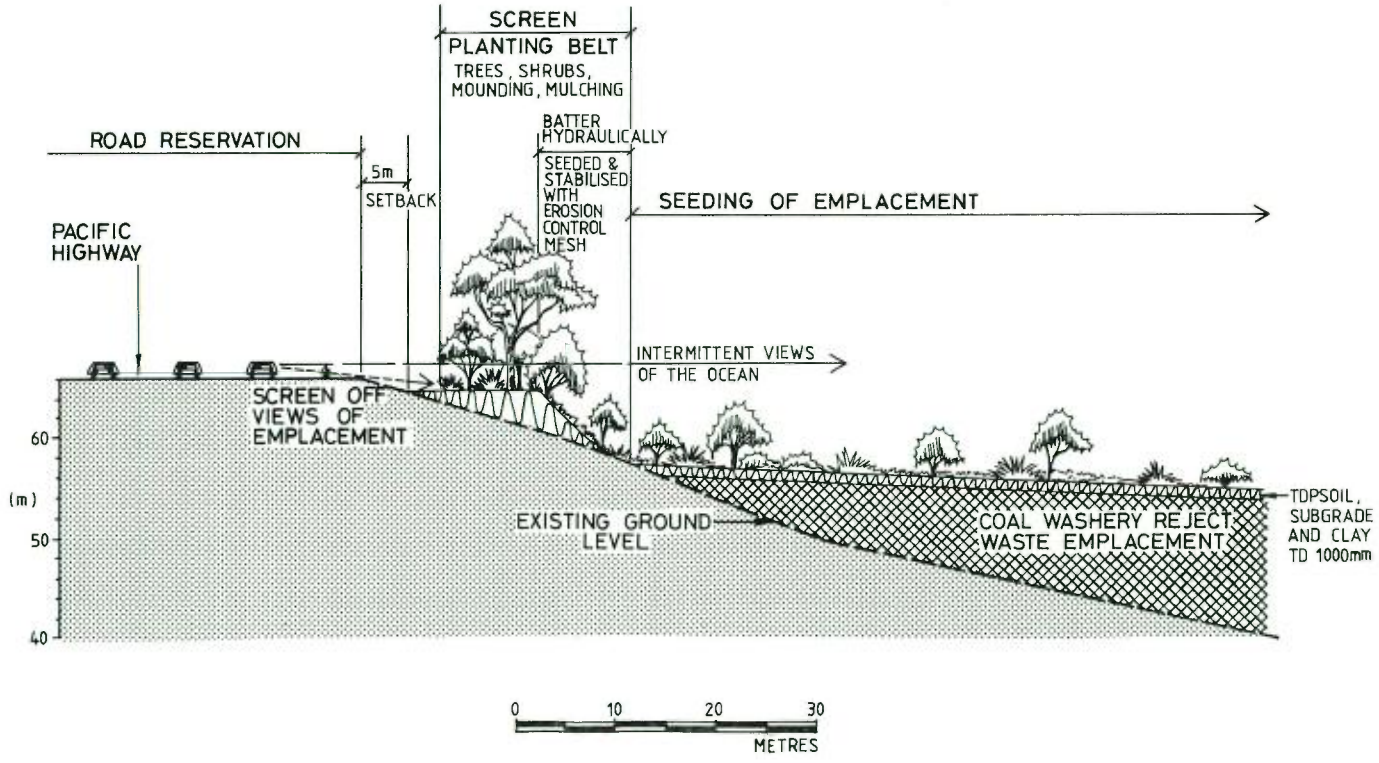


REHABILITATION AND LANDSCAPE PLAN

FIGURE 53



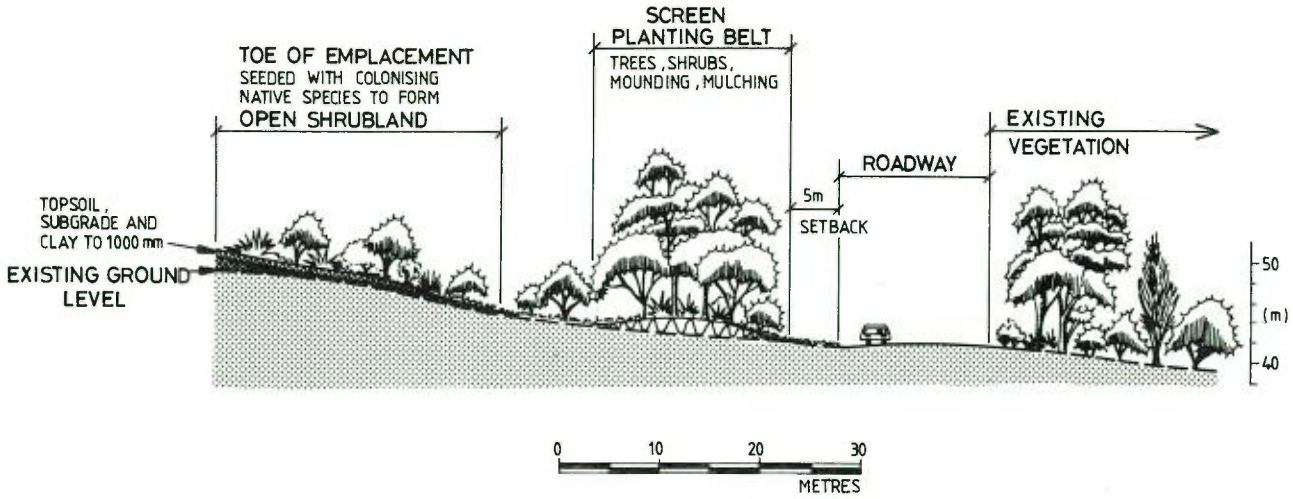
SECTION A-A



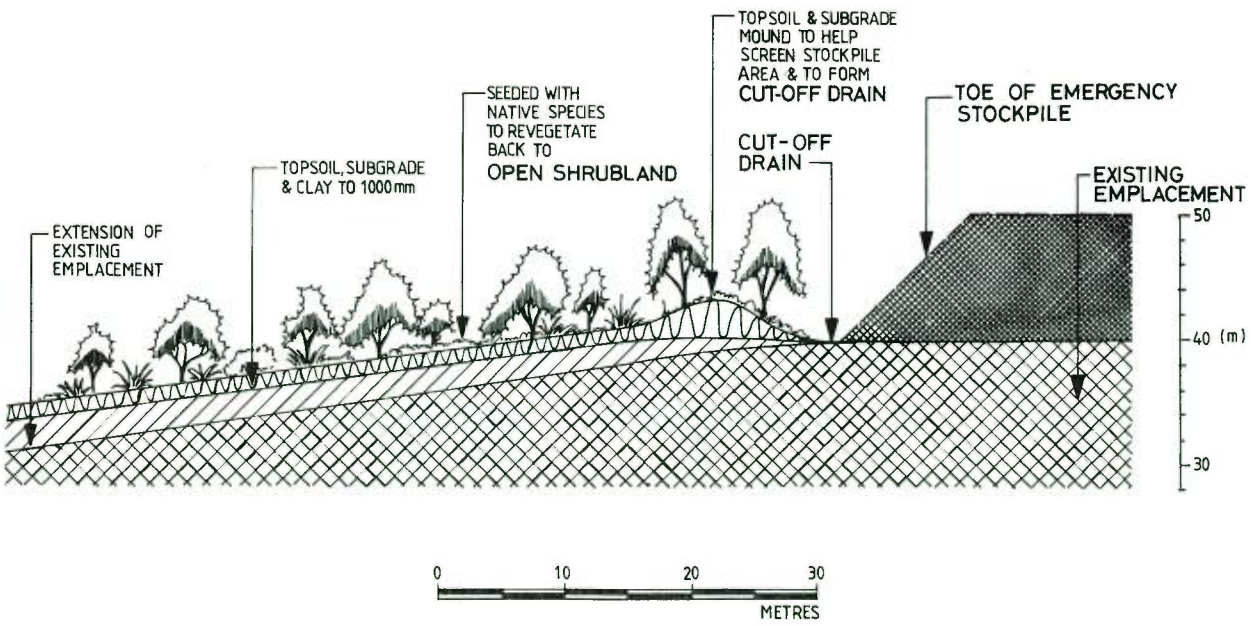
SECTION B-B

SECTIONS SHOWING PROPOSED SCREEN PLANTING AND REHABILITATION – PLAN A

FIGURE 54



SECTION C-C



SECTION D-D

SECTIONS SHOWING PROPOSED SCREEN PLANTING AND REHABILITATION – PLAN B

FIGURE 55

11.0 ENVIRONMENTAL SAFEGUARDS AND MONITORING FOR STAGE 2 DEVELOPMENTS

11.1 Water Quality and Water Pollution Control

Potential water contamination comes from rainfall and dust suppression water runoff from coal stockpiles, active filling areas of the coal washery reject emplacement, the Coal Preparation Plant and materials handling equipment. To control this, drive-in grit traps or settling ponds will be built to catch coarse material washed off active areas.

The raw coal stockpile, Catherine Hill Creek coal washery reject emplacement and some of the materials handling equipment is located within the catchment area of the Pollution Collection Dam on Catherine Hill Creek. Any runoff from those areas will be collected in the silt trap and filter dams prior to discharge and collection in the Pollution Collection Dam. These dams will be variable in size, but will have the capacity to contain run-off from a 2 hour, 1 in 10 year storm from the catchment they serve. Rainfall in excess of this will discharge but will generally be collected in the 49 Ml Pollution Collection Dam. All water collected in this dam will be reused in the Coal Preparation Plant. If there is any water collected in the Pollution Collection Dam, it will be used preferentially to the other supply sources.

Normally tailings from the Coal Preparation Plant will be pumped direct to the Catherine Hill Creek emplacement area as a slurry and dewatered in the coarse coal washery reject drainage cells there. The filling zones will be divided into cells approximately 1 ha in area, that will be filled and then left to give the tailings time to drain prior to further reworking. The filled cell will then be covered with a 1 m layer of coarse coal washery reject and drainage continued under the pressure loading imposed by subsequent filling operations.

The tailings water will either evaporate or drain through the coarse reject embankments into the Pollution Collection Dam. In this way water from the Coal Preparation Plant, not lost by evaporation, will be returned for reuse.

The Moonee Creek emplacement will be provided with its own settlement pond to collect any coarse material or silt washed off the emplacement area. Overflow from the settlement pond will be filtered in a filter pond before discharge to the Moonee Creek system.

Filling operations at both coal washery reject emplacement sites have been designed to minimise the extent of exposed surfaces at any one time. Final surfaces of the emplacement, and temporary faces to be filled over at a future date, will be progressively rehabilitated to control movement of fine material entering any watercourse.

Product (washed) coal will be stockpiled in covered bins and in open stockpile areas, which are located within the catchment area of Moonee Creek. Rainfall runoff from these latter areas will be collected in settlement ponds designed to collect runoff from the 2 hr, 1 in 10 year storm. Water collected in these ponds will be pumped into the water supply system for the Coal Preparation Plant. Any excess discharge will pass through filter dams before flowing directly to Moonee Beach.

11.2 Drainage

Drainage for the emplacements has been designed to control water movement through the emplacement zone. There are two sources of water to be considered: local catchment runoff and water transported to the site with the tailings slurry from the Coal Preparation Plant when the tailings are pumped directly to the emplacement.

Local catchment runoff will be isolated from filling operations using a 0.3 m deep drainage blanket across the filling zone and a culvert and/or perimeter drains. These drains will divert surface flow around or beneath the active filling areas of the emplacement. Compaction requirements for reject deposited at the site, and surface drains on the final landform, will restrict the quantity of rainfall penetrating the emplacement. Piezometers will be installed to monitor the level of the water table within the emplacement (See Section 11.8).

Side drains will be extended progressively to collect runoff from perimeter drains and to collect water from contour drains across the final landform. They will discharge directly into the Pollution Collection Dam below the emplacement zone.

11.3 Air Quality

Air quality in the study area may be affected by fugitive dust from coal stockpiles, the reject emplacement areas, conveyor equipment, coal handling, and by trucks transporting coal to the stockpile area and coal washery reject to the emplacements.

The following safeguards will be included to control dust emission :

(i) Coal Stockpiles. Operational raw coal and product coal stockpiles will be watered using automatic sprinkler systems to maintain the surface in a moist condition, which is more resistant to wind entrainment than a dry surface. Dust suppression chemicals will be added to the water to ensure effective wetting of the coal and agglomeration of the fines. Other stockpile areas, when active and being worked similarly, will be watered so as to ensure that fugitive dust emission does not occur. Haul roads will also be watered to prevent dust emission.

(ii) Coal Washery Reject Emplacement Areas. Control of dust emission from active areas of the emplacement will be by water spraying and, if required, the use of surface active agents. A water cart will be assigned to the emplacement area and used to water haul roads and active fill areas of the emplacement as necessary to avoid wind entrainment of dust.

(iii) Conveyor Equipment. Elevated conveyers will be enclosed to control emission of dust from the movement of coal. Belt scrapers will be installed at transfer points to keep the surface of the (return) conveyor belt clean.

(iv) Trucks transporting coal from Chain Valley Colliery will have their loads covered.

Ambient air quality monitoring has been undertaken at Catherine Hill Bay since January, 1986 (See section 4.11) and will be continued on a monthly basis to ensure that the air quality control systems are maintaining acceptable air quality.

In general a combustible material deposition rate at each gauge of less than 4 g/m^2/month will be considered satisfactory and where combustible material deposition is greater than 2.5 g/m^2/month, the cause will be investigated and, if necessary, remedial action will be taken.

11.4 Noise

Table 25 gives noise emission levels for various items of mechanical equipment which have been used in the calculation of target noise levels used in the assessment of this development. The levels are based on measured noise levels at 10 m, without attenuation where equipment would normally be enclosed or levels with silencers fitted for mobile equipment. The noise emission levels give target noise levels to be achieved and if particular items of equipment have higher levels than set out in Table 25, then additional noise attenutation will be required.

Due to the proximity of housing in Catherine Hill Bay village, particular attention has been paid to the control of noise emission from the components of the development. The following noise control safeguards and building attenuation measures will be incorporated into the design and operation of the proposed facilities:

(a) **Bradford Breakers:** These will be fully enclosed with metal sheeting and with rockwool or similar noise absorbing bats under the sheet steel roof. The overland conveyer Bradford breaker will be benched into the southern side of the ridge, facing away from the village of Catherine Hill Bay and the breaker near the Coal Preparation Plant will be positioned partly below ground and shielded by a bund wall or concrete block wall.

TABLE 25 : MAXIMUM NOISE EMISSION LEVELS FOR EQUIPMENT

Item	Noise Levels at 10 m (dBA)
Bradford Breaker	91
Overland Conveyer	65
Overland Conveyor drive unit	82
Other conveyers	60
Other conveyor drive units	75
Other conveyor transfer stations	82
Main transfer tower	85
Coal Preparation Plant	78 (includes building attenuation)
Screen House	78 (includes building attenuation)
INTERMITTENT SOURCES	
Front-end Loader	max. 82
Bulldozer	max 80-84
	idling 73
Vibrating Roller	max. 81-84
Truck (drive-past)	max. 87
Truck (dumping/loading)	85

NOTE: Except where indicated, these levels do not include attenuation from building walls, enclosures, etc.

(b) **Coal Preparation Plant:** The new Coal Preparation Plant building is being constructed so that the noise level at 10 m from the building, or any part of the extension, shall not exceed 78 dBA on the northern or western sides.

The building will be constructed with Colorbond or similar cladding and with no permanent openings for access or ventilation on the northern or western side (including the roof) of the building. Additionally, transparent sheeting, which will reduce noise attenuation by less than Colorbond sheeting, will not be incorporated on the northern or western sides (including the roof) of the building. All cladding will be extended to ground level, and such other noise control procedures as are required to meet the target noise levels outside the building will be incorporated into the design. These will include: installation of noise absorbing rockwool and liner under the roof; the use of a concrete suspended floor in the building for all screens and similar vibrating equipment; isolating the amenities and control rooms from the main part of the washing plant to ensure adequate noise reduction, and where necessary, attenuating or isolating individual items to reduce noise to acceptable levels.

The noise emission from the existing Coal Preparation Plant buildings will be evaluated as part of the Stage 2 development. Measures to attenuate noise emission will be implemented progressively and will include investigation of new cladding on the building and, as required, installation of the new cladding extending to the ground on the north and western sides of the building so as to ensure that adequate attenuation is achieved and that target noise levels in Catherine Hill Bay village are met. Other measures, if required, will also be implemented.

(c) **Conveyers etc.:** Conveyers will be either fully enclosed or enclosed on one side to prevent wind lift of the belt off the idler rollers. In general where conveyers are on the northern side of the haul road ridge between Catherine Hill Creek and

Moonee Creek, they will be enclosed on the side facing Catherine Hill Bay village; but on the Moonee Creek side they will be enclosed on the southern side. Where conveyers are elevated, they will be enclosed on both sides. The drive units, and particularly the transfer stations, will be fully enclosed. All such items, and also any other coal handling equipment (such as the screen house), will be fully enclosed by steel sheeting or other noise attenuating material to meet target noise emission levels. All coal handling systems, will be maintained in accordance with manufacturers specifications.

(d) **Truck Dump Hopper:** Acoustical absorbing material will be installed at the truck dump station to reduce transmission of dumping noise.

(e) **Landscaping:** A landscaped and bunded area will be developed between the Coal Preparation Plant and the village of Catherine Hill Bay to provide visual screening and some perceived noise attenuation.

(f) **Emplacement Operations:** Trucking of coal washery reject material to the emplacement and dumping near the working face will occur at all hours. Construction of the outer bank of the Catherine Hill Creek emplacement, facing Catherine Hill Bay village, will only occur during daylight hours and trucking and dumping at night and on week-ends will only be undertaken behind the outer shielding bank to reduce noise transmission from the emplacement. Compaction by bulldozer and vibrating roller (and other shaping and restoration activities) will occur only during daytime hours on weekdays (excluding public holidays).

11.5 Mine Subsidence

The Wallarah and Chain Valley Colliery Holdings are within the Swansea - North Entrance Mine Subsidence District. Mining operations are carried out in accordance with the provisions of the Coal Mining Act (No. 81, 1973), the Coal Mining Regulations Act (No. 67, 1982) and approvals for pillar extraction are granted by the Minister for Industrial Relations. All pillar extraction plans must be approved by the Chief Inspector of Coal Mines prior to extraction commencing.

For extraction of coal under Lake Macquarie and the lake foreshore (see Figure 26), partial extraction systems have been adopted in accordance with guidelines formulated by the Chief Inspector of Coal Mines to limit subsidence at the lake edges and to limit disturbance of the intervening strata between mine workings and the lake. All extraction plans for mining under the lake or lake foreshore must be approved by the Chief Inspector of Coal Mines prior to extraction commencing.

At Wallarah Colliery, longwall extraction panels are planned for under the Pacific Highway. Extraction of coal by longwall mining methods requires the approval of the Minister for Industrial Relations who is advised by the Chief Inspector of Coal Mines. The Company has established close liaison with the Department of Industrial Relations, the Department of Mineral Resources, the Department of Main Roads and the Mine Subsidence Board in this regard.

Partial extraction systems will continue to be adopted to protect existing residential developments at Gwandalan, Gwandalan West, Chain Valley Bay, Nords Wharf and Catherine Hill Bay. The Chief Inspector of Coal Mines has limited coal mining operations under the Gwandalan Sewage Treatment Plant to bord and pillar 'first workings' only.

Coal & Allied is a member of the Inter Departmental Group studying the co-ordination of urban development and mining in Wyong Shire. Formal submissions made to the study group, which comprises representatives of Wyong Shire Council, the Department of

Environment & Planning, the Department of Mineral Resources and the Mines Subsidence Board, have defined areas for future residential development in Gwandalan and Gwandalan West.

A subsidence engineer has been appointed by the Company to provide guidelines for mining beneath and in the vicinity of the proposed developments.

11.6 Emplacement Stability

A number of measures are proposed to ensure that the conditions assumed for the stability analysis (See Section 12.5) are maintained throughout and after the emplacement construction period. These measures can basically be divided into control, inspection and testing during construction, and the post-construction monitoring of emplacement conditions.

11.6.1 Inspection and Testing During Construction

The foundations of each individual unit of construction are to be inspected by an appropriately qualified engineer to determine whether additional stripping or special drainage measures are required to be incorporated into the emplacement.

During construction, regular density testing will be carried out to ensure that the nominated specific levels of compaction are being attained. (See Sections 10.2.2 and 10.6.2).

11.6.2 Post-Construction Monitoring

As the emplacement is progressively completed, survey monuments will be established to allow detection of any lateral movement and settlement. In addition, piezometers will be installed within the fill to monitor pore pressures generated within the tailings layers (when tailings slurry is placed in the emplacement) as well as the overall piezometric surface in the foundations and the course reject layers. Details are given in Section 11.8.

11.7 Vegetation and Erosion Control

The proposed coal handling facilities and coal washery reject emplacement areas have been designed to minimise the area of disturbance of the natural vegetation which would occur at any stage in the life of the proposed development. A network of diversion drains and surface water drains across the generally gentle fill slopes of the emplacements and an on-going revegetation scheme (as described in Section 10.12) will ensure that surface erosion will be controlled over the site.

The existing vegetation in the area to be affected by the proposal is mostly undisturbed and comprises a majority of indigenous species, which extend over a large area along the eastern side of the peninsula. To ensure that the native vegetation surrounding the proposed development is not adversely affected, the revegetation programme uses only indigenous species and an initial cover crop of an annual species, which will not persist beyond the first couple of years after sowing. The cover crop is to ensure stabilisation of the soil surface until the indigenous species provide a stable cover.

The indigenous species chosen for resowing have been selected with consideration given to the compiled species list, experience with planting in the area to date and the list of available Australian native seed. The resultant list does not contain as wide a divergence of species as currently exists on the development and emplacement sites, but these plants should reduce the soil surface available for weed infestation and erosion, and thereby safeguard the existing vegetation communities and topsoil.

Revegetation of the eastern face of the Water Supply Dam, Pollution Collection Dam, raw coal stockpile area and the product coal stockpile area will be undertaken by hydraulic seeding using a slurry of seed, a binding agent and fertiliser. Foliage from cleared vegetation, either cut, chipped or largely intact, will be placed over the surface to provide immediate erosion control and optimal growing conditions together with the hydraulic slurry. The seed mix set out in Section 10.12 will be used. Irrigation to optimise germination will be implemented as required and maintenance undertaken to remove any noxious weed invasion.

11.8 Management and Monitoring of Emplacement Areas

To ensure the efficiency and adequacy of the proposed safeguards, on-going management and monitoring is to be instituted from commencement and is to continue for 5 years after completion of the emplacements. The feed-back from the monitoring of completed areas of the emplacements will give useful information as to the suitability of the construction and rehabilitation techniques and allow for improvement of these techniques as the construction continues.

The parameters to be monitored are:

(i) the internal temperature of the emplacement;
(ii) the lateral movement and settlement of the fill material;
(iii) piezometric data;
(iv) the revegetation programme;
(v) dust emission;
(vi) water quality.

Survey and piezometric data will be retained for future reference and comparison. Piezometers and survey markers will be left in place for future measurements if required.

(i) Combustion and Temperature Monitoring

Temperature measuring pipes will be installed in the emplacement during construction and readings taken periodically. The results will be recorded and retained. Any continuing rise in temperature will be an indication of heating or combustion in the emplacement. This is not expected. However, if combustion is detected, remedial action will be undertaken.

(ii) Lateral Movement and Settlement

As the emplacement is progressively completed, survey monuments will be established and surveyed annually. The survey monuments will be located both horizontally and vertically by precision surveying and levelling and thus

instabilities and settlement will be readily indicated. In the interpretation of these results, it will be necessary to separate the effects of under mining subsidence from any movement due to instability in the emplacement.

(iii) Piezometric Surfaces

During contruction, and upon completion of each stage of the emplacement, piezometers will be installed to monitor the level of the water table.

Piezometers will be installed within the layers of tailings (slurry) placed into the Catherine Hill Creek emplacement, in the coarse reject and in the foundation material. The water table levels will be measured independently for each material. Readings will initially be taken 3 months and 6 months after installation, and then annually over the life of each stage and for a further 5 years after completion.

(iv) Revegetation Programme

Ongoing inspection of the vegetation established over the emplacement will be continued for 5 years after the emplacement is completed. Any erosion scour or other damage to the vegetation cover will be repaired.

Inspection for noxious weed invasion will be made and action taken to remove or eradicate the noxious weed.

v) Dust Emission

As set out in Section 11.3, dust deposition monitoring will be continued. Additionally regular visual inspections of vegetation adjacent to active areas of the emplacement will be undertaken to check whether coal dust is being blown off the emplacement.

vi) Water Quality

Regular sampling of discharges (if any) from the pollution control dams below the emplacements will be undertaken.

11.9 Safeguards - Visual Amenity

There are four distinct aspects of this development which will affect the visual amenity of the area. The safeguards which have been incorporated into the proposal vary for the different parts of the development, as follows:

1. proposed coal handling facilities;
2. Catherine Hill Creek coal washery reject emplacement;
3. Moonee Creek coal washery reject emplacement;
4. Pollution Collection and Water Supply dams.

11.9.1 Proposed Coal Handling Facilities

The proposed coal handling facilities have been sited, wherever possible, to avoid being obvious in significant views. This has not always been possible and some of the facilities are prominent in views from the residences of Catherine Hill Bay.

To reduce visual impact, a low profile design has been adopted for the Coal Preparation Plant building to minimise breaking the skyline when viewed from the west.

Careful evaluation of colour for the external sheeting has been undertaken to visually integrate the new structures with the environment of the area. Colours such as 'Mocha' (a brown colour with moderate greyness) for the walls and 'Sand' for the roof, have been selected by an Industrial Designer retained to advise on profiling of structures and architectural concepts to integrate the new structures with the environment. The height of these additions will only be marginally greater than the existing plant. Based on the design study a total building height of approximately 20 metres appears feasible. By comparison the existing jig plant is 15 metres high and a conventional dense medium cyclone plant is typically about 30 metres high. All new facilities will also be painted in colours which are designed to reduce the prominence of the development. These are detailed in Appendix H - the Industrial Designers Report.

11.9.2 Catherine Hill Creek Coal Washery Reject Emplacement

The Catherine Hill Creek coal washery reject disposal emplacement has a large capacity and covers an area of some 65 ha. The emplacement operation necessitates the progressive clearing of all vegetation, which is part of the existing visual environment. As a safeguard to the existing visual amenity, the following constraints to the design of this emplacement have been incorporated:

(a) restriction of the extent of the emplacement to between the Highway and the ridgeline behind the Catherine Hill Bay village;

(b) restriction of the height of the emplacement to below the level of the main ridgelines;

(c) staging of the emplacement to minimise the extent of cleared land visible at any one time during the proposed life of the emplacement;

(d) progressive rehabilitation of the emplacement with indigenous vegetation;

(e) contouring of the works to appear as natural as possible while maintaining the required capacity of the landform.

11.9.3 Moonee Creek Coal Washery Reject Emplacement

The Moonee Creek coal reject washery emplacement, has a much smaller capacity than the Catherine Hill Creek emplacement and only extends over an area of 11.5 ha. The emplacement has been restricted in size to avoid breaking the skyline and will be constructed by the 'uphill' procedure to provide as much visual shielding as possible when viewed from the south. Progressive rehabilitation with indigenous species will be implemented and the existing vegetation will only be cleared progressively as necessary to construct the emplacement.

These constraints will also apply to the gravel quarry proposed for the emplacement area.

11.9.4 Pollution Collection and Water Supply Dams

The Pollution Collection Dam is located in close proximity to the residences of 'Catherine Hill Bay village. The Water Supply dam is further from the residences and smaller, but it may introduce a positive visual alteration of a clear water body in the valley. The dam walls will incorporate a planting programme to safeguard the views from the nearby residences. This will involve planting of semi-advanced plants in specific locations after seeding the face of the dam wall with the native seed mix.

The raw coal stockpile embankments will be treated in a similar manner to the Pollution Collection Dam and Water Supply Dam embankments.

Other safeguards include the planting of tubestock species of indigenous vegetation in locations as shown on Figure 53. The planting is designed to further reduce the visibility of the coal handling facilities and emplacement operations.

12.0 ASSESSMENT OF ENVIRONMENTAL IMPACT OF STAGE 2 DEVELOPMENTS

12.1 Water Quality And Drainage

The proposed expansion of operations at Catherine Hill Bay has been designed to minimise any reduction of water quality in adjacent streams. Silt trap ponds and filter dams have been included in the designs to trap suspended carbonaceous material washed off coal handling areas and the emplacement, as well as soil eroded off vegetated areas.

Runoff from the raw coal stockpile area will flow to a grit trap and then a filter/settlement pond. This has been sized to collect low flows from dust suppression activities and rainfall runoff from a 2 hour, 1 in 10 year storm (a 2 hour storm occurring once in 10 years). Overflow from the raw coal stockpile settlement pond will pass to the 49 Ml Pollution Collection Dam, from where it will be recycled to the Coal Preparation Plant.

The Catherine Hill Creek emplacement affects a significant area of the Catherine Hill Creek valley and catchment. Silt trap dams and filter dam/embankments have been included in the construction sequence to trap any fine carbonaceous material washed off the emplacement in wet weather. In addition, the large silt trap dam below the emplacement will collect eroded silt during the early life of the emplacement. The pollution control ponds for the emplacement have been designed to collect all runoff from a 2 hour, 1 in 10 year storm. Rainfall in excess of this event will flow directly to the 49 Ml Pollution Collection Dam in the valley below the emplacement. This dam will act as a supply to the Coal Preparation Plant (see Section 9.4 and 12.2) and will normally be kept pumped as low as possible to maintain the maximum collection storage for rainfall runoff. This dam will also collect seepage out of the emplacement from dewatering of tailings pumped direct to the emplacement as a slurry.

The combination of 49 Ml Pollution Collection Dam and individual silt trap dams and filter ponds at each source of potentially silt laden water will effectively prevent pollution of Catherine Hill Creek. The Pollution Collection Dam will also act as a retention pond for catchment runoff and reduce flood levels below the dam. The dam's spillway has been designed to accommodate the Probable Maximum Precipitation storm over the catchment so that the dam will not be overtopped or damaged under the most extreme conditions possible. It will be effective in containing polluted water and preventing the proposed developments in the Catherine Hill Creek valley causing water pollution downstream from the dam.

Runoff from the existing facilities in the catchment of Moonee Creek is presently treated in settlement ponds. These ponds have been designed to control runoff from coal handling areas from a 2 hour, 1 in 10 year storm. These facilities have been satisfactory in controlling water quality in the past, and are licenced by the State Pollution Control Commission. Development of the new coal handling facilities will require development of additional grit traps, settlement/collection ponds and filter ponds to control runoff. In general, all runoff from the coal handling areas will be collected in a settlement/collection pond and pumped back to the Coal Preparation Plant. This will avoid any discharge. If the rainfall is in excess of the capacity of the collection pond (runoff from a 2 hour, 1 in 10 year storm), the later runoff from the coal handling areas will flow to the filter pond and, after treatment, will be discharged to Moonee Beach.

The Moonee Creek emplacement (and gravel quarry) will be provided with both a grit trap/settlement pond and filter pond to polish any discharge from the settlement pond. This will be effective in maintaining the quality of water in the creek system and will maintain the flow of water to the wet heath areas downstream.

Emplacement surface drains have been designed to accommodate the peak discharge from a 1 in 10 year storm. This design criteria is

considered to be adequate for site facilities and the emplacement operation. On the emplacements, the steepest grade of the landform is 1 vertical to 4 horizontal, which will be revegetated with a grass cover. Extreme runoff will cause contour banks to overtop, causing downslope overland flow, which will be infrequent and should not cause scour of the finished revegetated surface. The Catherine Hill Creek emplacement shape has a shallow drainage path along its southern limit. During periods of overland flow, runoff may occur downslope in this zone. This channel has a very gentle grade and diverts flow into the side drain.

Chemical testing of the coal washery reject to be produced has shown that it will not become acidic and will not cause an acid leachate problem.

In the Catherine Hill Creek Valley, all dry weather leachate and runoff from the emplacement and coal handling areas will be reused in the Coal Preparation Plant and in wet weather all run-off will usually be reused. In the Moonee catchment, coal handling water will similarly be recycled.

Discharge of runoff water from both the coal handling facilities and the emplacements will be rare. Any carbonaceous sediment which does escape through the pollution control dam system will be non-toxic and the only potential adverse effect will be sedimentation in the creek. This is not expected. The Moonee Creek emplacement, with an estimated life of less than 2 years, is the only component of the proposed development which will not recycle runoff water to the washery. The likelihood of discharge from this area is remote. For all other parts of the development, runoff and other water discharges will be carefully conserved and reused in the Coal Preparation Plant.

This development will not cause any water pollution problem and will cause no adverse impact on the Moonee Valley wet heath areas.

12.2 Water Supply

The evaluation of available water supply from the Company's sources of the Moonee pondage, Middle Camp dams and new Water Supply and Pollution Collection Dams has shown that these sources would be unable to supply the estimated demand of 1450 - 1500 Ml/annum. Consequently it will be necessary to draw water from the Wyong Shire reticulated supply.

The estimated maximum demand is about 7 Ml/day, but more usually will be about 4 Ml/day because of supply from the Company's own sources. The estimated annual demand from the Wyong Shire system is about 550-800 Ml.

Wyong Shire Council have advised that:

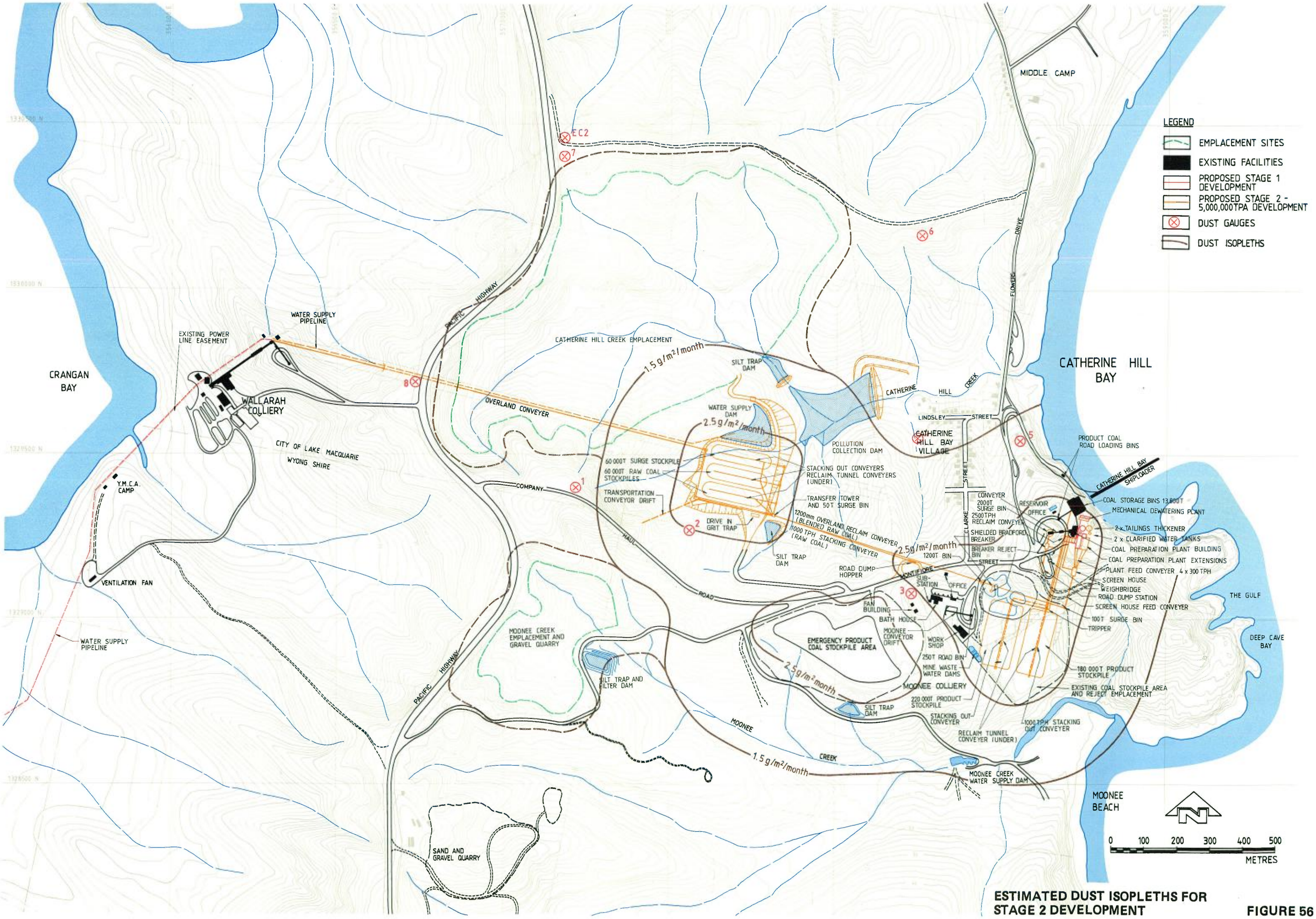
" - current projections indicate that there is adequate hydraulic capacity to supply the expected demands from the headworks system. However, an assessment will be necessary to examine the impact, timing and costs associated with future headworks augmentation requirements.

- future aspects which are currently under examination include:

    1) water charges and method of charging
    2) impact, timing and costs associated with the augmentations required within the distribution system
    3) the optimum peak instantaneous load for the W.S.C. system and any restrictions which may be placed on the times of demand." (Ref.8).

12.3 Air Quality

It is considered that the safeguards outlined in Section 11.3 will be adequate to ensure that the Stage 2 coal handling and emplacement operations do not become a source of dust nuisance. If visual inspections of vegetation indicate increasing dust deposition, then the control measures within the site area will be upgraded as required.



ESTIMATED DUST ISOPLETHS FOR STAGE 2 DEVELOPMENT

FIGURE 56

Similarly the results of the dust deposition monitoring will be reviewed regularly and the results related to the inspections of coal dust deposition on vegetation. If the dust gauge monitoring shows deposition of combustible material in excess of 2.5 g/m^2/month, the cause will be investigated and if deposition of combustible material recorded is above 4 g/m^2/month then remedial measures will be taken to reduce fugitive coal dust emission. This will be done in accordance with State Pollution Control Commission requirements.

Adequate water will be available to enable the control procedures to be implemented satisfactorily, and it is not expected that the proposed developments will increase fugitive coal dust emission around Catherine Hill Bay. Indeed movement of the open coal stockpiles from the ridge adjacent to the Coal Preparation Plant during this environmental study and installation of automatic stockpile spraying systems as a part of this development will reduce the amount of wind blown fugitive coal dust from the Company's Catherine Hill Bay operations.

12.4 Noise

As discussed in Section 4.12, Catherine Hill Bay and surrounds have, for some time, experienced noise levels which result from the transport, handling and processing of coal. The proposed new development will have associated noise characteristics which will alter the acoustic environment in the area. However, the Company will ensure that current noise levels affecting residences at Catherine Hill Bay and Middle Camp are not increased by the proposed new Stage 2 developments. The impacts associated with the Stage 1 development are discussed in Section 8.1.

The residential location which is potentially the most affected by the proposal (and currently the most affected by noise from the existing coal handling operations) is that of the southern-most house in Clarke Street (adjacent to the hotel). This house, which corresponds to background noise Sample Point No. 4, (see Figure 14), has been used as a reference point for the calculation of noise impact on this part of the village from the proposed Stage 2 Coal Preparation Plant expansion, coal handling and reject emplacement developments.

Other residential locations for which projected noise levels have been calculated and assessed include the western end of Lindsley Street (background noise Sample Point No. 5, at the lower end of the village) and the nearest or southern-most house at Middle Camp (background noise Sample Point No. 7). Expected noise levels have also been calculated for within Munmorah State Recreation Area - (at the Bongon Trig. Point Lookout) and for the Moonee Beach Picnic Area.

The estimates of noise levels expected to result from the proposed developments at the receiving points are given in Table 26 for both semi-continuous and intermittent noise sources. The maximum semi-continuous noise levels are considered to be equivalent to L_{10} levels. Estimated noise isopleths for the Stage 2 : 5,000,000 tpa development are shown on Figure 57. The estimated noise levels in Table 26 and those shown on Figure 57 are derived from calculations based on known or similar measured equipment noise levels (see Section 11.4 and Table 25), attenuation through buildings or enclosures where appropriate and estimated attenuation due to distance and shielding by topography.

As discussed in Section 8.1, the State Pollution Control Commission's Environmental Noise Control Manual gives acceptable limits for background noise levels for various residential environments. Row (e) in Table 21-1 in this manual refers to residential receiver areas located near industrial areas, which is considered to apply to the village of Catherine Hill Bay. The acceptable limits of L_{90} background noise for this category are 50 dBA for daytime and 40 dBA for night-time, with extreme limits 5 dBA higher in both cases.

Following discussions with the State Pollution Control Commission, it was agreed that it may be necessary to implement a noise reduction programme for the existing Coal Preparation Plant as the new Stage 2 developments are commissioned. This will include resheeting the existing buildings to the ground and other measures as discussed for the new plant to ensure that target noise levels in the village of Catherine Hill Bay are met (see Section 11.4).

The existing L_{90} noise levels at noise Sample Point No. 4 (see Tables 11, 12 and 13) are between 42 dBA and 53 dBA (with little variation according to time of day) and most of these levels are primarily produced by the present coal handling/preparation/transportation activities, which will be supplemented by the proposed development. It is considered appropriate that any re-development of the colliery facilities should be designed to ensure that present or existing noise levels after the full Stage 2 development is completed and operational, and also as the progressive commissioning of the components of the Stage 2 development is completed, are kept within the present range of ambient noise levels. The lower background levels at noise Sample Point No. 4 (around 42 dBA - 45 dBA) were measured when the Coal Preparation Plant was not operating. Typical background levels with the Coal Preparation Plant operating are 46 - 53 dBA. The level at the end of the Stage 1 development is estimated to be 45 dBA (see Section 8.1).

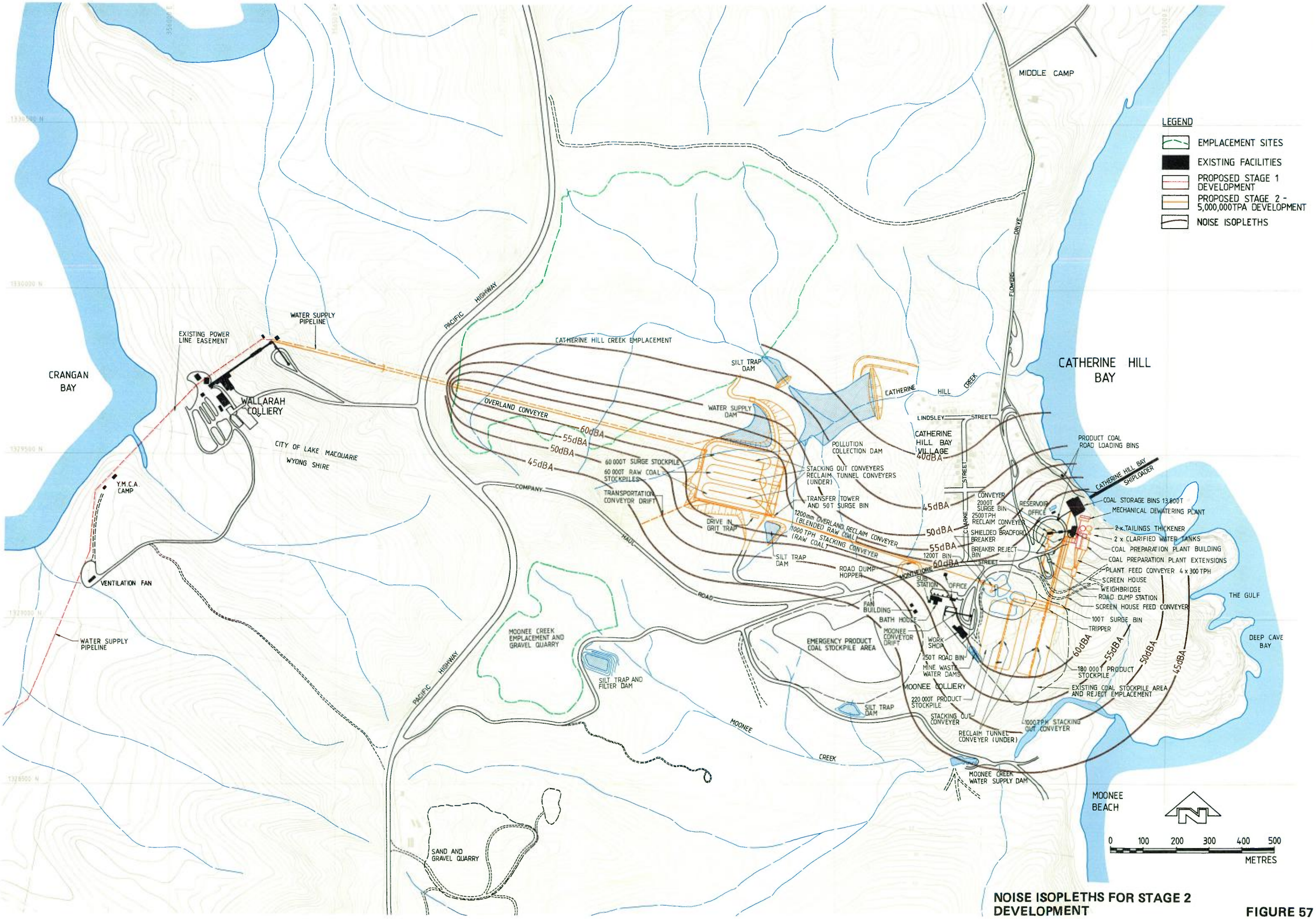
Therefore, in order to ensure that the acoustic environment of the village is not subjected to increased levels, the Company will ensure that all continuous or semi-continuous operations will not produce a resultant noise level at Sample Point No. 4 (or other residential locations) of more than 45 dBA. This includes the existing Coal Preparation Plant. The projected levels given in Table 26 show that this target noise level will be achieved.

Projected peak or higher intermittent noise levels are also given in Table 26. These estimated levels do not include the effects of trucking on the main haul road and the noise from this activity will continue as at present, but with reduced frequency. For Sample Point No. 4 current maximum levels of over 70 dBA occur commonly with occasional peaks to 80 dBA (from passing traffic). Maximum levels of up to 65 dBA occur here from trucking activity on the haul road and near the existing Coal Preparation Plant. With the Stage 2 development, noise levels of this order will continue to occur, but with a reduced frequency as the number of total truck movements (particularly from Moonee Colliery) decline.

TABLE 26 : PREDICTED MAXIMUM NOISE LEVELS FROM PROPOSED STAGE 2 DEVELOPMENTS

	Stage 2 : 3,600,000 tpa Development		Stage 2 : 5,000,000 tpa Development	
	Semi-continuous noise (L_{10})	Intermittent noise	Semi-continuous noise (L_{10})	Intermittent noise
(a) At house adjacent to Hotel, Clarke St. Catherine Hill Bay (Sample Point No. 4)	44 dBA	60 dBA	45 dBA	60 dBA
(b) Near houses at western end of Lindsley St., Catherine Hill Bay (Sample Point No. 5)	37 dBA	51 dBA	38 dBA	51 dBA
(c) Southern-most house at Middle Camp (Sample Point No. 7)	28 dBA	32 dBA	29 dBA	32 dBA
(d) Moonee Beach Picnic area	45 dBA	52 dBA	48 dBA	54 dBA
(e) Bongon Trig. Point lookout	37 dBA	41 dBA	38 dBA	41 dBA

NOTE: The intermittent levels given here include the effects of trucking on the emplacement and emplacement access road. The sound of trucks moving on the main haul road is not included.



NOISE ISOPLETHS FOR STAGE 2 DEVELOPMENT

FIGURE 57

Trucking on the Catherine Hill Creek emplacement access road will, however, also be heard in the village and could cause levels of up to about 50 dBA on an intermittent basis at all hours. This is not considered to be a major impact at Sample Point No. 4 (which is subject to the higher truck noise levels from the main haul road and Coal Preparation Plant area) but may be more noticeable at the northern end of the village, (Sample Point No. 5). Other sounds from emplacement activities such as bulldozing and compacting (which will be during daytime only, Monday to Friday) could cause intermittent levels of up to 48 dBA in parts of the village at the worst case during emplacement construction: that is, when emplacement is taking place at the outer edges of each "bench" with no shielding provided by the outer face or berm. At most times, noise levels from emplacement construction will be substantially lower than this.

The main single contributor to projected continuous or semi-continuous noise levels in the upper part of the village will be the Coal Preparation Plant and adjacent Bradford breaker, which are less shielded by the landform than the overland conveyer Bradford breaker and product coal stockpile areas. Particular attention will therefore be required in the construction and noise attentuation treatment of these features, as discussed in Section 11.4, to ensure the emitted noise does not exceed the anticipated levels. This may also include some treatment of the existing Coal Preparation Plant building to reduce noise emission from that source.

As well as assessing the expected noise levels at residential locations, projected levels are also given in Table 26 for the nearby Munmorah State Recreation Area and Moonee Beach. At Moonee Beach picnic and camping area, semi-continuous (L_{10}) noise levels of up to 48 dBA can be expected during the Stage 2 development. At the Bongon Trig. Point lookout, some 2 km to the south, levels will not exceed about 38 dBA. Both these locations are dominated by surf noise and therefore it is unlikely that any disturbance with result from the proposed Stage 2 developments.

12.5 Emplacement Landform and Stability

The proposed landform for the emplacements in the Catherine Hill Creek valley and the Moonee Creek valley have been designed to optimise the use of the site for coal washery reject disposal and to minimise the visual impact from local viewing points.

The emplacement landform has been shown to be geotechnically stable under extreme conditions using strength parameters for the coal washery reject, which are appropriate to the construction procedure described in Section 10, and strength parameters for the foundation materials as determined by the foundation investigation. A representative cross-section of the Catherine Hill Creek emplacement has been analysed to investigate stability. This is shown on Figure 58.

In the short term, or immediate post construction phase, stability of the Catherine Hill Creek emplacement is not considered to be a problem. This is firstly because of the relatively high undrained strength of the foundation clays (c_u = 100 kPa), and secondly because the application of the total emplacement load to any particular point in the foundation will not be instantaneous. It is considered that the majority of the excess pore pressures generated by the emplacement loading will dissipate during the construction period. Hence an "effective stress" analysis is more appropriate. This is equivalent to the analysis required for the long term stability calculation (discussed below).

The long term stability has been calculated using the computer programme STABL which uses Carter's method (1971) of slope stability analysis. The approach, including equilibrium equations used in this method, is documented in Reference 7. Four cases, or load combinations were considered for the representative section analysed. These are :

Case 1 : A water table corresponding to infiltration from rainfall only within the emplacement, but with no seismic forces acting.

Case 2 : The above calculated water table and the occurrence of a seismic event equivalent to a horizontal acceleration of 0.10 g.

TABLE 27 STABILITY ASSESSMENT - CATHERINE HILL CREEK EMPLACEMENT

CASE	**1**	**2**	**3**	**4**
Water Table	Nominal	Nominal	Extreme	Extreme
Earthquake	no	yes	no	yes
Factor of Safety (for failure surfaces extending through the foundation material)	1.59	1.08	1.52	1.04
Factor of Safety (for failure surfaces contained wholly within the emplacement fill)	2.07	1.40	1.89	1.28

Case 3 : An extreme water table (due to moisture increase resulting from emplaced tailings) within the emplacement, but with no seismic forces acting.

Case 4 : An extreme water table and the occurrence of a seismic event equivalent to a horizontal acceleration of 0.10 g.

Stability analyses were carried out for trial failure surfaces extending into the foundation soils as well as surfaces contained wholly within the emplacement fill. The results of the analyses are summarised in Table 27.

It is noted that normally accepted minimum values for factor of safety are 1.4 to 1.5 for static cases and 1.0 to 1.05 with seismic effects added. The calculated factors of safety for the completed emplacement are therefore considered to be acceptable.

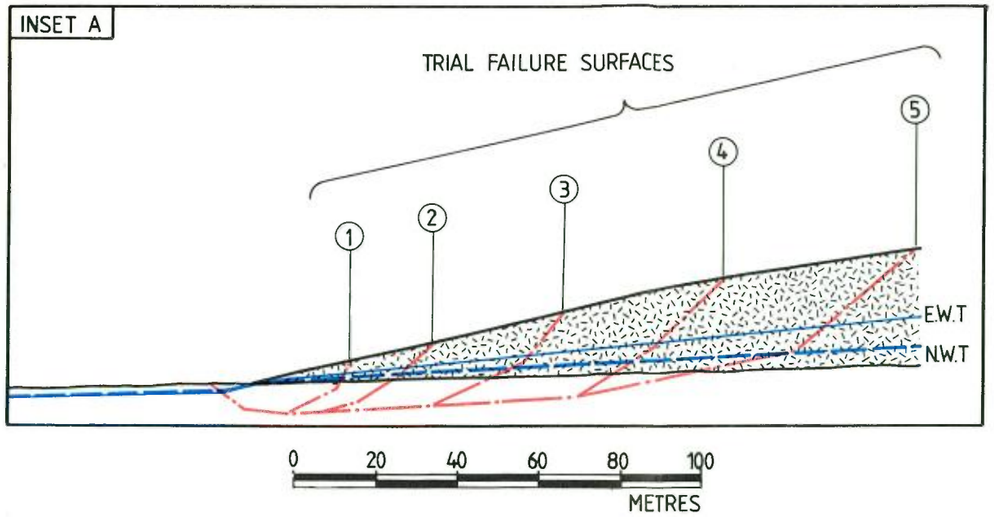
Settlement of the foundation material is only a potential problem in the toe areas of the emplacement that are located over the deeper alluvial soils. This is unlikely to be a major problem due to the overconsolidated nature of the foundation clays and the relatively shallow depth to rock.

12.6 Visual Amenity

In order to assess the impacts on the existing visual environment, the importance of the different typical views and the relative prominence of the proposed development in those typical views have to be assessed. This has been done using computer constructed photomontage techniques. Eight different perspective photomontages give the different aspects of the development shown against typical local views at different enlargements. These are shown on Figures 59, 60, 61, 62, 63, 64, 65 and 66. Table 28 summarises the significance of these different views and the relative short term and long term impacts on these views. This table forms the basis for conclusions concerning the broad visual impacts on the existing environment.

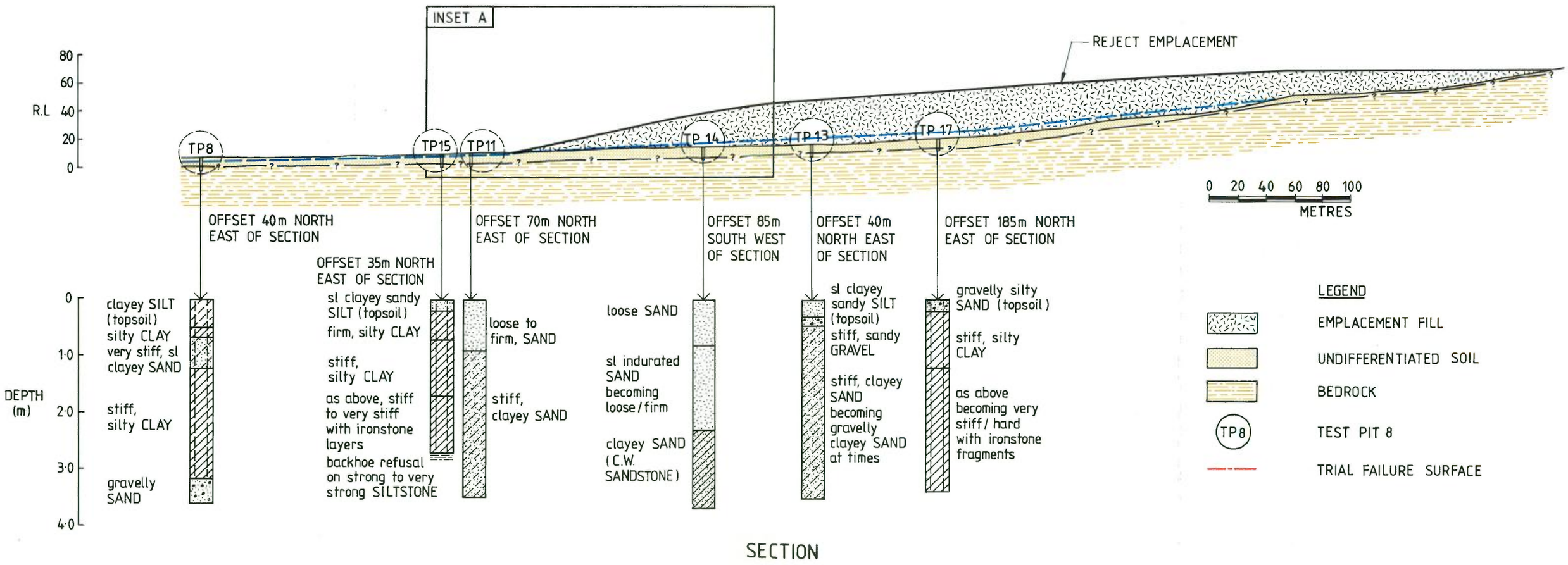
In general the proposed developments will have three different types of adverse impact on the visual amenity.

1) Short term impacts;
2) Long term impacts;
3) Intermittent impacts.



FACTOR OF SAFETY (F.O.S)					
	FAILURE SURFACE No.				
LOAD CASE	①	②	③	④	⑤
STATIC (N.W.T)	1·72	1·59	1·61	1·69	1·94
EARTHQUAKE (N.W.T)	1·14	1·08	1·10	1·15	1·28
STATIC (E.W.T)	1·65	1·52	1·51	1·58	1·79
EARTHQUAKE (E.W.T)	1·11	1·04	1·04	1·08	1·18

N.B.
- N.W.T - nominal water table
- E.W.T - extreme water table
- Factor of safety for trial failure surfaces through the emplacement fill only are not critical (i.e. higher F.O.S. returned) and thus not presented.



SECTION

STABILITY DIAGRAM FOR COAL WASHERY REJECT EMPLACEMENT IN CATHERINE HILL CREEK **FIGURE 58**

The first type is that which is associated with the coal washery reject emplacements and the face of the Pollution Collection Dam wall. These have an initial impact in the short term that is much greater than the long term effect. This is because the major impact on the visual environment from these parts of the development relates to clearing of the vegetation. For the Catherine Hill Creek emplacement, the safeguards described in Section 11.7 will assist in the reduction of the overall impact associated with the staged clearing of 65 ha of vegetation over 22 years. The Moonee Creek emplacement is much smaller (11.5 ha) but will be treated similarly to the Catherine Hill Creek emplacement. As the Moonee Creek emplacement is more prominent in district and regional views, the short term adverse impacts will be greater than at Catherine Hill Creek. However, as the cleared area is smaller, and the life of the emplacement is less, the short term period of impact will also be less than that for Catherine Hill Creek. The long term impacts associated with these coal washery reject emplacements and the dam wall will be decreasing over time as the natural vegetation recolonises the affected areas. It is not possible to predict the time when the continuous cover of the vegetation will be fully restored.

The second type of impact affects local views, is long term and is that which is associated with permanent changes to the appearance of the area as a result of the development. For example, the appearance of the Water Supply Dam, the Pollution Collection Dam and the coal handling facilities will remain essentially the same from the time of construction onwards. The arguably positive visual effect of the dam water bodies will to some extent reduce this impact, as will the cladding of new facilities with specially selected coloured panels and the proposed tree planting scheme.

A third type of impact, one of intermittent nature is associated with the location of the coal stockpile areas. The surface of these areas will remain without vegetation and will therefore have a minor but long term impact, and the prominence of the stockpiles will vary with their use. For the period when the emergency stockpile area is filled to its capacity, the stockpiles will be prominent in many district and regional views and the short term impact will be correspondingly high; when the stockpile areas are only partially filled, they will not be as prominent and the short term impact will be correspondingly lower.

After examination of the photomontages which show the siting of the coal handling facilities and the emergency stockpiles generally within existing cleared areas, and consideration of the proposed planting and treatments of the buildings which are aimed to reduce the potential impact of this development, it is considered that as a result of the proposed development there will be an additional adverse impact on the existing visual environment. This impact will be most obvious in views from the south and in views from local residences. However as the existing environment shown in these views already contains similar facilities to those proposed and because of an obvious and historical association with coal mining activities, it is considered that the level of impact on the visual environment should be acceptable within the area and to the local community.

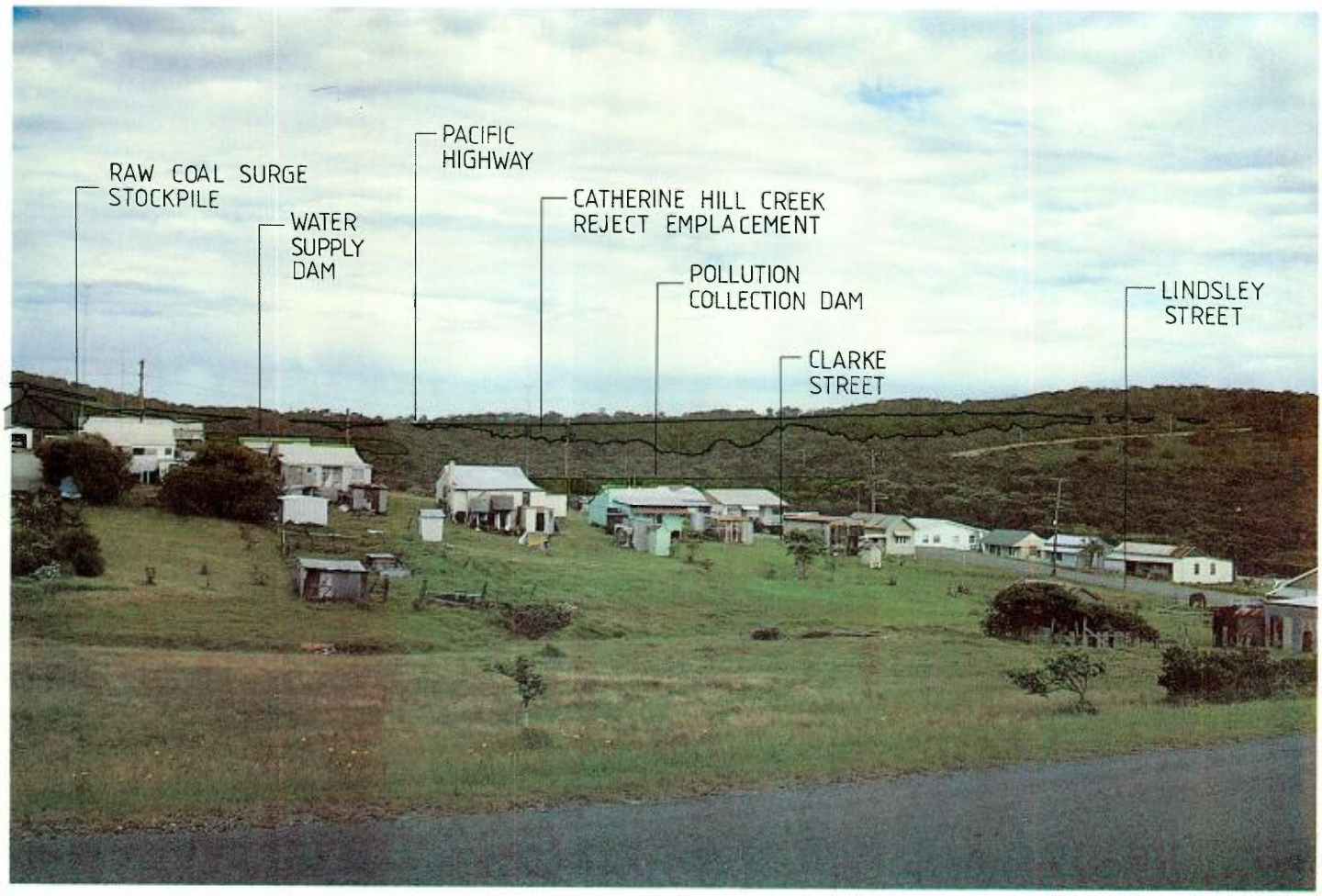
12.7 Vegetation

A total area of some 80ha of natural vegetation will be progressively cleared during the life of the emplacements and revegetated with the seeds of the dominant and available species. The aim of the revegetation scheme is to provide a stable cover of colonising native vegetation so as to encourage the return of the different vegetation communities that will be cleared. With successful revegetation, there will be only a minor adverse impact on the vegetation in the long term. However, in the short term there will be an overall reduction in the number of different vegetation communities in the area and also a reduction in species diversity. It is unlikely that the Cabbage Tree Palms Livistona australis and the Blackboys, Xanthorrhoea media will ever re-establish themselves in the emplacement areas. The existing landform with the gullies and slopes necessary for their survival will have been changed to that which suits other more common species.

It is this anticipated loss in diversity of species, and possibly loss of canopy cover in the short to mid term, which will constitute adverse impacts in relation to the vegetation. Seasonal revegetation programmes, ongoing monitoring of successful and less successful seed species and incorporation of Soil Conservation Service advice should ensure that other impacts associated with the vegetation in the area will be kept to a minimum and that the revegetation programme will be successful.

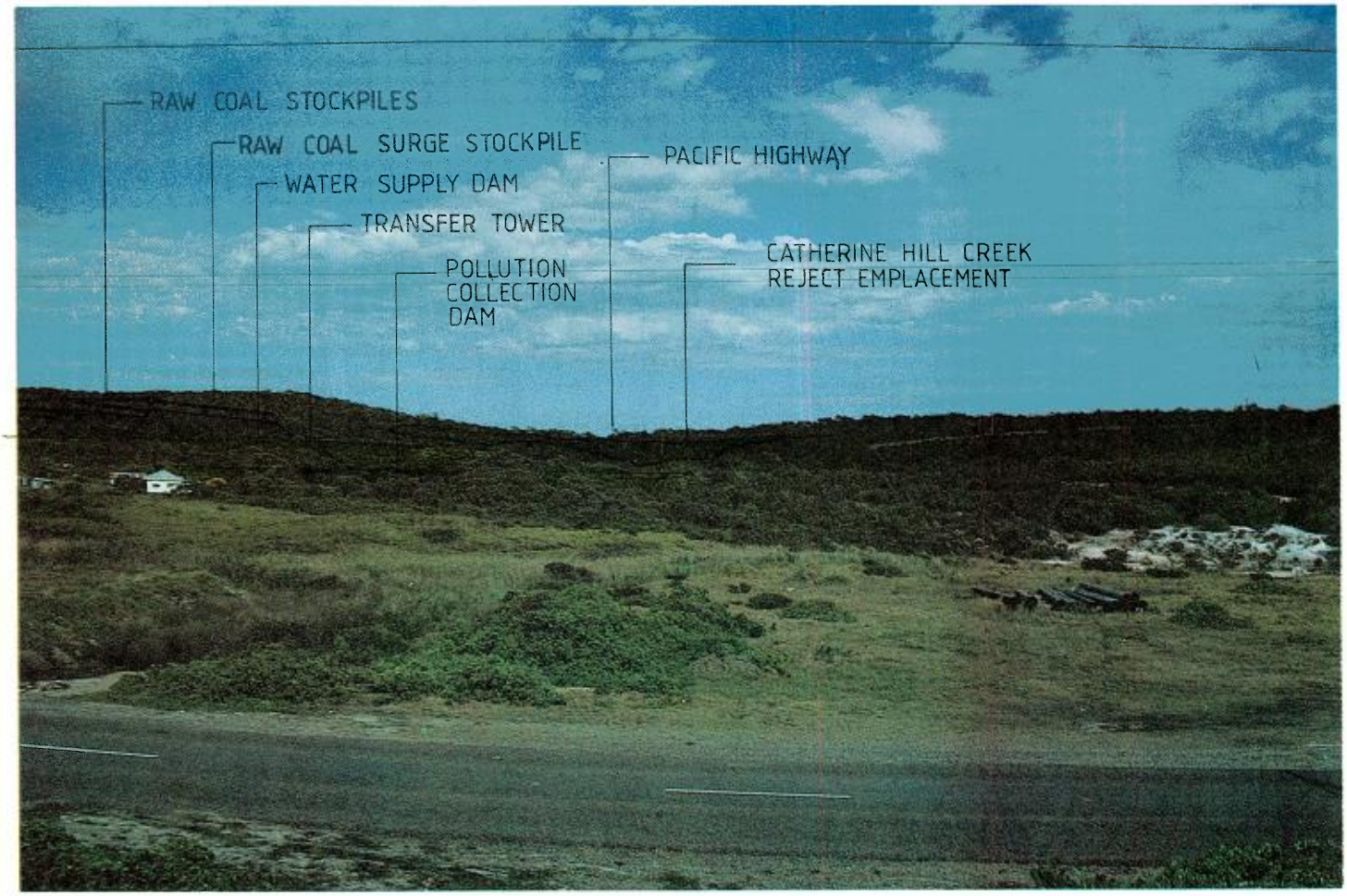
TABLE 28 : IMPACT OF THE STAGE 2 DEVELOPMENT PROPOSAL ON VIEWS AS PHOTOGRAPHED

VIEWING POINT NO. AND FIGURE No.	SIGNIFICANCE OF VIEW	VIEW OF EXISTING FACILITIES	PROPOSED NEW COAL HANDLING FACILITIES & STOCKPILE AREAS	PROPOSED REJECT EMPLACEMENT CATHERINE HILL CREEK	PROPOSED POLLUTION CONTROL AND WATER SUPPLY DAM	PROPOSED REJECT EMPLACEMENT MOONEE CREEK
1 View from Catherine Hill Bay village FIGURE 59	Significant to local residents of Catherine Hill Bay village	No existing coal handling facilities visible : only the easement clearing	A portion of the raw coal stockpile and the majority of the surge stockpile and its conveyor are visible: - Long term adverse impact.	Short term clearing of vegetation in middle and minor topography change - Significant in the Short term - Reduced in the Long term.	Permanent clearing of vegetation and change to topography in foreground of view: - Long term adverse impact - Provision of water body, possible reduction in impact.	Not Visible, screened by ridgeline to the south.
2 View from picnic tables at beach FIGURE 60	Significant to local residents & to a lesser extent sightseers and picnic makers.	Clearing for the ease-ment is visible but no existing coal handling facilities.	Most raw coal handling facilities and stockpiles visible - Long term adverse impact.	Small proportion visible: - Minor impacts short and long term.	Top of dam walls visible in foreground - Adverse impact until covered with vegetation.	Not Visible, screened by stockpiles and ridgelines.
3 View from Moonee Beach FIGURE 61	Significant to regional tourists.	Moonee truck loading bin and mine office are visible. Some Stage 1 facilities will also be visible.	Most product stockpiles and conveyors visible in the foreground of view. Break in horizon line . - Significant impact long term.	Not visible, screened by ridgeline.	Not Visible screened by ridgeline.	Not Visible, existing vegetation will screen views.
4 View south from Pacific Highway FIGURE 62	Minor significance to Pacific Highway travellers.	The existing Moonee truck loading bin is visible.	Small portion of facilities visible in background of the view on ridge - Significant impact.	Not Visible screened by ridgeline to the north.	Not Visible screened by ridgeline to the north.	Not Visible screened by Catherine Hill Creek Valley and ridglines.
5 View from Bongon Lookout, Munmorah State Recreation Area FIGURE 63	Significant to regional tourists.	The existing Moonee truck bin and stockpiles are prominent in the middleground of the view. Stage 1 plant will also be visible.	Small portions of coal stockpiles conveyors, screen house & prep. plant visible in middle ground: - Minor Impact Emergency stockpile prominent: - Intermittent impacts.	Visible behind Moonee Creek valley: - Significant impact before revegetation, - Long term minor impact.	Not visible in this view.	Prominent in middle ground of view: - Significant impact before revegetation - Long term minor impact.
6 View from Bongon Lookout (telephoto 210mm) FIGURE 64	Enlargement of view of signficance to regional tourists.	The Moonee truck loading bin, transfer station, coal stockpiles, road networks and cottages may be seen.	Buildings and stockpiles break horizon line in middle ground view: - Long term additional adverse impact.	Not shown in photograph but would be partially visible in view.	Not shown in photograph but may be partially visible.	Not shown in photograph but would be visible in middleground of view.
7 First view of water north from Pacific Highway FIGURE 65	Significant to Pacific Highway travellers.	The existing Moonee truck bin and the clearing for the exist-ing stockpile area are visible. Stage 1 facil-ities will be visible.	Most facilities visible in middle ground of view Emergency stockpile prominent when used: - Significant impact.	Not visible, screened by ridgeline and vegetation in foreground.	Not visible view blocked by ridgeline.	Not visible, screened by vegetation in foreground.
8 Lateral view from Pacific Highway FIGURE 66	Minor significance to Pacific Highway travellers.	Only the cleared ease-ment and the truck loading bin on the head-land in the middle ground of the view are visible. Stage 1 facilities will be visible.	The Conveyors, the surge stockpile, the screen house & prep plant are visible in existing clearing for the easement: - Minor additional Impact.	Substantial clearing in foreground of view: - Significant impact before revegetation. Impact reduced in the long term dependant on the success of revegetation.	Water and wall partially visible - Minor impact.	Not Visible, view blocked by ridgeline to the south.



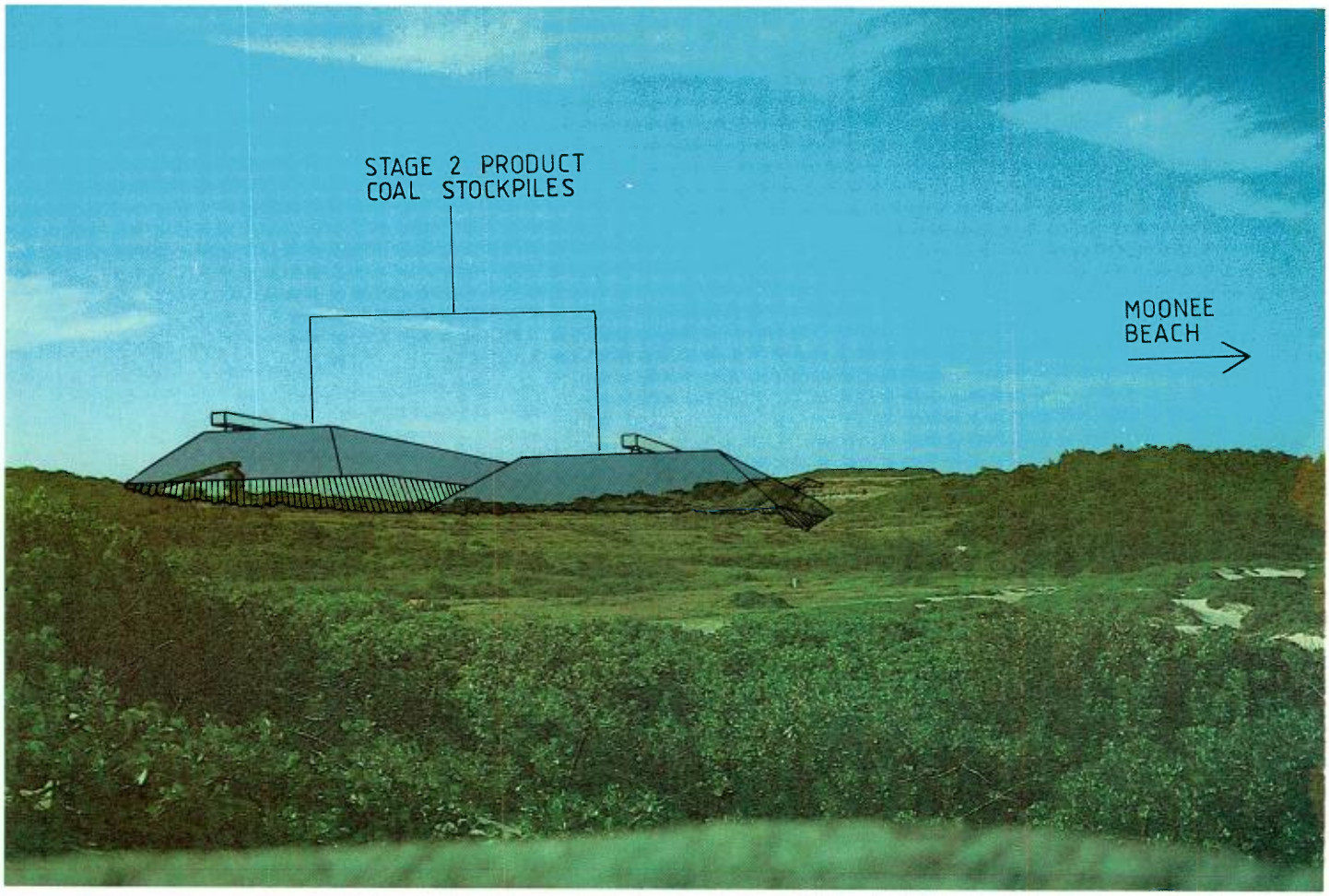
PHOTOMONTAGE OF PROPOSED DEVELOPMENT FROM CATHERINE HILL BAY VILLAGE

FIGURE 59

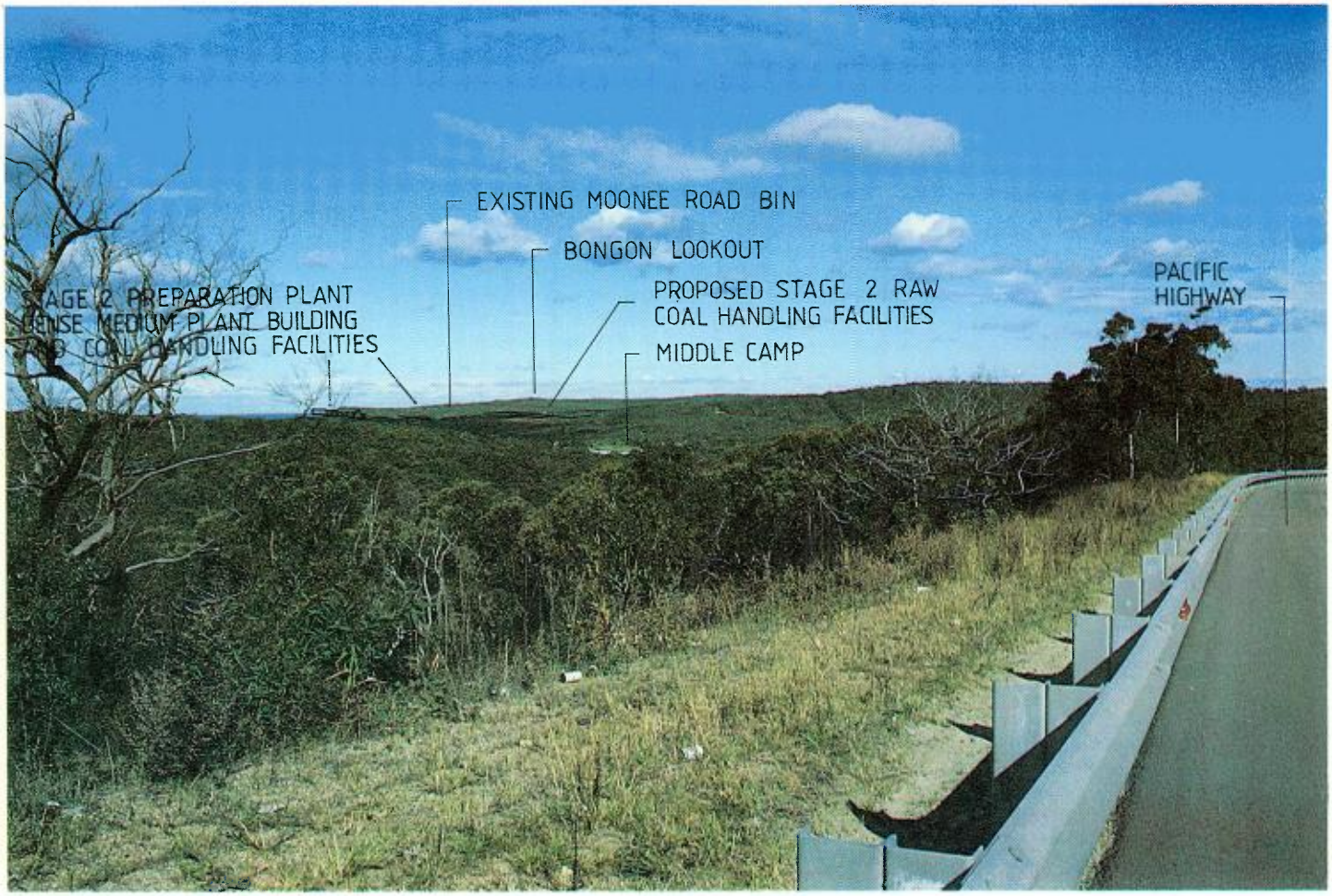


PHOTOMONTAGE OF PROPOSED DEVELOPMENT FROM CATHERINE HILL BAY BEACH

FIGURE 60

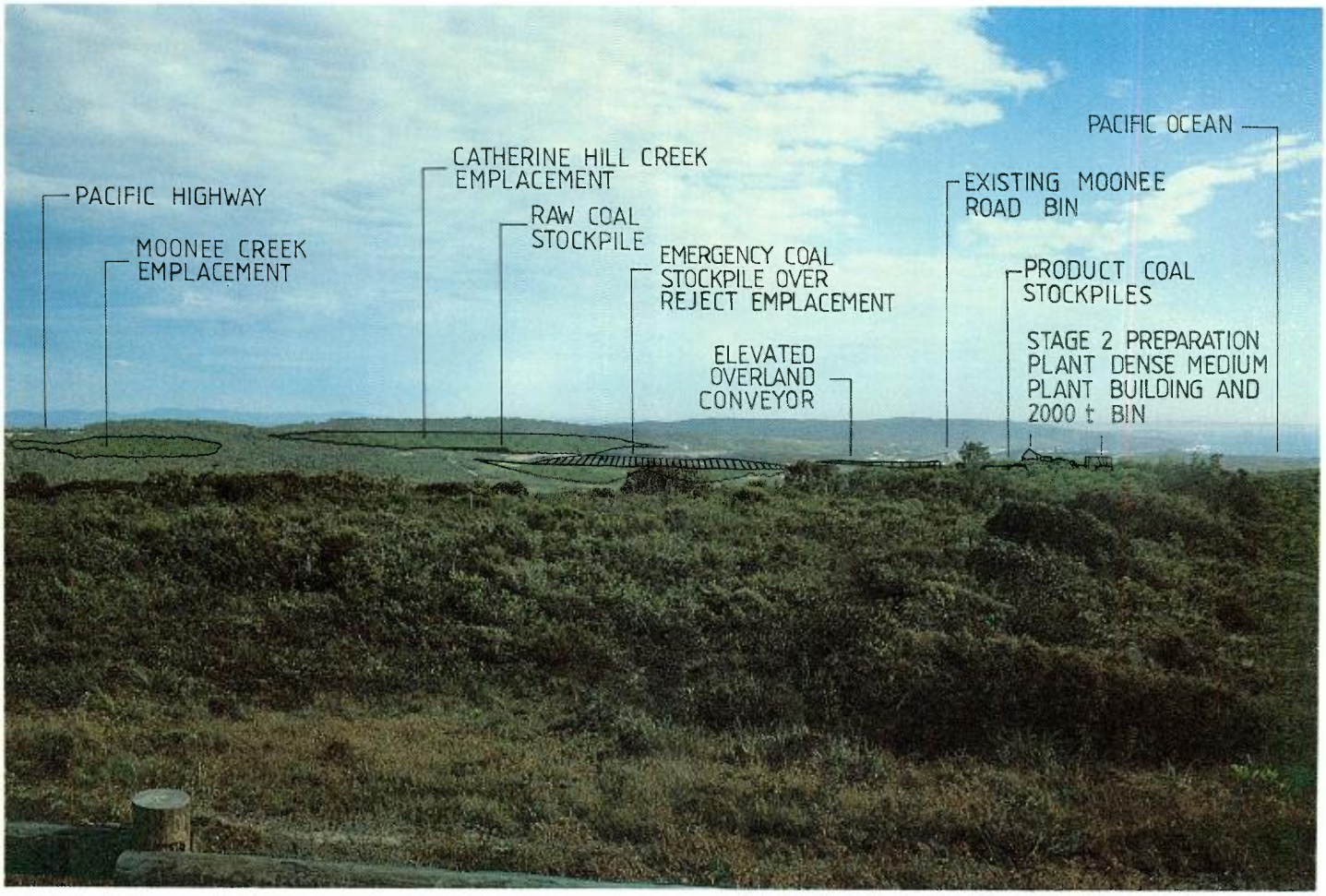


PHOTOMONTAGE OF PROPOSED
DEVELOPMENT FROM MOONEE BEACH FIGURE 61



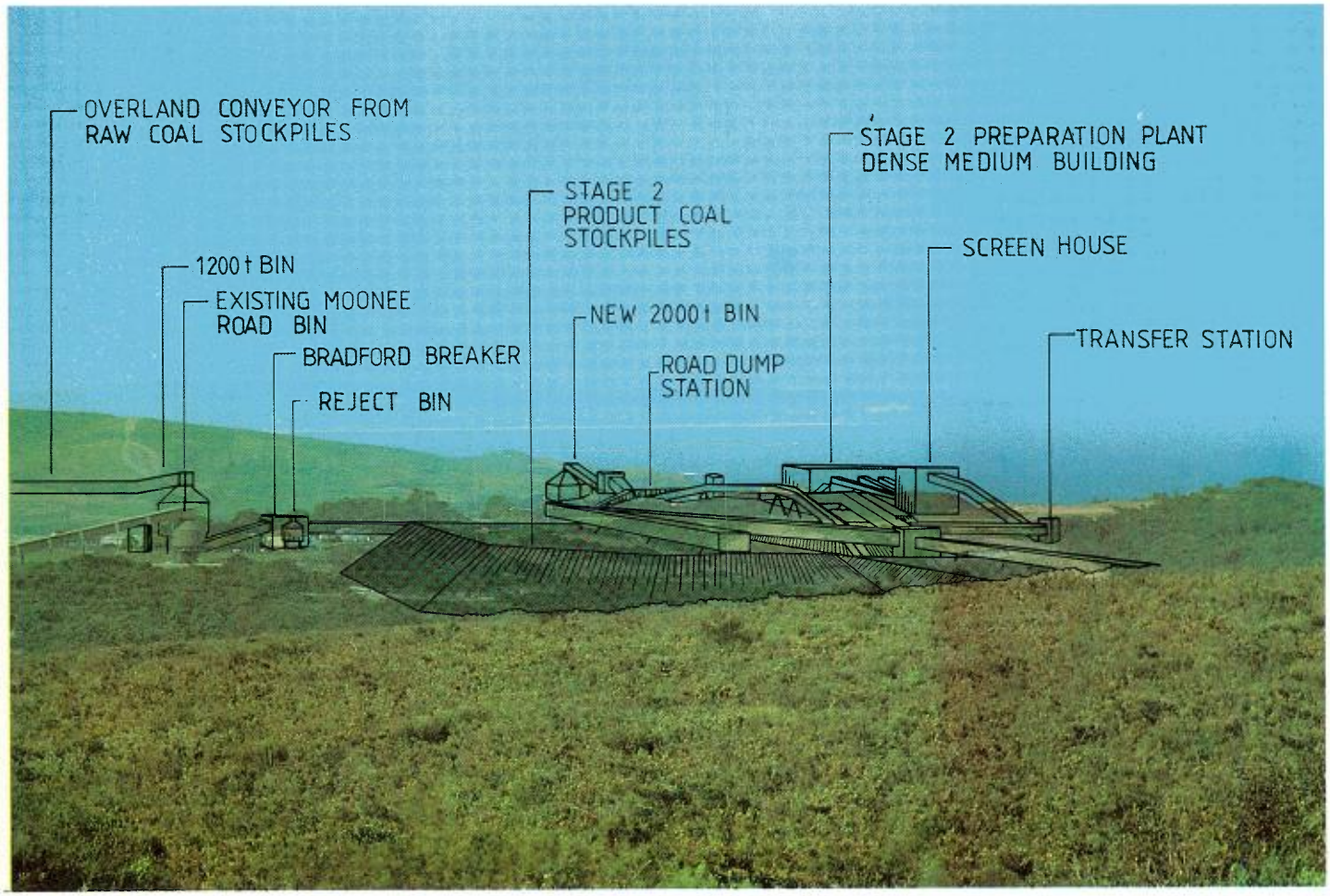
PHOTOMONTAGE OF PROPOSED DEVELOPMENT FROM PACIFIC HIGHWAY LOOKING SOUTH

FIGURE 62



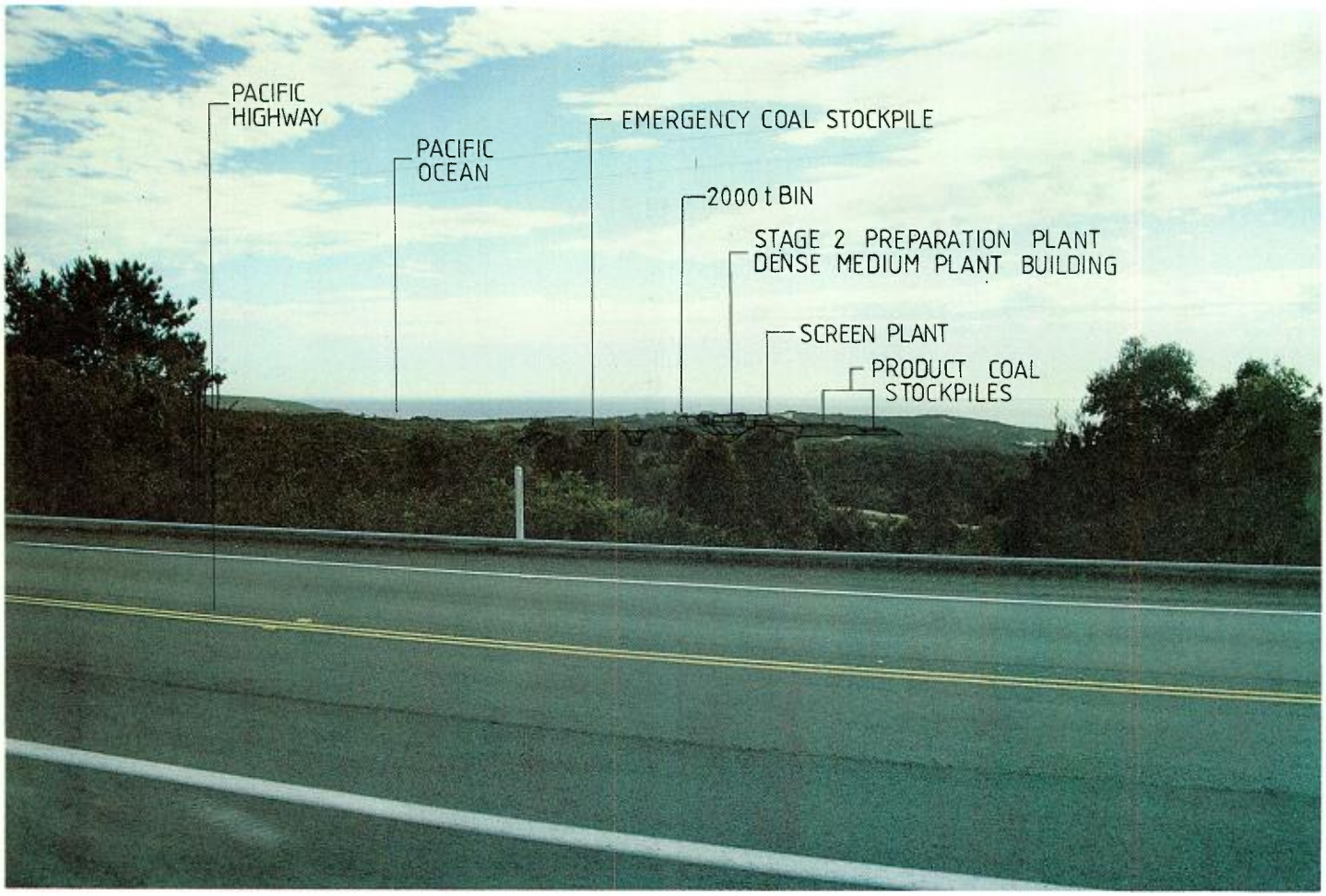
PHOTOMONTAGE OF PROPOSED DEVELOPMENT FROM BONGON LOOKOUT – MUNMORAH STATE RECREATION AREA

FIGURE 63



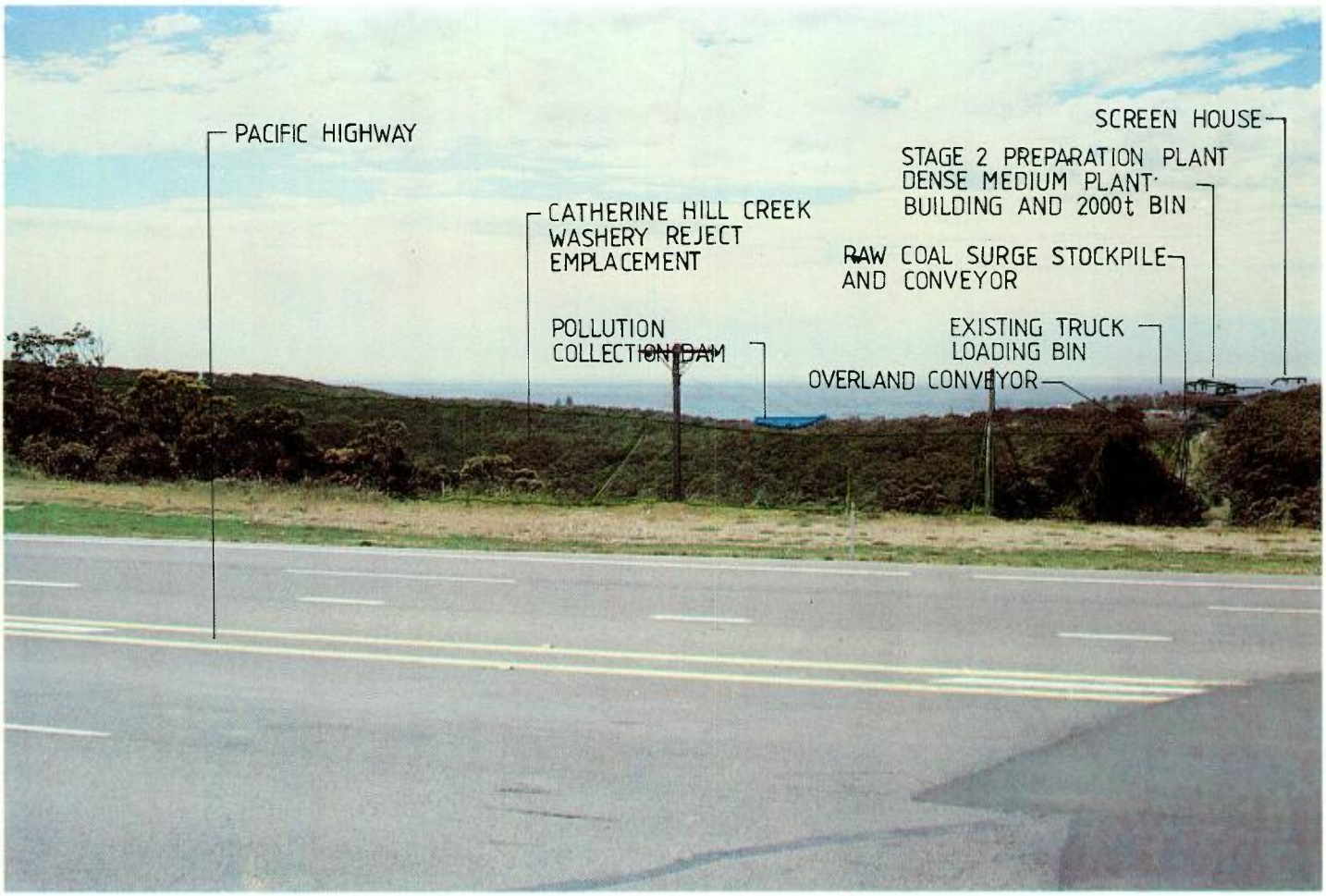
TELEPHOTO PHOTOMONTAGE OF PROPOSED DEVELOPMENT FROM MUNMORAH STATE RECREATION AREA

FIGURE 64



PHOTOMONTAGE OF PROPOSED DEVELOPMENT FROM PACIFIC HIGHWAY LOOKING NORTH-EAST

FIGURE 65



PHOTOMONTAGE OF PROPOSED DEVELOPMENT FROM PACIFIC HIGHWAY ADJACENT TO CATHERINE HILL CREEK VALLEY

FIGURE 66

12.8 Fauna

The establishment of the coal washery reject emplacements will result in the loss of a relatively large area of natural bushland. As a consequence there will be some loss of faunal species from these areas and the loss of the habitats over the sites.

Movement from an area of disturbance will be possible for most species, particularly as the coal washery reject emplacement areas are established gradually by sequential development. However, there is no evidence of the successful re-establishment of displaced animals within new areas. The limited number of behavioural and ecological studies available tend to support the conclusion that few displaced species survive e.g. Ewer, 1973, Tyndale-Biscoe and Calaby, 1975.

The loss of the species found within the emplacement areas will have no effect upon the overall status of these animals within the region. All fauna located can be considered as common and widespread throughout the region and are well represented in nearby conservation areas e.g. Munmorah State Recreation Area and Awabakal Nature Reserve. Some of the habitats have the potential to support other species that may require some form of protection. However the condition of most areas of habitat within the emplacement areas indicates a history of human impact that may have already resulted in these habitats not being as attractive to fauna as those found elsewhere.

The wet heath found to the south of the proposed development is considered an important habitat for fauna. A brief survey undertaken in this area located several species not found in the Catherine Hill Creek survey area and the general condition of the habitat was considered good. Retention of this area, as proposed, and acquisition by the Government under the Coastal Lands Acquisition Policy, as agreed between the Company and the Government, will safeguard a valuable environmental area and provide an important addition to the adjoining Munmorah State Recreation Area.

The timbered area to the west of the Pacific Highway is essentially the same as the woodland habitat to the east. A brief survey did not reveal any fauna or habitat that is not well conserved elsewhere. The land surrounding Catherine Hill Bay village was not considered of high faunal conservation value.

The construction of the overland coal conveyer could have the potential to disrupt wildlife movement. Disruption could occur from direct collision with the above ground conveyer or by the clearing of vegetation. As the route will closely follow the existing transmission line there should be no significant impact from the conveyer upon wildlife movement.

The construction of the coal washery reject emplacement within the Catherine Hill Creek valley could disrupt the north-south and east-west movement by wildlife. Movement to and from the north and Munmorah State Recreation Area may be halted by the Catherine Hill Creek reject emplacement areas. However, sufficient woodland and heath habitat will be retained to the east and west of the reject emplacement to allow movement to continue, particularly as development and clearing will be progressive. Construction of the Pollution Collection Dam downstream of the emplacement will be an important mitigation measure to prevent pollution along the small stream and consequent adverse effects on the littoral and marine environment of Catherine Hill Bay.

Movement by animals to and from Lake Macquarie and Catherine Hill Bay has already been restricted by the construction of the four lane Pacific Highway. The Catherine Hill Creek emplacement will do little to further restrict movement.

12.9 Transport and Traffic

At present coal trucks must transport raw coal from Wallarah Colliery via the Pacific Highway to the Coal Preparation Plant at Catherine Hill Bay. As the Pacific Highway has been improved there has been an increasing trend for traffic to proceed at higher speed. This is in contrast with the movement of trucks laden with coal. Although turning lanes are provided, there remains a conflict of road usage.

An integral part of the Stage 2 development proposal is to construct an overland conveyer from Wallarah Colliery to Catherine Hill Bay, which will remove between 630 and 770 coal truck **movements** off the Highway. This will be a major advantage. If the overland conveyer from Wallarah should **not** be built, coal truck traffic for the increased output of 1,500,000 tpa raw coal would increase by an average of 320 **movements** to 950 **movements** per day.

Chain Valley Colliery will generate up to 360 truck **movements** per day (average 320) transporting raw coal to the Catherine Hill Bay Coal Preparation plant. This will be an increase of about 44 truck **movements** per day on average compared to current usage, which will be a small number of movements compared to the estimated 16,400 vehicle movements per day currently on the Pacific Highway at this point.

Thus, the proposed Stage 2 developments to increase the capacity of the Coal Preparation Plant from 2,500,000 tpa to 5,000,000 tpa will decrease the number of truckloads of coal transported on the Pacific Highway substantially, as the majority of the coal will be handled by conveyers.

The number of truckloads of coal washery reject from the Coal Preparation Plant will increase from approximately 50 truckloads per day to about 90 - 100 truckloads per day for the Stage 1 Coal Preparation Plant throughput of 2,500,000 tpa. This will occur on a 24 hour basis, but only on local roads adjacent to the Coal Preparation Plant. For the Stage 2 : 5,000,000 tpa development, tailings reject will normally be pumped to the coal washery reject emplacement as a slurry. In this case, there will be about 260-280 truck loads per day of coarse (solid) coal washery reject transported to the emplacement. If all tailings should be mechanically dewatered, then the total for both coarse and dewatered tailings 'cake' would be about 360-380 truck loads per day.

This increase in trucking, directly related to reject handling, is an adverse impact of the development on the local environment, which is offset by the decrease in truck transport of coal from the 250 tonne Moonee Road Bin. This reduction will be an initial average of 153 truck loads (306 truck movements) per day for the Stage 2 : 3,600,000 tpa development to the present average 100 truck loads per day and subsequently 253 truck loads (506 truck movements) for the Stage 2 : 5,000,000 tpa development.

12.10 Land Use and Planning Considerations

The proposed coal handling, coal stockpiling, coal washery reject emplacement and dam components of the Catherine Hill Bay Coal Preparation Plant Stage 2 development conflict with existing environmental protection zoning over the Company's freehold land. The proposed developments are a transient land use, which will only exist until the Company's coal leases are worked out. When this occurs, the coal processing facilities will be dismantled and removed.

As discussed in Section 4.4, the reason why the coastal land at Catherine Hill Bay has not been cleared and developed is because it was acquired by the coal mining company to prevent sterilisation of valuable coal reserves. Coal mining activities are well established at Catherine Hill Bay and the proposed development is an extension and expansion of this activity.

It is considered that Government objectives to retain the open space separation of development in Wyong Shire and the City of Lake Macquarie, as set out in the Hunter Regional Environmental Plant No. 1 (Ref 4.) will not be compromised by this development. Moreover the fragile coastal wetlands in the Company's freehold land in Wyong Shire will remain intact and unaffected - a situation which would most probably not be the case if the land had been in other ownership. The agreement between the Company and the N.S.W. State Government for this land to come into public ownership, and form an extension to the Munmorah State Recreation Area, will reinforce planning objectives in this area, as well as safeguarding a fragile ecosystem and being a benefit to the community.

The proposed development will result in progressive clearing of coastal land, with subsequent progressive revegetation. It will also result in construction of coal handling equipment which will be removed when the coal leases are worked out. When this occurs, the land will revert to coastal open space in accordance with Government objectives.

During the transient life of the development, additional jobs and substantial export earnings will result, with important benefits to the community at large. This is recognised as an expected development in the Hunter Regional Environmental Plan and as an important contribution to the regional economy.

The proposed development is considered to have a positive impact because it will maintain employment in the coal mining industry, which is historically tied to the Catherine Hill Bay area, and will increase both direct and indirect job opportunities in an area where employment is restricted. This is important in a region like Wyong Shire and the City of Lake Macquarie, where current unemployment levels are high. In Wyong, unemployment in June 1986 was estimated as 18% (some 5,300 people). Unemployment in the city of Lake Macquarie although estimated to be lower than in Wyong Shire is still above 10%. This development, in both the construction and operational phases, will provide new job opportunities in both local government areas.

12.11 Social and Economic Conditions

At present Coal & Allied employ about 750 people (directly) in the area and must improve their coal preparation facilities in order to remain competitive in the export market. The Stage 1 development will increase this employment to approximately 850 people and this Stage 2 development will progressively increase employment to about 1,250 people. This development is necessary for the Company to maintain and progressively increase their current (direct) employment levels. Failure to proceed with the development will lead to a reduction in employment.

The development will enable increased production with consequent additional export earnings and will strengthen the regional economic base.

The proposed emplacements in Catherine Hill Creek and Moonee Creek valleys have a combined capacity of approximately 10,300,000 m^3. This will provide the Company with adequate disposal capacity for the coal washery reject to be generated by the Catherine Hill Bay Coal Preparation Plant for an estimated 22 years of operations.

12.12 Energy Statement and Electricity Demand

The development proposals will substantially increase the amount of coal produced and available as a source of energy. Most will be exported as 'steaming coal'.

The new 66 kV transmission line and supply direct from the Munmorah Zone Substation (in the Sydney County Council area) together with the new substation at Catherine Hill Bay will make a 10 MVA supply available. This is estimated to be adequate for the full Stage 2 development, including the new mine developments to produce the extra coal to be processed.

The increase in mine output and power demand in the Coal Preparation Plant and materials handling facilities will not otherwise affect the regional electrical supply network.

Because the coal will be transported away from Catherine Hill Bay by coastal collier, there will be no additional energy requirement for road or rail transport.

The proposed development will not sterilise any coal resources.

13.0 PREPARATION OF ENVIRONMENTAL IMPACT STATEMENT, STUDY TEAM AND ACKNOWLEDGEMENTS

The preparation of this Environmental Impact Statement for the proposed expansion of the Catherine Hill Bay Coal Preparation Plant and associated works has been undertaken by Johnstone Environmental Technology Pty. Limited and associated consultants in conjunction with Longworth & McKenzie Pty. Limited.

The principal members of the study team were:

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The study team wish to acknowledge the helpful discussions held with the following organisations:

Department of Environment and Planning

State Pollution Control Commission

Department of Main Roads

Lake Macquarie City Council

Wyong Shire Council

National Parks and Wildlife Service

Electricity Commission of N.S.W.

Department of Mineral Resources

Heritage Council (N.S.W.)

National Trust of N.S.W.

Telecom Australia

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