EIS 467

AB019128

Namoi Valley Coal Project : environmental impact statement

NSW DEPT PRIMARY INDUSTRIES
AB019128

VICKERY JOINT VENTURE

ENVIRONMENTAL IMPACT STATEMENT

NAMOI VALLEY COAL PROJECT

EIS
467

FEBRUARY 1986

467

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VICKERY JOINT VENTURE

ENVIRONMENTAL IMPACT STATEMENT

N.S.W. DEPARTMENT OF
MINERAL RESOURCES
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NAMOI VALLEY COAL PROJECT

FEBRUARY 1986

FORM 4

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

ENVIRONMENTAL IMPACT STATEMENT

This Statement has been prepared by or on behalf of Vickery Joint Venture, being the applicant making the development application referred to below.

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

. Vickery Joint Venture, Namoi Valley Coal Project, Development of an Underground Coal Mine and Associated Transport Activity in the Namoi Valley.

The development application relates to the land described as follows:

. Authorisation Number 151 and Authorisation Number 157.

. Parts of Blue Vale Road, Torrens Road, Boston Street Bridge Road, and associated Travelling Stock Routes. C&W Reserve No. 25858.

. Portions 111, 112, 113, 471, 472, 473, 474, 475, and part 445 Parish of Gunnedah, County of Pottinger.

. The Crown Road passing through Portion 157, separating Portion 157 from Portion 6 and extending north to the existing Blue Vale Road within the Parish of Burburgate and County of Nandewar.

. Portion 7, 32, and 40 - Parish of Brentry, County of Nandewar.

. Portion 17 - Parish of Vickery, County of Nandewar

. Portion 133 - Parish of Boggabri, County of Nandewar

. All within the Land District of Gunnedah.

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

Name, Qualifications and address of person who prepared Environmental Impact Statement: David Olsen B.Agr.Sci. (Hons)
9 Anderson Place
GUNNEDAH NSW 2380

CERTIFICATE: I, David Olsen of the Vickery Joint Venture hereby certify that I have prepared the contents of this Statement in accordance with Clause 34 and 35 of the Environmental Planning and Assessment Regulation, 1980.

David Olsen

Signature

14th January, 1986

Date

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ABBREVIATIONS

ABS	Australian Bureau of Census and Statistics
ACA	Australian Coal Association
A151	Authorisation Number 151
A157	Authorisation Number 157
CBR	Californian Bearing Ratio
CCC	The Coal Cliff Collieries Pty. Limited
CTC	Central Traffic Control
CES	Commonwealth Employment Service
dB(A)	A weighted decibel
EIS	Environmental Impact Statement
g/m^2month	grammes per square metre per month
J	Joule
km	kilometre
km^2	square kilometre
km/h	kilometres per hour
kV	kilovolt
KCC	Kembla Coal & Coke Pty. Limited
l	litre
l/s	litres per second
$L_{A0.1}$	Maximum noise level
L_{A90}	The A weighted sound level exceeded 90% of the time
$L_{Aeq}24$	Equivalent continuous 24 hour noise level
LEP	Local Environmental Plan
MJ/kg	Megajoules per kilogram
me/l	milliequivalents per litre
m	metre
m^3	cubic metre
m^3/s	cubic metres per second
mm	millimetre
m/s	metres per second
10^6m^3	million cubic metres
mg/l	milligrammes per litre
Ml	Megalitre
Ml/day	Megalitres per day
mS/cm	microSiemens per centimetre
$M/annum	Millions of dollars per year
Mt	million tonne
Mtpa	million tonne per annum
ppm	parts per million
ROM	run-of-mine
SPCC	State Pollution Control Commission
t	tonne
tpa	tonnes per annum
tph	tonnes per hour
TAFE	Department of Technical and Further Education
TDS	Total Dissolved Solids
TR72	Trunk Road 72
VJV	Vickery Joint Venture
WVK	West Vickery

SECTION 1

SUMMARY

1.0 SUMMARY

This Environmental Impact Statement (EIS) supports a Development Application submitted to Gunnedah and Narrabri Shire Councils.

The Development Application covers a proposal to mine and transport coal from the Namoi Valley in northwestern New South Wales.

Initially a small underground coal mine is proposed. Eventually a larger underground coal mine will be developed. Three small conventional and experimental opencut coal mines are developed in the early years of the Project. Underground production would provide 96% of the total output in the first 21 years of the Project.

The maximum annual production is 1.94 Mtpa of washed low ash coal. Washery waste is disposed of in tailings ponds and rejects disposal areas at the Mine.

Remaining coal reserves have not been sterilised and will be developed by underground and opencut methods as technology and markets permit.

Coal will be transferred from the Mine to a Train Loader by 25 t coal haulage trucks. The existing Blue Vale Road will be upgraded to accommodate coal haulage vehicles. A new bridge over the Namoi River and an overpass at Trunk Road 72 will be built to provide direct access from the Mine to the Train Loader.

Haulage will occur 24 hours per day, five days per week. Some Saturday operations will be required to meet train and ship schedules and to overcome operational difficulties caused by breakdown, floods, or industrial matters. Coal haulage and three small opencuts will be operated under contract.

The Train Loader will be built adjacent to the North Western Rail Line, 3 km northwest of Gunnedah. A balloon loop will provide train access to the Loader. The Loader will consist of two parallel 100,000 t capacity coal stockpiles serviced by a central mobile bucket wheel stacker/reclaimer. Trains will be loaded through a bin constructed over the balloon loop.

At maximum production, the Project will provide 186 new mining jobs. It is predicted that 137 of these will be filled by people already in the area. Due to the high local employment component, and existing unemployment and infrastructure conditions in the region, no adverse socio-economic impacts are expected.

Environmental impacts representing a worst case situation have been used throughout this document as the basis for discussions. These impacts have been identified and ameliorative measures described.

SECTION 2

PROJECT OBJECTIVES AND THE APPROVAL PROCESS

2.1 VICKERY JOINT VENTURE OWNERSHIP STRUCTURE

The ownership structure is shown in Figure 2.1.

The Joint Venturers are Kembla Coal & Coke Pty. Limited (KCC) through its wholly owned subsidiary, The Coal Cliff Collieries Pty. Limited (CCC) (80%) and Vickery Coal Pty. Limited (20%).

2.2 PROJECT OBJECTIVE

The Vickery Joint Venture (VJV) objective is to design, construct and operate a commercially viable and environmentally acceptable coal mining project. The operation will produce premium quality coal products suitable for many applications including:

- All combustion processes
- Pulverised coal injection
- Direct reduction processes
- Coke blend component
- Briquetting
- Liquefaction
- Coal Water Mixtures.

The project described in this Environmental Impact Statement (EIS) is primarily an underground coal mining development. Three small experimental opencut coal mines are also described. These opencut coal mines will field test conventional and innovative overburden handling techniques. The techniques will need to prove successful if present subeconomic Vickery opencut coal reserves and the remainder of the underground reserves are to be developed commercially by opencut methods. The future development of the opencut reserves and the remainder of underground reserves would be addressed in a separate EIS and development application.

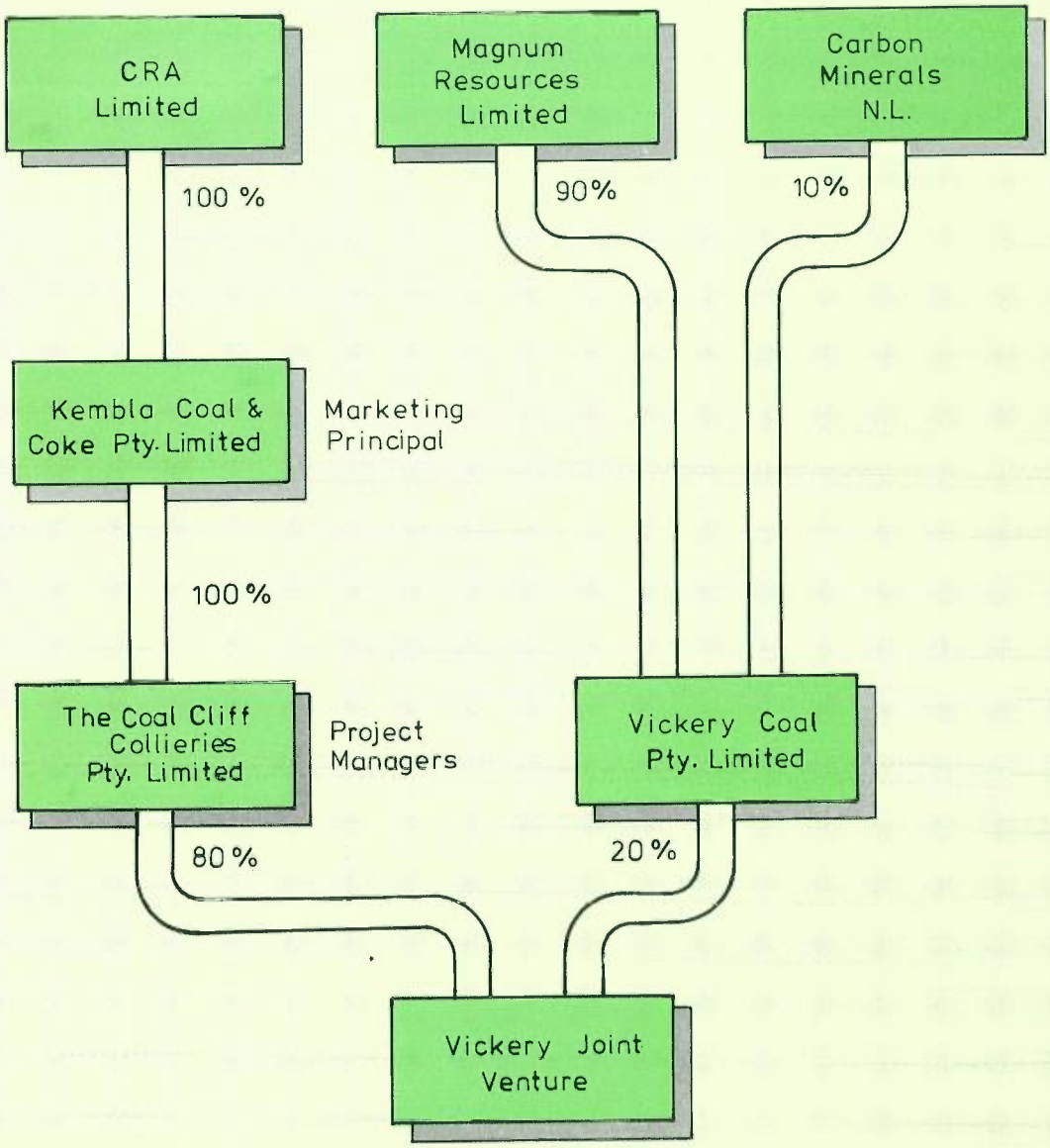
A successful Vickery Project will enable KCC to deliver high quality Namoi Valley coal products to the international market. Future growth of the Namoi Valley as an international coal source would be greatly assisted by a successful Vickery Project.

2.3 ENVIRONMENTAL IMPACT STATEMENT OBJECTIVES

This EIS was prepared with the following objectives:

- To describe the design and operation of a commercial and environmentally sound underground coal mining operation near Gunnedah in northwestern NSW.

  To describe three small opencut mines based on conventional and innovative overburden handling systems that could enable future development of subeconomic opencut coal reserves.



VICKERY JOINT VENTURE

THE COAL CLIFF COLLIERIES PTY LTD PROJECT MANAGERS

OWNERSHIP STRUCTURE

FIGURE 2.1

2.3 ENVIRONMENTAL IMPACT STATEMENT OBJECTIVES (Cont)

- To describe the existing environment of the Project.
- To identify the environmental impacts of the proposed Project.
- To describe means of mitigating and managing the environmental effects of the Project.
- To obtain Development Consent for the Project.

2.4 ENVIRONMENTAL LEGISLATION

This EIS was prepared and submitted to the NSW and Federal Governments to satisfy requirements of the Legislation described in this section.

2.4.1 Federal Legislation

Commonwealth Government approval will be required for the export of coal under the Customs (Prohibited Exports) Regulations. The Minister responsible for export control is the Minister for Trade.

The Department of Arts, Heritage and Environment has decided that the Vickery Project is within the scope of the Environment Protection (Impact of Proposals) Act 1974. An environmental assessment will be undertaken by the Department, in accordance with the requirements of the Administrative Procedures under this Act. The Minister for Trade has designated KCC as a proponent in respect to these Procedures.

Administrative arrangements have been agreed between the Commonwealth and NSW Governments to enable co-ordinated public review and assessment of projects which require both Commonwealth and State approvals.

Under these arrangements, this EIS meets the requirements of both Governments. Under the Environment Protection (Impact of Proposals) Act, public submissions are forwarded to the proponent, who is required to take them into account and prepare a final environmental document. On the basis of this document, the Minister for Arts, Heritage and Environment makes recommendations on the proposals to the Minister for Trade. A favourable recommendation allows the Minister for Trade to approve coal exports.

2.4.2 State Legislation

2.4.2.1 Development Consent

The NSW Environmental Planning and Assessment Act, 1979 and associated Regulation, 1980, provide the basis for development control in NSW. The activities associated with the proposed Project require development consent under the legislation. As this Project is classified as Designated Development, the Development Application must be accompanied by an EIS.

The Development Application was submitted to Gunnedah and Narrabri Shire Councils, which are the relevant Local Government Authorities. These Councils must forward a copy of the application and EIS to the Department of Environment and Planning. The Application and EIS are advertised and placed on public display. Public submissions received by the Council are sent to the Department.

All proposals for coal mining development are covered by a direction from the Minister under Section 101 of the Act. This direction requires Councils to refer the application to the Secretary of the Department of Environment and Planning for determination by the Minister.

Following assessment of the EIS and consideration of public and Government submissions, the Department then prepares an Assessment Report. The consent authority, in this case the Minister, must consider this Report in determining the application.

2.4.2.2 Coal Lease

The Minister for Mineral Resources and Energy has the responsibility for granting the Coal Lease. The Department of Mineral Resources administers the Coal Mining Act, 1973.

Exploration for coal in the Vickery Area has been carried out within Authorisations 151 and 157 (A151 and A157). Where the Minister for Mineral Resources and Energy has granted Authorisation titles under Section 20 of the Coal Mining Act, 1973, the Coal Lease is acquired by Ministerial invitation. The intention to issue this invitation in respect to A157 has been published in the NSW Government Gazette. Coal Lease Application No. 2 has been lodged over A151. Coal Leases are granted for 21 years and provision for renewal of these titles is contained in the Coal Mining Act, 1973.

2.4.2.3 Joint Coal Board Approval

The VJV will need to obtain Joint Coal Board approval under Order 27. This Order gives the Joint Venture approval to open a coal mine.

2.4.2.4 State Pollution Control Commission Approvals and Licences

If development consent is granted, it is necessary to submit applications to the NSW State Pollution Control Commission for approvals to construct and licences to operate the Project. Approvals to construct are required under the Clean Air Act, 1961, Clean Waters Act, 1970 and Noise Control Act, 1975. Annual licences to operate are required for the first two Acts. An annual Licence to operate will soon be required under the Noise Control Act, 1975.

2.5 ANALYSIS OF NEED FOR THE PROJECT

2.5.1 Corporate Policy

KCC corporate policy is to develop and operate coal mines in NSW. KCC has had a long association with coal and coke production in the Illawarra Region and proposes to selectively expand its coal operations in NSW.

The Vickery Project will enable the KCC group to be responsible for the management of a larger coal resource consisting of a wider variety of coal types.

Vickery will contribute a high quality low ash coal to KCC's export products. This will enhance the likelihood of continued coal operations for the KCC group.

Continuity of operation is important to KCC for:

- Maintenance of long term corporate economic viability,
- Establishing new and diversified marketing opportunities,
- Establishing new employment opportunities by growth within the KCC group.

2.5.2 Export Marketing

KCC has operated coal mines in NSW since 1954. It has built a respected corporate image and has established itself as a competent and reliable exporter of coal to world markets. Twelve countries are presently importing KCC coal products.

KCC has recognised the marketing opportunities available for premium grade coals in both energy and metallurgical applications. Vickery coal is high in energy and low in ash, sulphur and other deleterious elements. It is suitable for a wide range of existing and developing uses.

Most countries and corporations maintain a diversified energy and raw material supply policy. These policies and an increase in world energy consumption will ensure a steady growth in coal demand.

Vickery coal will capture new and additional markets for NSW.

The high energy, low ash properties of Vickery coal will have a strong appeal in developing markets such as:

- pulverised coal injection into blast furnaces,
- coal water mixture applications.

It will appeal to buyers operating heat generating and steam raising equipment and will be sought as a component for coke making. As a result of its properties, transport costs per unit of energy are optimised, giving Vickery coal an advantage in any application where transport charges are a high percentage of delivery cost.

In order to assess market response to Vickery premium coal, KCC, through the VJV, is presently operating an underground sampling operation on A157, at Red Hill, to test marketability, mining conditions, and infrastructure capabilities.

Samples have been taken by a wide range of coal users and delivery commitments are running well ahead of sample production. Several opportunities have arisen to secure long term contracts for coal sales and these are the commercial basis for the proposed development.

As a result of the favourable response, the VJV is seeking consent to open a long term coal mining operation to service their developing markets. Mining experience at Red Hill has greatly assisted mine planning for the proposed development. With appropriate upgrading of the Blue Vale Road and construction of a train loader, existing infrastructure will be capable of handling the maximum output of 1.94 Mtpa saleable coal production.

2.5.2 Export Marketing (Cont)

The outlook for Australian coal exports has been forecast by the Australian Coal Association (ACA).*

The International steaming coal export trade is predicted to increase by approximately 60 Mtpa between 1985 and 1990. The ACA predicts Australian steaming coal exports will increase by 18 Mtpa, from the existing 27 Mtpa to 45 Mtpa over the same five year period.

Existing steaming coal capacity in NSW and Queensland is estimated at 75 Mtpa. The demand for domestic and export steaming coal in 1985 is 61 Mtpa. Present capacity exceeds demand, however with growth in demand estimated by the ACA at 7-8% per annum, additional steaming coal capacity will be needed before 1990.

Predictions for expansion of demand for coking coal varies considerably, depending on the future mix of semi-soft, soft, and hard coking coal types used in the world's steel industries.

2.5.3 National Benefit Derived from the Project

Coal exports are a very important contributor in Australia's trade balance and Current Account. A new export orientated Project will contribute to a better balance in the level of national foreign debt. A continuing unfavourable trade balance will jeopardise importation of goods required by the community for national growth and maintenance of living standards. Additional exports provide tax revenue for the Federal Government and provide a trade base for international relations. The latter is particularly important for Australia's future involvement in the Pacific area.

A number of benefits will accrue at both State and Local levels. Considerable revenue is generated by State taxes, royalties and up-front payments, all of which benefit a Statewide community. Similarly, decentralisation of industry and improved utilisation of rail and port facilities has long term benefits for the community.

KCC believes the Project is strategically beneficial in achieving its corporate objectives. At the same time, it provides benefits at International, National, State and Local levels.

The Project represents a significant capital investment with approximately 85% of expenditure occurring in Australia. This expenditure will benefit Australian industry and the community.

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* Industry Overview, May 1985. The Australian Coal Association.

SECTION 3

PROJECT DESCRIPTION

3.1 PROJECT AREA

The proposed Vickery Project is located approximately 22 km north-north west of Gunnedah, and 18 km east-south east of Boggabri. Gunnedah is 318 km northwest by rail from Port Newcastle. The Project Area is situated immediately east of the Namoi River (Refer Figure 3.1).

The Project Area adjoins the alluvial black soil plains of the Namoi Valley to the south, north and north-west. The eastern border of the site is characterised by less fertile, shallow soils grading into the infertile soils of the Kelvin State Forest.

Approximately one third of the Project Area is covered by the Vickery State Forest which will be unaffected by mining, except for surface subsidence. The remainder is characterised by mixed grazing and farming country.

No mining facilities, mining activities, or train loading occur within the 100 year flood levels of the Namoi River. However, parts of the coal haulage road are subject to flooding.

3.2 COAL EXPLORATION HISTORY

The original tenement held by Sunshine Gold Pty. Limited (now Vickery Coal Pty. Limited) was Exploration Licence 209. This was located to the east and southeast of Boggabri. Following enactment of the Coal Mining Act, 1973, the Company applied for a twelve (12) block Reward Area. The Reward Area became, first Authorisation 76 and later, Authorisation 151 (A151). A Coal Lease Application over A151 was submitted in October 1974 and is still pending. In July 1979, an additional area adjoining the western boundary of A151 was granted. This was Authorisation 157 (A157). A151 has an area of 36 km^2 (12 blocks), while A157 has an area of 12 km^2 (4 blocks) (Refer Figure 3.1).

There have been four major phases of exploration activity within these Authorisations.

Sunshine Gold Pty. Limited drilled ten boreholes in A151 and two in A157.

Further exploration occurred under a Joint Venture agreement with AMAX Exploration (Australia) Corporation. Forty boreholes were drilled within A151.

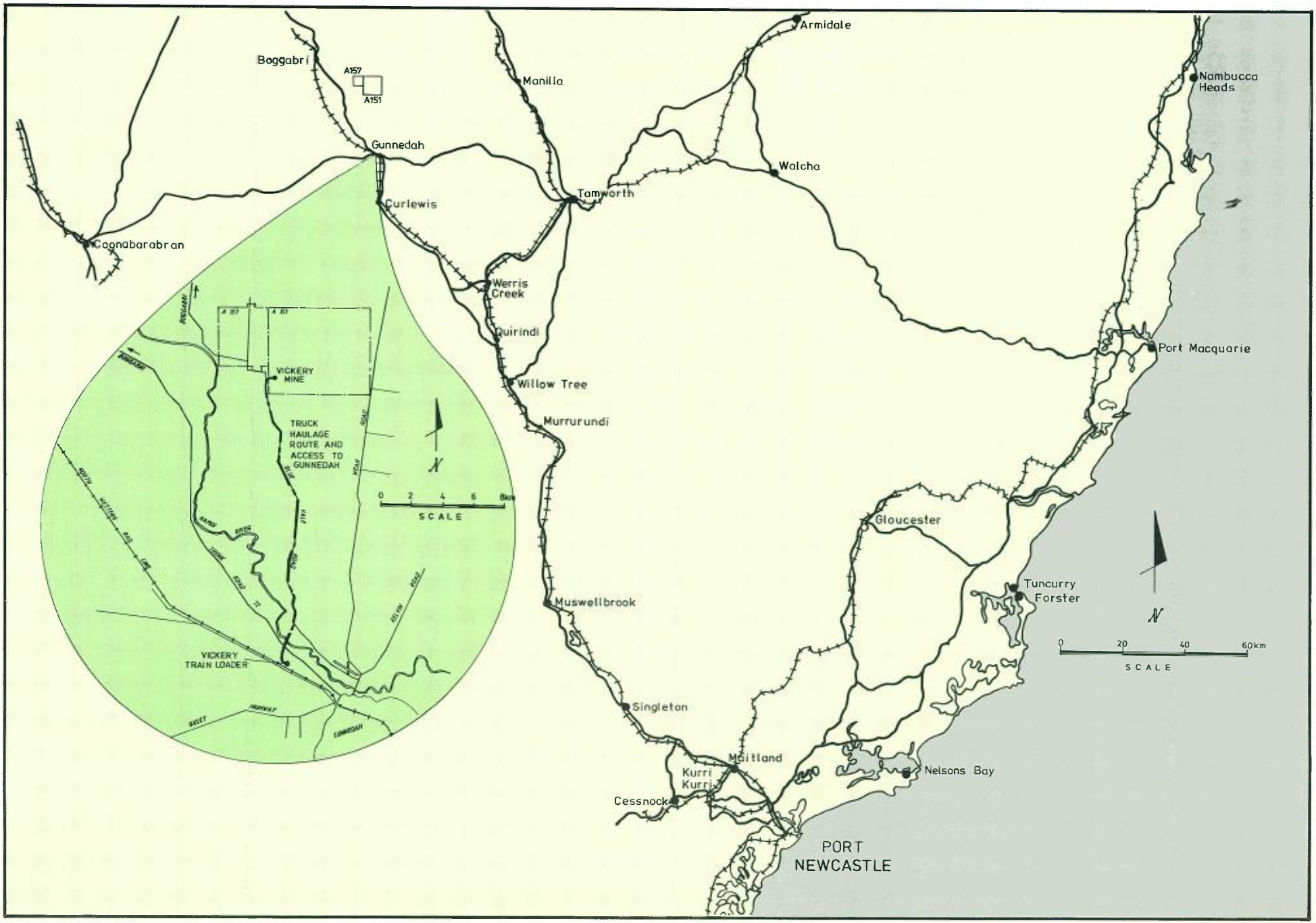
Following the granting of A157, Sunshine Gold Pty. Limited drilled 31 fully cored bore holes. Most were drilled in A157, and some in the western section of A151.

VICKERY JOINT VENTURE

THE COAL CLIFF COLLIERIES PTY LTD PROJECT MANAGERS

PROJECT LOCATION

FIGURE 3.1



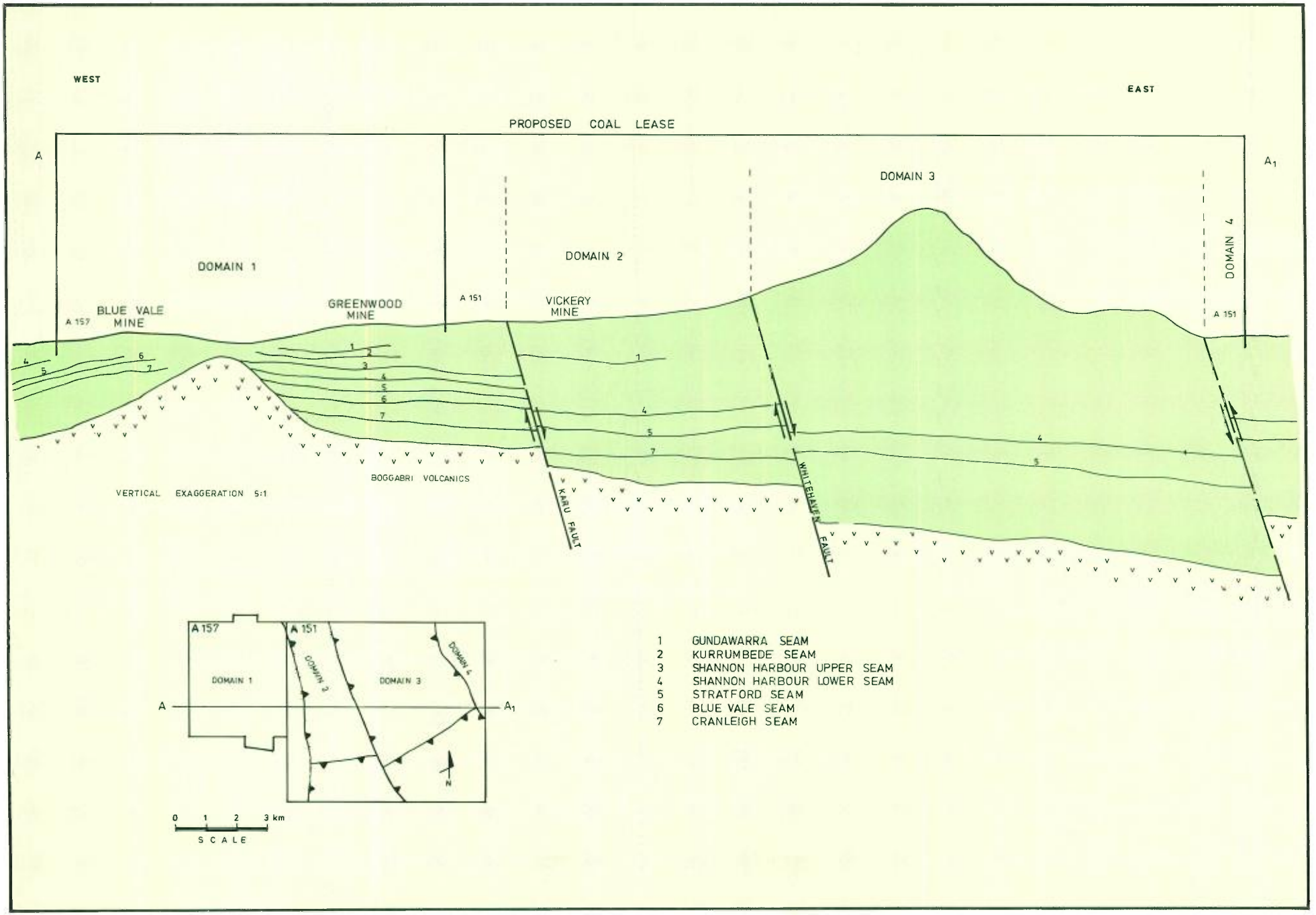


FIGURE 3.2

VICKERY JOINT VENTURE

THE COAL CLIFF COLLIERIES PTY LTD PROJECT MANAGERS

GEOLOGICAL CROSS SECTION

3.2 COAL EXPLORATION HISTORY (Cont)

In November 1981, KCC through its wholly owned subsidiary CCC, joined Sunshine Gold Pty. Limited in a Joint Venture. Since then, KCC has managed the exploration programme. CCC will develop and manage the Project and KCC will market the coal on behalf of the Joint Venture.

3.3 COAL RESOURCES DESCRIPTION

3.3.1 Coal Seams and Local Geology

The Authorisations cover sub-cropping Permian coal-bearing sediments of the Gunnedah Basin. The coal-bearing sequence forms part of the Nandewar Group of Lower Permian Age. The coal measures are considered equivalents to the Greta Coal Measures of the Hunter Valley.

The basement rocks underlying the coal bearing sequence are the Boggabri Volcanics.

Deposition in the area has occurred in an elongated basin with a north-west to south-east axis. Sediments are thickest in the east and coal seams coalesce to the west.

The coal seams generally dip to the north-east. The coal measures are bounded to the east of A151 by the Mooki Fault.

There are seven named seams of economic interest occurring within a sequence of conglomerate, sandstone and shale.

Structural features have been used to divide the coal measures into four Domains. The location of the Domains is shown in Figure 3.2.

Domain 1 includes all coal measures west of the Karu Fault. The sequence, including the coal seams, thins and onlaps a basement high as shown in Figure 3.2. Depth to the basal seam ranges from 30 m on the western margin to approximately 160 m adjacent to the Karu Fault. The south-western corner of A151 contains a small area of coal measures onlapping the same basement high and dipping to the west. This area contains approximately 9% of Domain 1 reserves. This Domain is presently considered to be a sub-economic opencut deposit with an average insitu volumetric stripping ratio of 8.5 m^3 of rock to 1.0 t of coal.

Domain 2 is located between the Karu and Whitehaven Faults. Both are normal faults with their displacement varying from 60 m to 100 m. The Domain 2 coal seams are generally thicker than those of Domain 1 and there are four seams with underground mining potential. The bottom economic seam lies at depths ranging from 180 m to 300, m. All of Domain 2 requires the application of underground mining methods. An intruded area exists in the north of this Domain.

Domain 3 lies between the Whitehaven Fault and an unnamed reverse fault in the north-east of A151. The coal measure sequence thickens markedly in Domain 3 and is accompanied by some seam splitting and deterioration. Only two seams of economic interest remain at depths ranging from 300 m to 500 m. There are isolated intruded zones within the Domain.

Domain 4 is located in the north-east corner of A151. This area is approximately 2 km from the Mooki Thrust fault zone. The Domain has two possible economic seams capable of underground development at depths between 100 m and 200 m.

3.3.2 Coal Characteristics

Washery beneficiation will be required to produce consistent low ash, high energy coal products. Low levels of insitu ash will however, allow the marketing of some run of mine (ROM) coal.

Vickery coal is characterised by low levels of insitu ash, sulphur, and trace elements, high calorific value, low phosphorus and chlorine content, high ash fusion temperatures, and a Hardgrove Grindability Index consistent with the high volatile nature of the coal.

Vickery coal is suitable for many applications including:-

- All combustion processes
- Pulverised coal injection
- Direct reduction processes
- Coke blend component
- Briquetting
- Liquefaction
- Coal water mixtures

3.3.3 Coal Reserves

Insitu reserves of Domain 1, in seams thicker than 0.6 m, have been measured at 111.5 Mt. This coal has an average volumetric stripping ratio of 8.5 m^3 rock to 1.0 t of coal. There is a further 4.7 Mt in seams with thickness of 0.3 m - 0.6 m, however, the recovery economics of these seams is less attractive.

Underground insitu reserves for seams of 1.5 m or thicker are estimated at 64.8 Mt in Domain 2, 133.8 Mt in Domain 3, and 3.8 Mt in Domain 4.

In the first 21 years of the Vickery Project, 41.9 Mt of coal will be mined to produce 36.9 Mt of saleable product.

Production levels were set to match perceived market opportunities. The remaining reserves have not been sterilised and will be developed by appropriate opencut and underground mining methods when commercial opportunities become available. The most likely development is multi-seam opencut mining of Domain 1 and multi-seam underground mining continuing into Domains 3 and 4.

Estimated Vickery Coal Reserves by Domain and seam are listed in Table 3.3-1

Table 3.3-1 VICKERY COAL RESERVES ('000 tonne) INSITU

SEAM	DOMAINS				
	1	2	3	4	TOTAL
GUNDAWARRA	6,600	7,500	--	--	14,100
KURRUMBEDE	5,400	--	--	--	5,400
SHANNON HARBOUR UPPER	10,800	--	--	--	10,800
SHANNON HARBOUR LOWER	11,200	16,500	37,300	3,800	68,800
STRATFORD	19,500	25,700	85,500	--	130,700
BLUE VALE SEQUENCE	24,800	--	--	--	24,800
CRANLEIGH	33,200	15,100	11,000	--	59,300
TOTAL	111,500	64,800	133,800	3,800	313,900

NOTES:

1. Reserves in Domain 1 list coal in seams greater than 0.6 m thick.

2. Reserves in Domains 2,3, and 4 list coal in seams greater than 1.5 m thick.

3.3.4 Non-Coal Material

Testing of the non-coal material indicates adequate topsoil or topsoil forming material is available to enable rehabilitation of disturbed areas. A minimum of 100mm of topsoil will be returned to all areas.

The weathered rock between the Gundawarra seam and the soil has elevated Sodium Adsorption Ratio (SAR) values. Elevated SAR levels mean high soil sodium concentrations relative to magnesium and calcium. This can cause soil aggregates to disperse leading to an accelerated erosion process. To avoid dispersion and soil erosion problems, this material will be covered with stable topsoil stripped from the disturbed areas.

There are no deleterious elements present in the solid rock. The rock lithologies are predominantly conglomerates and sandstones formed in a freshwater environment.

The total Sulphur levels of the coal are low at 0.4% and of this the Pyritic Sulphur component is 0.04%.

The pH of rock saturation extracts is higher than 7 confirming the low levels of acid producing pyrite. The pH of the surface weathered zone ranges from 5.4 to 8.0 while natural surface water and groundwater has neutral pH.

3.4 DEVELOPMENT

The VJV is presently operating the Red Hill Sampling Operation.* Samples of Gundawarra seam are being extracted and mining will continue until the Gundawarra seam reserves in this pod are depleted.

The current proposal commences upon completion of the Sampling Operation. The proposal involves:

- The continued operation of the Red Hill Sampling Operation as the Red Hill Mine for approximately 1 year. It will produce 200,000 t and completes extraction of the Gundawarra Seam from Red Hill.

- Development and operation of the Greenwood Mine working the Gundawarra seam by longwall underground methods. It will produce 3.5 Mt saleable over 4 years.

- The development and operation of the Vickery Mine which will extract by longwall underground methods, coal from the Gundawarra seam and the deeper Shannon Harbour Lower, Stratford, and Cranleigh seams east of the Karu fault. This Mine will produce up to 1.94 Mtpa of saleable coal.

- The operation of three small experimental opencut mines to develop and field test conventional and innovative opencut mining methods. The innovative methods will apply the latest mining technology concentrating on continuous rock cutting and loading without blasting. The latest systems integrate these methods with continuous haulage, rather than using diesel powered intermittent methods such as trucks. The result will be a more cost effective opencut mining method. The success of these methods will provide a basis for development of the presently subeconomic opencut reserves within A157. These mines are Shannon Hill Opencut producing 220,000 t saleable in 1 year, Greenwood Opencut producing 180,000 t saleable in 1 year, and Blue Vale Opencut producing 1.28 Mt saleable over 3 years.

- The operation of a coal preparation plant with a rated throughput of 550 tph, with product and reject handling.

- The transportation of coal by truck along an upgraded Blue Vale Road to a train loader adjacent to the North Western Rail Line, 3 km northwest of Gunnedah.

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* This project is fully described in the Environmental Impact Statement for Red Hill dated September, 1983; and the Supplementary Document dated February, 1984.

3.4 DEVELOPMENT (Cont)

TABLE 3.3-2 VICKERY PROJECT ANNUAL TONNAGE (ROM AND WASHED) OVER 21 YEARS OF THE PROJECT ('000 tonnes)

Year		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15-21	TOTAL
Production																	
Red Hill	ROM	200															200
Greenwood	ROM	400	1010	1370	830												3610
	Washed		960	1300	790												3050
Vickery	ROM				1020	1730	1680	2040	2000	2000	2000	2000	2000	2000	2200	2200	36070
	Washed				870	1470	1430	1770	1760	1760	1760	1760	1760	1760	1940	1940	31620
Experimental Opencut Mines																	
Shannon Hill	ROM	240															240
	Washed	220															220
Greenwood	ROM				180												180
Blue Vale	ROM				400	600	600										1600
	Washed				320	480	480										1280
TOTAL	ROM	840	1010	1370	2430	2330	2280	2040	2000	2000	2000	2000	2000	2000	2200	2200	41900
	Washed	200	960	1300	1980	1950	1910	1770	1760	1760	1760	1760	1760	1760	1940	1940	36170
	Saleable	820	960	1300	2160	1950	1910	1770	1760	1760	1760	1760	1760	1760	1940	1940	36950

3.4 DEVELOPMENT (Cont)

The full mining potential of the deposit will be realised in response to the interaction of market opportunities and commercial viability. Domain 1 remains as a long term major opencut development and underground operations could continue at the same production level or greater into Domains 3 and 4.

3.4.1 Individual Mines

3.4.1.1 Red Hill Mine

The Red Hill Sampling Operation will continue as the Red Hill Underground Mine. No alterations to the present method of operation are envisaged. (Refer Figure 3.4).

Production will continue at 200,000 tpa until reserves are fully extracted. This operation allows continuity of production and employment during development of the Greenwood Mine.

Coal will be stockpiled on the surface, then trucked from Red Hill along a private road to the Blue Vale Road and onto the Train Loader.

3.4.1.2 Greenwood Mine

Surface facilities for Greenwood Mine will be constructed during the first year of the Project.

Surface facilities will include a bathhouse, office, carpark, electrical sub-station, stores yard, and workshop. Adjacent to these will be the major drivehead for the conveyor entering the Mine box cut and a dump station for the delivery of coal from the shallow opencut developments and the second Greenwood underground entry (Refer Figure 3.5).

The surface facilities will be built on a pad constructed from material taken from the box cut entry. The box cut will be developed to allow highwall entry points for longwall mining. Most of the excavated material will be placed in the Shannon Hill Mine out-of-pit overburden dump.

Another entry will be developed from the final highwall of the Shannon Hill Opencut. The Gundawarra seam in the southern end of the Greenwood Mine will be extracted from this entry.

The Greenwood Mine will be a longwall underground operation (Refer Figure 3.6). Development will consist of continuous miners or heading machines driving roadways to create longwall blocks for pillar extraction. Coal will be conveyed out of the Mine, then on an overland conveyor to the Vickery preparation plant.

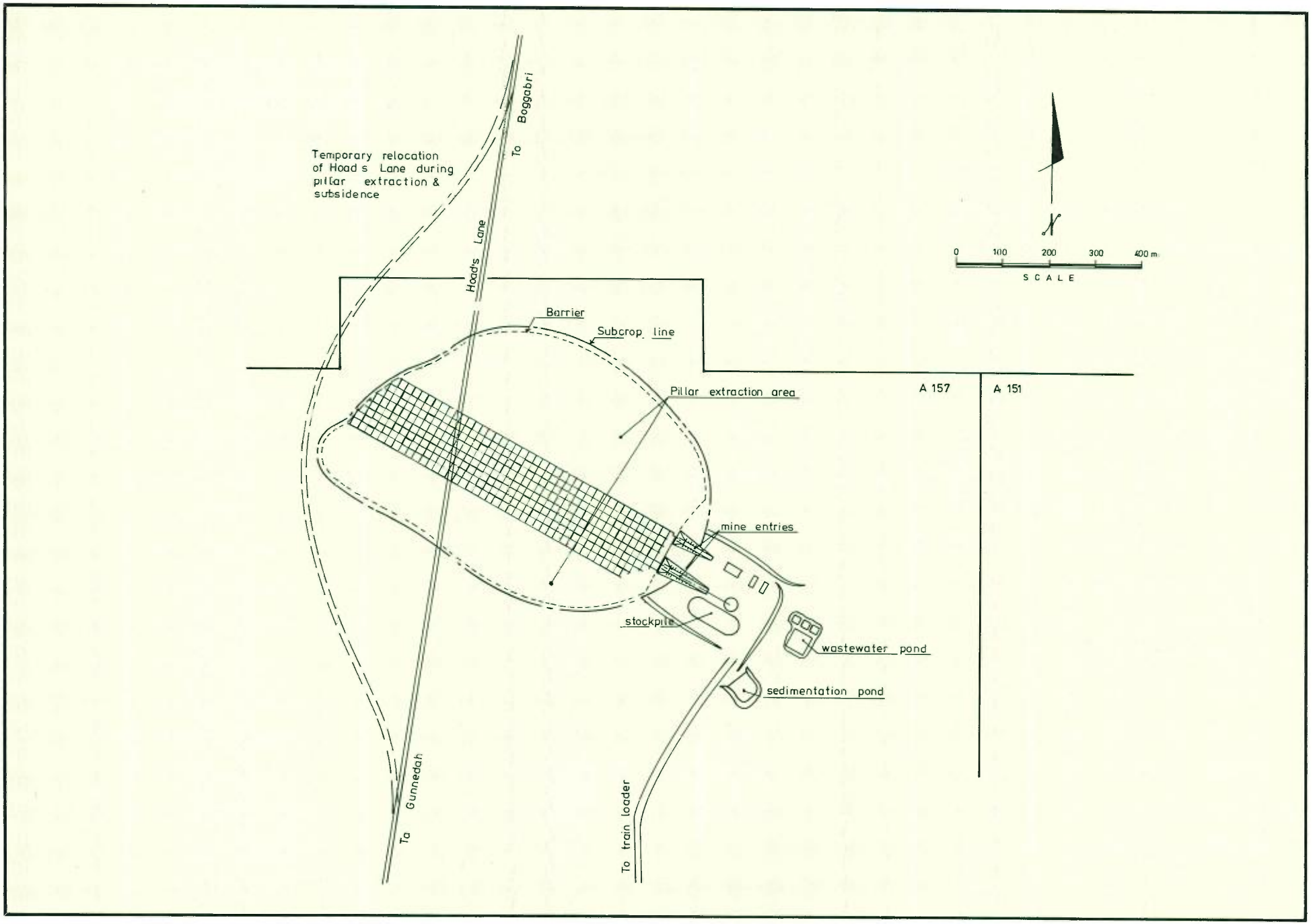


FIGURE 3.4

VICKERY JOINT VENTURE

THE COAL CLIFF COLLIERIES PTY LTD PROJECT MANAGERS

RED HILL MINE

VICKERY JOINT VENTURE

THE COAL CLIFF COLLIERIES PTY LTD PROJECT MANAGERS

GREENWOOD MINE SURFACE
FACILITIES AND BOX CUT

FIGURE 3.5

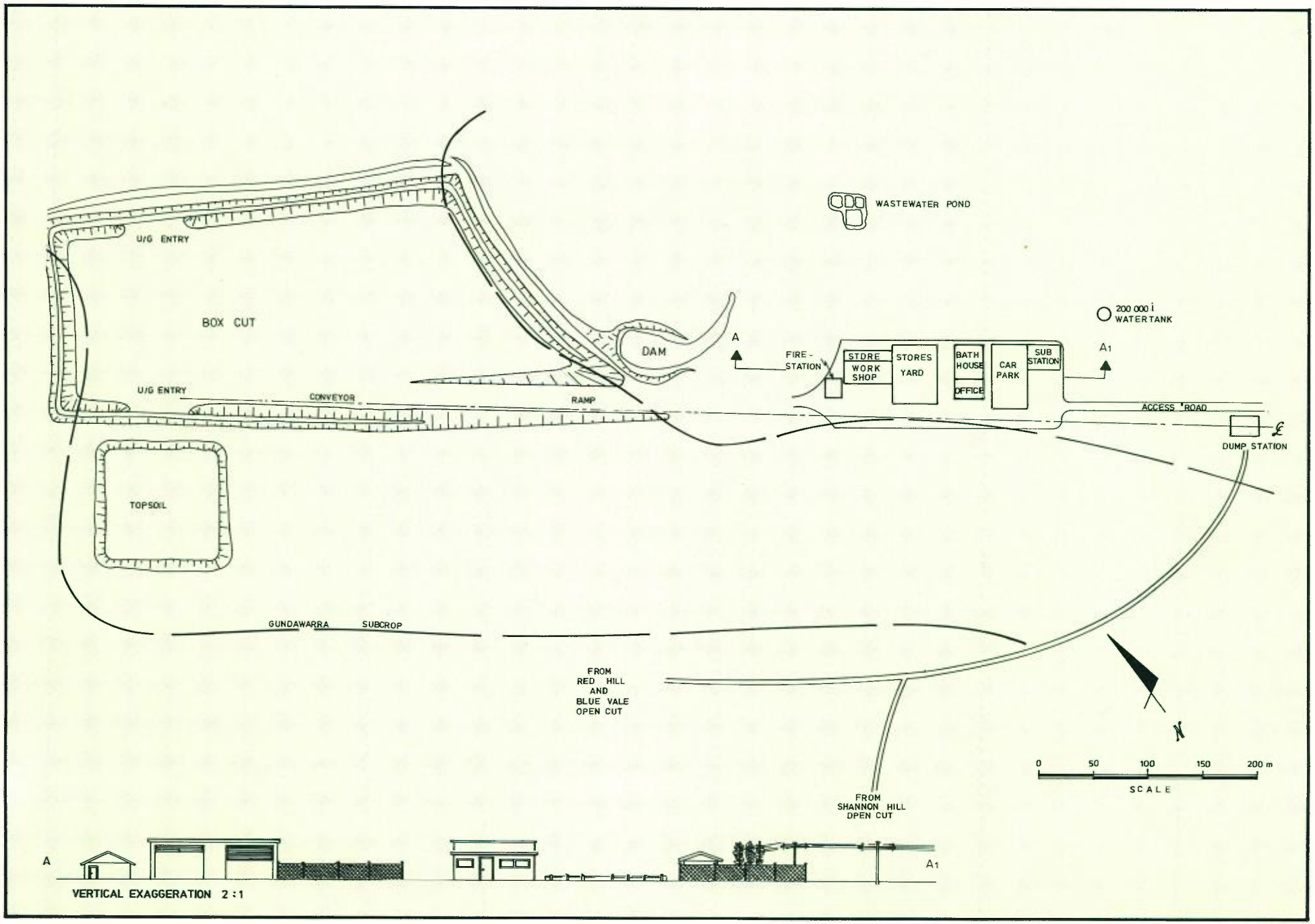


FIGURE 3.6

VICKERY JOINT VENTURE

THE COAL CLIFF COLLIERIES PTY LTD PROJECT MANAGERS

GUNDAWARRA SEAM MINE PLAN
GREENWOOD, SHANNON HILL, AND VICKERY MINES LANDSCAPE PLANTINGS

3.4.1.2 Greenwood Mine (Cont)

There will be no coal stockpiling at Greenwood apart from an emergency pad to cover breakdown of the conveyor system. Details of the coal preparation plant are discussed in Section 3.5.

An unsealed access road will be constructed from the Blue, Vale Road to the Mine surface facilities (Refer Figure 3.6).

Water will be stored in a 200,000 l tank adjacent to the pad. This tank will be supplied from the main dam and bore system.

Power will be reticulated from the main 66kV / 11kV sub-station located at the Vickery Mine. Both water and power services will follow the conveyor which links Greenwood Mine to the preparation facilities at Vickery Mine (Refer Figure 3.6).

Diversion banks will divert water around the surface facility site and the box cut entry. Wastewater ponds will be located away from the surface facilities.

Although the Greenwood Mine surface facilities are constructed on coal bearing land of Domain 1, it is intended to remove the structures at the end of the Mine's life, thus avoiding coal sterilisation.

Any remaining Gundawarra seam coal within Domain 1 will be recovered at a later date by further developments. These developments will be determined by market opportunities and the technical and commercial results from the small experimental opencut mines.

3.4.1.3 Small Experimental Opencut Mines

Three areas have been selected for experimental opencut mining (Refer Figure 3.3). They will be used to test existing mining methods and develop and demonstrate innovative opencut methods. Mining recovery will be approximately 90% of the unweathered coal. Development of successful methods will enable future opencut mining of subeconomic opencut reserves of Domain 1. These reserves at present are not commercially viable due to the high stripping ratio, thin seams, and the costs associated with mining such a deposit by conventional means.

Opencut operations will be directed by VJV staff and research personnel. Supervisors and machine operators will be on a contract basis, their numbers depending on the type and extent of the trial programmes.

Shannon Hill Opencut Mine

The Mine contains approximately 266,000 t of unweathered insitu Gundawarra seam at depths of 10 to 20m. The Mine will operate in the second half of Year 1 for 6 months. Mining recovery will approximate 90%. Mining methods will initially use conventional equipment. Scrapers will remove the topsoil for separate stockpiling or immediate placement. Large bulldozers will rip the overburden and scrapers will carry it to the overburden dump areas.

Once a sufficient pit length is formed, consideration will be given to an inpit crushing trial to evaluate crushing procedures for future mine planning. Ripped overburden will be moved by large front end loaders into a mobile crusher. The crushed rock will be loaded into trucks for transport to the dump area. The trial time of any one system will depend on its application problems, its further development potential and its relative productivity.

Coal mining will also trial several methods. The productivity of ripping, bulldozing and loading into trucks will be compared to a modified continuous miner performing the same mining and loading function. Coal will be trucked to the dump station at the Greenwood Mine surface facilities.

Figure 3.7 shows the opencut and associated dump area.

There is $1.44 \times 10^6 m^3$ to be placed at a swell factor of 1.4. Placement will be 0.4×10^6 loose m^3 into the worked out pit and 1.6×10^6 loose m^3 out of pit. Inpit dumping will be maximised to limit the total area of disturbed land.

The overburden dump has 12^o batters and a 14 m bench height. The outer batter will be constructed first and vegetated as soon as possible to screen subsequent dumping.

The space between the final highwall and the inpit dump will be used as an entry to continue the Greenwood Mine in the remaining higher stripping ratio Gundawarra seam.

The test results will be used as a basis for the next opencut trial area.

Greenwood Opencut Mine

The Mine contains approximately 200,000 t of unweathered insitu Gundawarra seam at depths of 15-30 m. Mining recovery will approximate 90%. The Greenwood Mine involves the simplest application of innovative equipment, with future trials becoming increasingly complex.

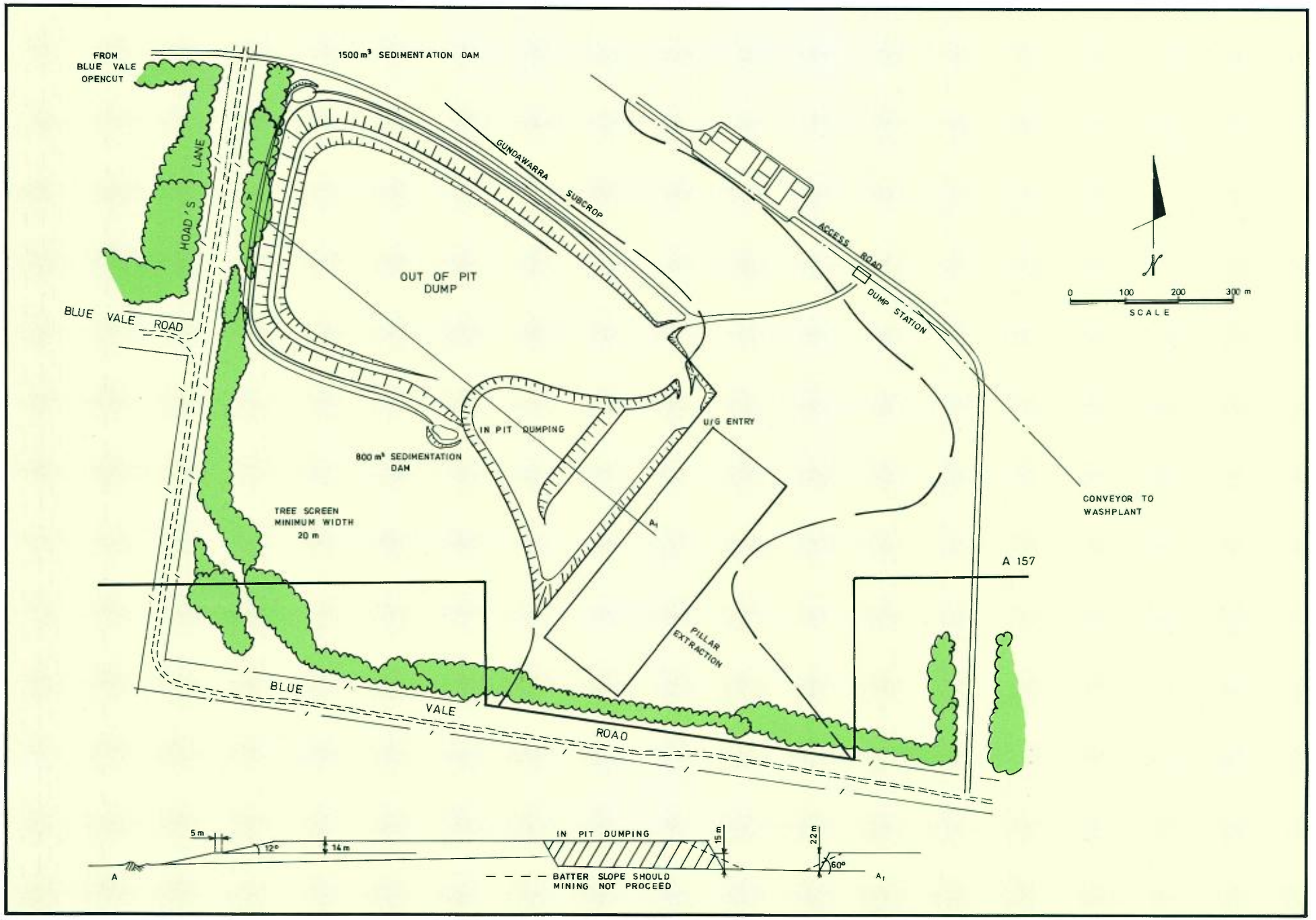
This Mine will operate in Year 4 of the Project.

VICKERY JOINT VENTURE

THE COAL CLIFF COLLIERIES PTY LTD PROJECT MANAGERS

SHANNON HILL OPENCUT MINE
GENERAL LAYOUT

FIGURE 3.7



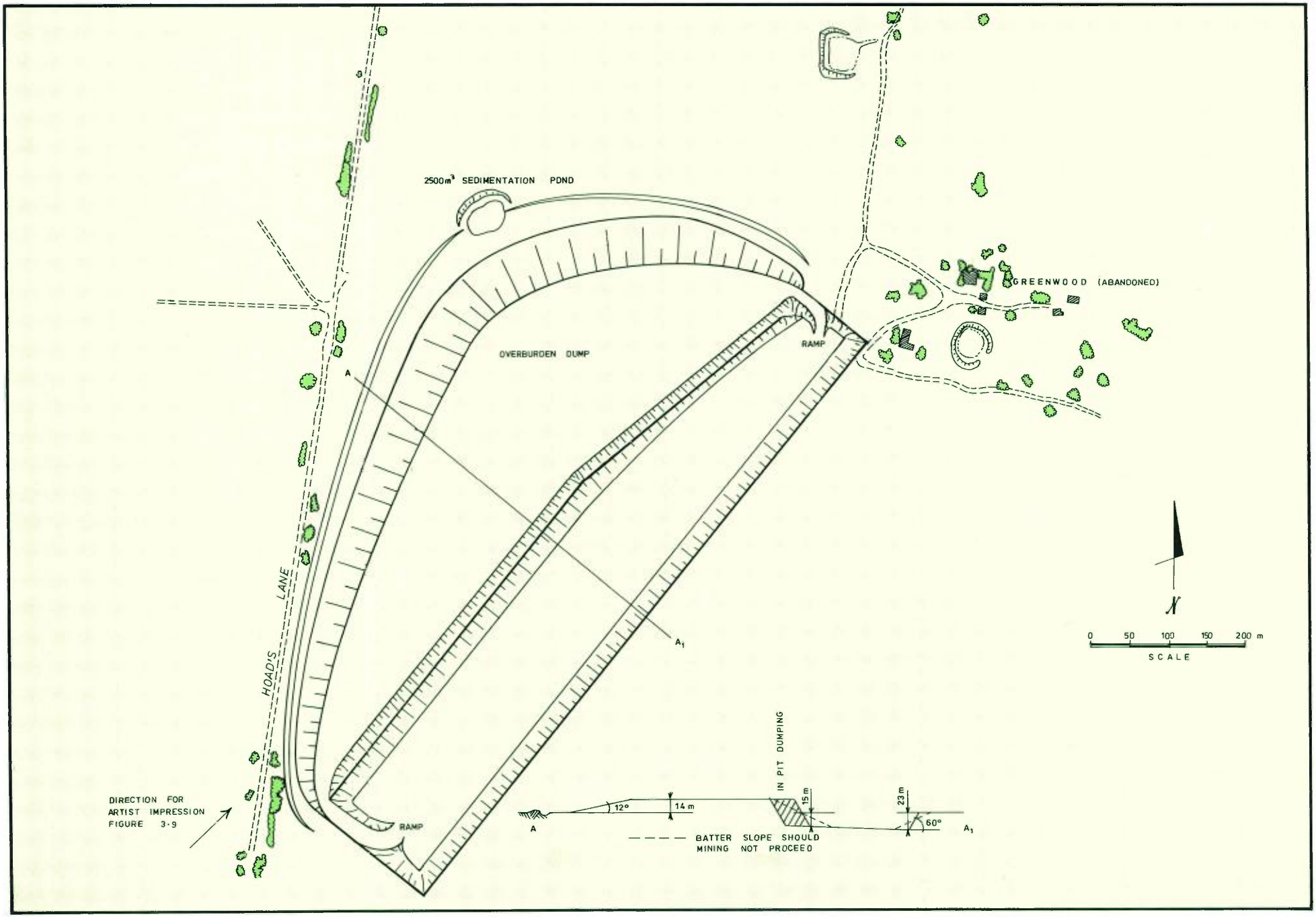


FIGURE 3.8

VICKERY JOINT VENTURE

THE COAL CLIFF COLLIERIES PTY LTD PROJECT MANAGERS

GREENWOOD OPENCUT MINE
GENERAL LAYOUT

3.4.1.3 Small Experimental Opencut Mines (Cont)

Greenwood Opencut Mine (Cont)

Overburden will be excavated with such machines as the Holland loader, Easi-miners, Wirtgen continuous miners, and other similar units. Initially, the overburden will be loaded directly into trucks. Finally, a belt conveyor and possibly a crusher will be installed and used in conjunction with the surface continuous miners for overburden excavation and transport from the Mine.

Coal will be removed from the Greenwood Opencut Mine by continuous coaling machines loading directly into trucks. These machines will include modified underground continuous miners, Easi-miners, and Wirtgen continuous miners. The trucks will take the coal to the Greenwood surface area to be loaded through a dump station onto the overland conveyor. The conveyor will transfer the coal to the Vickery Coal Preparation Plant. Timing of the Greenwood Opencut and Underground Mines allows recovery of the 20 m wide barrier normally left between opencut and underground workings.

The overburden dump has been designed with 12^{o} batters and a bench height of 14 m. The initial overburden will form the outer batter which will be vegetated to screen subsequent dumping.

A diversion drain at the toe of the batter will direct all runoff water into a 2500 m^3 sedimentation dam.

The machines will be used to strip and load top soil for rehabilitation. Soils will be used to cover contoured overburden dumps prior to the area being revegetated. If areas are not ready for rehabilitation, soil will be stockpiled for later use. Soil residence time in stockpiles will be minimised. A minimum topsoil depth of 100mm will be returned to all areas.

The area will be planted with trees and cereals undersown with lucerne. Future plantings of other pasture species may be necessary. A temporary void will remain. Where necessary, the steeper sides of the void will be fenced.

The Greenwood Opencut Mine will provide data on the productivity of the machines and their performance with both dump trucks and conveyor haulage. This data will be used for future mine planning on the Vickery Project.

Figure 3.8 is a plan of the layout of the Greenwood Opencut Mine and overburden dump. Figure 3.9 is an artist's impression of the operation approximately half way through the Mine.

Overburden will be dumped along the low wall. As the highwall progresses to the east, the overburden removed will be dumped in-pit and the void left by mining will be partly filled. Inpit dumping will be maximised to limit the total area of disturbed land.

A maximum of 0.84×10^6 m^3 will be placed out of pit. Assuming a swell factor of 1.4, the volume of the Greenwood overburden dump will be 1.2×10^6 m^3.

A volume of 0.52×10^6 m^3 of overburden will be placed inpit at a swell factor of 1.4. A final void of approximately 0.80×10^6 m^3 will remain after mining. The use of the final void depends on whether the area is opencut mined at a future date. If there are no immediate opencut plans for the area, the outer batters will be reduced to 25^o.

Blue Vale Opencut Mine

Production from this experimental opencut mine commences in Year 4 and is completed in Year 6.

The Mine has insitu reserves of approximately 1.8 Mt of which 1.6 Mt is unweathered and recoverable.

The same machines used at Greenwood Open Cut Mine will be used to remove the overburden from the Blue Vale Mine. The overburden will be transported from the pit by trucks and conveyors and moved to out-of-pit storage on a barren zone immediately northeast of the Mine (Refer Figure 3.10).

The trials will evaluate the Holland Loader and its use with trucks and conveyors for overburden extraction between thin dipping seams. Productivity will be evaluated in a variety of strata with varying thickness. Operation sequencing in a multi-seam situation under varying geological conditions will be assessed. Bench designs will be similar to that shown in Figure 3.10.

The deeper areas of this Mine will allow limited trials of in-pit crushing of unweathered, higher strength overburden. The overburden above the Cranleigh seam will also be used for limited blasting trials. Blasting may be required once per week during the latter stages of the Mine. A regular drilling pattern with vertical holes up to 20m deep will be used. ANFO / slurry blasting agents will be used. Blasting will occur during daylight hours at shift change.

VICKERY JOINT VENTURE

THE COAL CLIFF COLLIERIES PTY LTD PROJECT MANAGERS

GREENWOOD OPENCUT MINE
ARTIST'S IMPRESSION

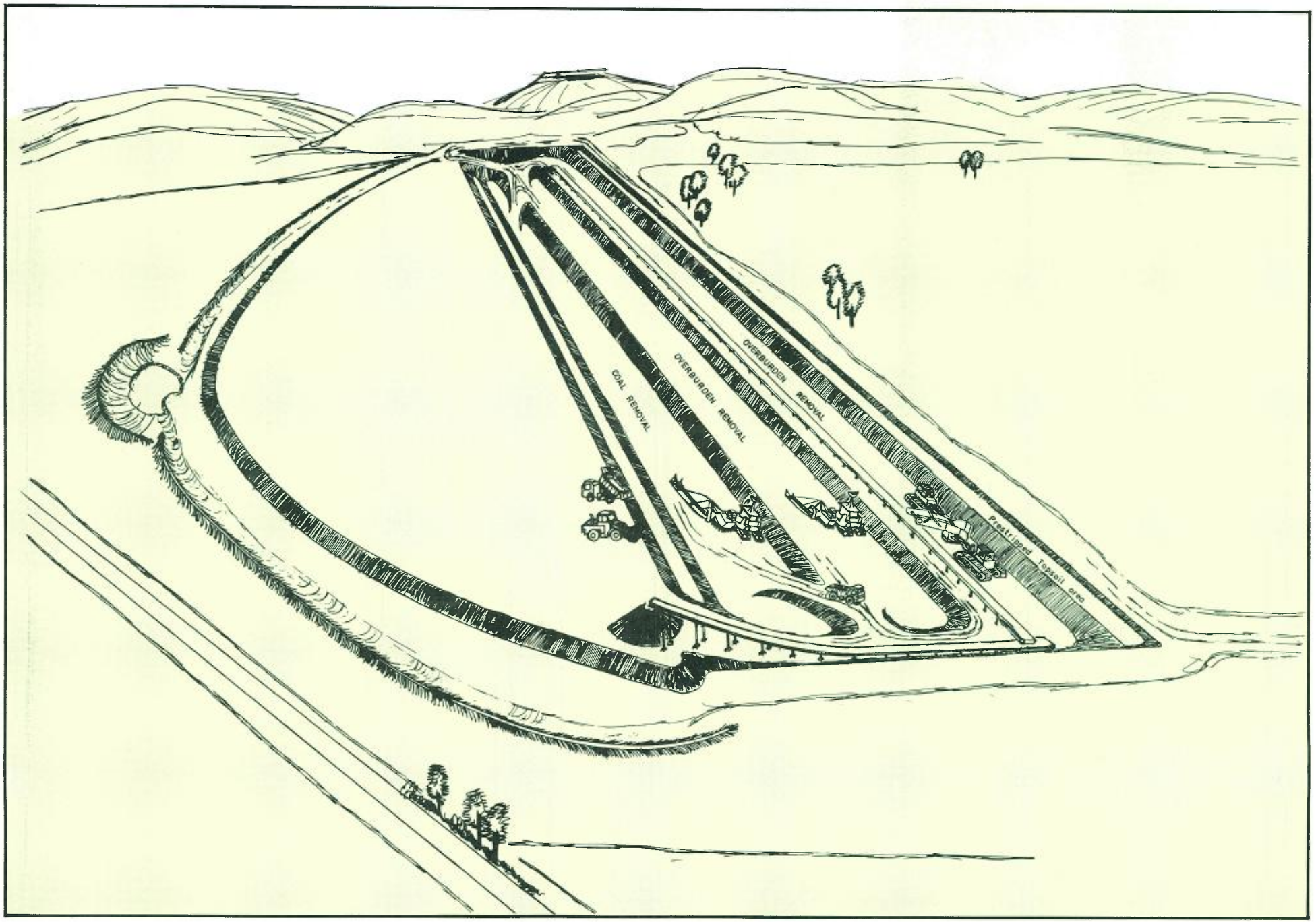


FIGURE 3.9

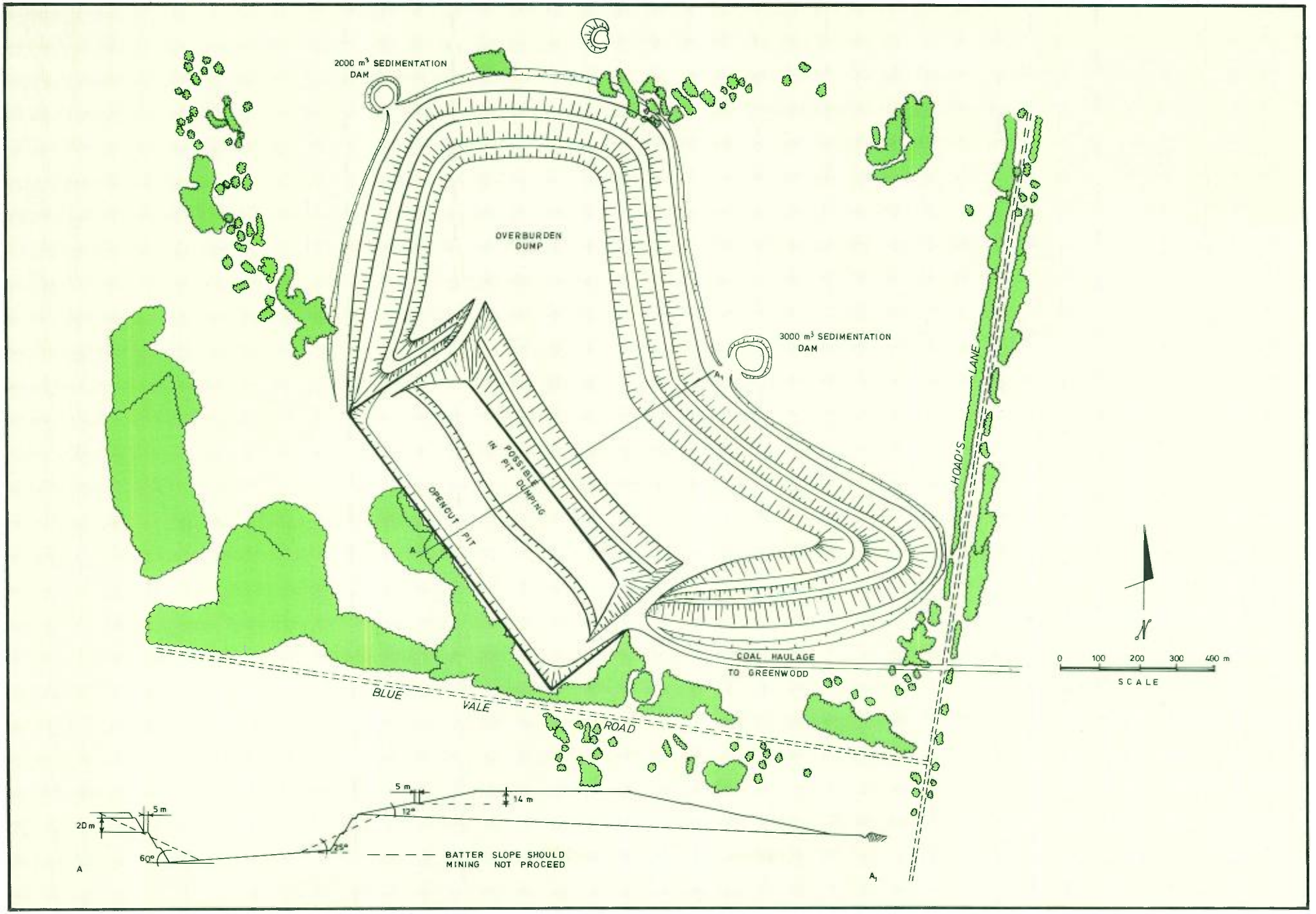


FIGURE 3.10

VICKERY JOINT VENTURE

THE COAL CLIFF COLLIERIES PTY LTD PROJECT MANAGERS

BLUE VALE OPENCUT MINE
GENERAL LAYOUT

3.4.1.3 Small Experimental Opencut Mines (Cont)

Blue Vale Opencut Mine (Cont)

Some material will be dumped in the pit, however due to floor slopes ranging up to 7^{o}, the inpit dumping programme will be gradual, with progress based on the monitored results. The overburden dump area is sufficient to hold all excavated material.

A maximum of 12.5 x $10^{6}m^{3}$ of overburden will be placed out-of-pit at a swell factor of 1.4. Any in-pit dumping will reduce the out-of-pit dump size, as well as decrease the final void. If material is placed in-pit it will not sterilise coal or limit the choice of mining method applicable to the remainder of this coal pod.

Coal will be extracted by a surface continuous miner loading into trucks. The trucks will take the coal to the dump hopper at the Greenwood Mine and from there it will be conveyed to the Vickery Mine Preparation Plant. Coal trucks will cross Hoads Lane. Give Way signs will be installed on the coal haulage route and Heavy Vehicles Crossing warning signs will be placed on Hoads Lane.

Blue Vale operations will include selective removal of soil for use in rehabilitation. Some soil will be placed directly while some will be stockpiled for later use.

The rehabilitated overburden placement areas will be planted with trees and cereals undersown with lucerne. Future plantings of other pasture species may be necessary. The void will be fenced and will provide access to a future mine.

Contour drains at the toe of the overburden batter will direct runoff water into two sedimentation ponds with a combined capacity of 5,000 m^{3}.

The future of the Blue Vale area will be the subject of another Development Application once test results are assessed from the experimental opencut operations. Final opencut wall batters will be reduced, depending on the nature of future mine plans.

3.4.1.4 Vickery Mine

The Vickery Mine will be developed in two Stages.

Stage 1

Stage I will develop the Gundawarra seam east of the Karu fault (Refer Figure 3.2). It is planned to commence Stage I of the Vickery Mine in Year 4 of the Project.

A total of 4.8 Mt of ROM coal will be produced from the Gundawarra Seam over 4 years.

Surface facilities for Stage I are outlined in blue in Figure 3.11. These surface facilities provide the basis for future development of the Vickery Mine - Stage 2 and including bathhouse, office, workshop, store, stores yard, and carpark. The coal handling plant, washery, electrical substation and water reticulation will have been built for the Greenwood Mine.

Two access ramps and drifts provide access to the Gundawarra seam. The drifts intersect the seam to the north of an east-west fault. The Gundawarra seam is downthrown on the southern side of this fault. Main headings and longwall headings will be developed to the north and south of the fault by continuous miners or heading machines. The longwall blocks will subsequently be extracted. Details of the underground mine layout are given in Figure 3.6.

The most southerly area of the Mine is limited to pillar development as it is overlain by the edge of the Namoi Valley aquifers. Full pillar extraction could cause excess dewatering problems for this area of the mine. Full details of mine operations will be discussed with the Coal Mines Inspectorate of the Department of Industrial Relations before implementation. This restriction limits mining recovery of the Gundawarra seam in Domain 2 to approximately 65%.

Coal will be transported from the Mine by the drift conveyor belt to the Vickery Mine Preparation Plant.

Stage 2

Stage 2 of the Vickery Mine is planned to commence production in Year 7 of the Project and continue through to Year 21. The second stage extracts coal from the Shannon Harbour Lower, Stratford, and Cranleigh seams below the Gundawarra seam (Refer Figure 3.2).

Access to the seams will be obtained initially by a shaft which will be sunk during the early operation of the Mine. Heading developments will be initiated from the shaft. Coal will be taken up the shaft and trucked to the preparation plant.

Two drifts will be sunk to intersect the three coal seams in proximity to the shaft. The shaft and drifts will be connected and the headings within each seam will be developed from the bases of the drifts.

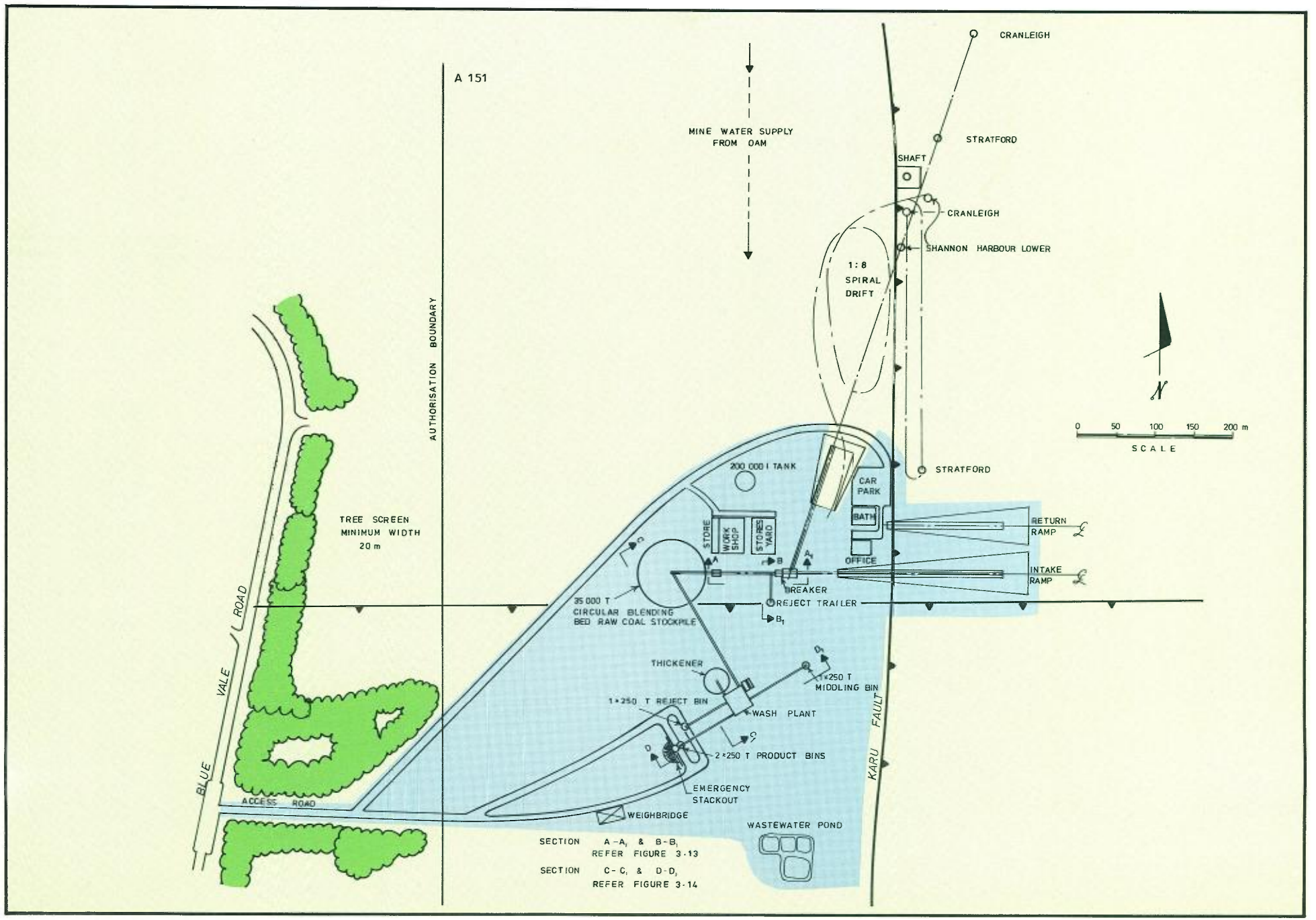
The headings will be developed using continuous miners or heading machines. Longwall panels will be developed and extracted. The layout of the Vickery Mine in the Shannon Harbour Lower Seam is shown in Figure 3.12. Layouts in the Stratford and Cranleigh seams will be superimposed on this layout.

VICKERY JOINT VENTURE

THE COAL CLIFF COLLIERIES PTY LTD PROJECT MANAGERS

VICKERY MINE
SURFACE LAYOUT

FIGURE 3.11



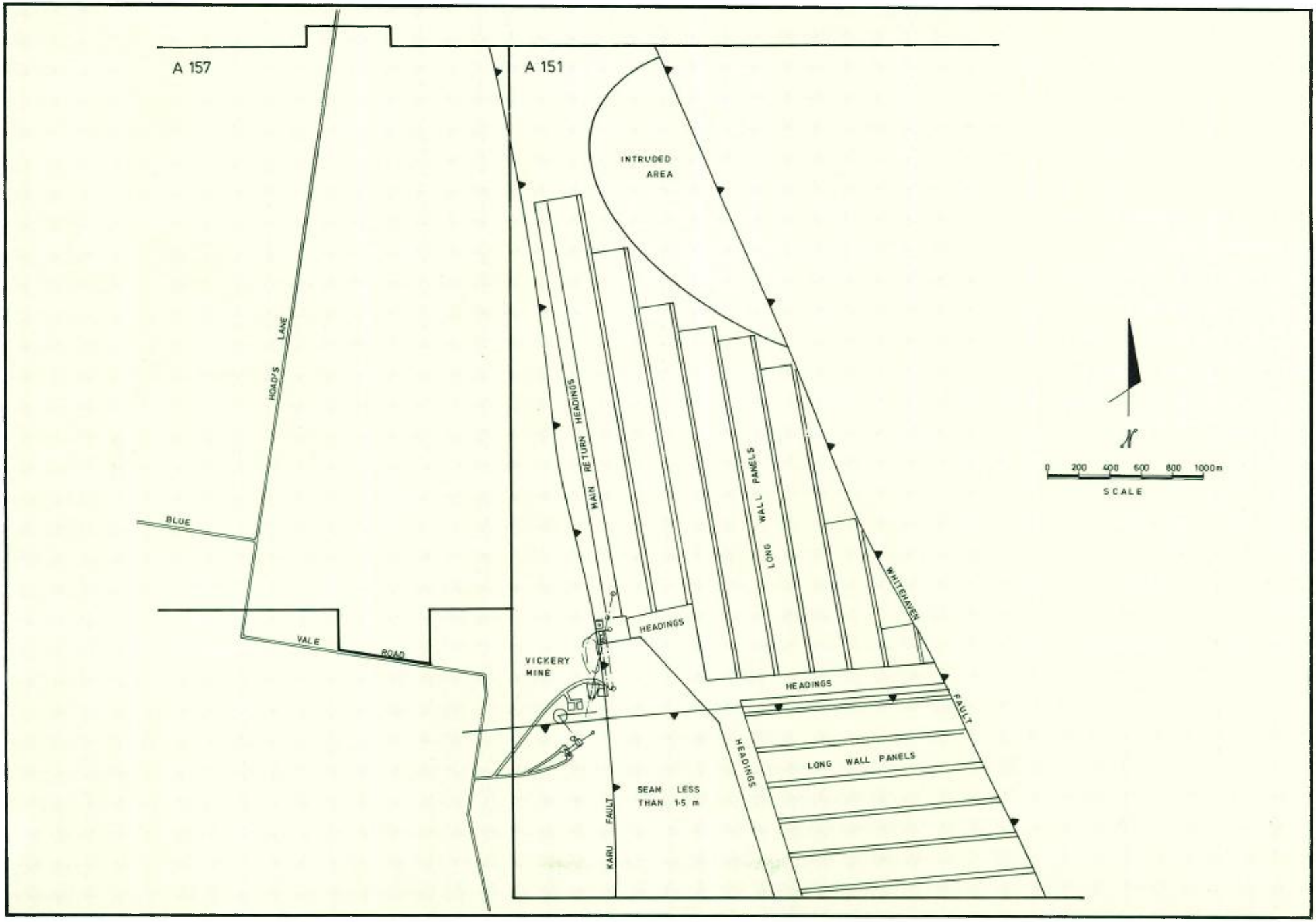


FIGURE 3.12

VICKERY JOINT VENTURE

THE COAL CLIFF COLLIERIES PTY LTD PROJECT MANAGERS

VICKERY MINE
UNDERGROUND LAYOUT
SHANNON HARBOUR LOWER SEAM

3.4.1.4 Vickery Mine (Cont)

Mining recovery in the Shannon Harbour Lower, Stratford, and Cranleigh seams of Domain 2 will approximate 75% based on present geological knowledge and the proposed mining methods.

3.5 MINE COAL HANDLING

3.5.1 Mine to Preparation Plant

The Preparation Plant will be constructed in Year 1 of the Project.

Coal from the Red Hill Mine will be trucked directly to the Coal Loader.

Coal from Greenwood Mine will be transferred by conveyor to the breaker station and washery within the Vickery Mine surface facilities.

Conveyors from the Greenwood and Vickery Mines will feed the breaker station via a feed chute at rates of up to 1,550 tph (Refer Figure 3.13). The chute allows for addition of an emergency ROM stockpiling system should the reliability of the scalping screen, breaker or raw coal stockpiling system prove unsatisfactory. The proven reliability of such conventional plant does not warrant installation of the ROM system during initial construction.

Oversized coal will pass through the rotary breaker for reduction to -100mm, then to the collection conveyor. Undersized coal will pass directly to the collection conveyor.

Uncrushed coal, stone, and tramp material will be discharged from the rotary breaker onto a rejects conveyor and into a rejects trailer which will take approximately two weeks to fill. It will be trucked to the coarse rejects disposal area.

Raw coal will pass along the collection conveyor to a circular blending bed stockpiling system. A slewing and luffing stacking conveyor will discharge the coal to form a conical stockpile across an advancing circular face, layering the coal in a chevron style. The full operating capacity of the raw coal stockpile will be 35,000 t (Refer Figure 3.14).

Coal will be reclaimed from the following face of the stockpile by a bridge type scraper / reclaimer.

The combination of chevron stacking and full face reclaiming ensures the delivery of a well blended and homogenous feed to the coal preparation plant.

Raw coal will be reclaimed from the circular blending bed at rates up to 550 tph for delivery to the Preparation Plant. The reclaim scraper will discharge onto a coal feed conveyor. The tail end of this conveyor will be located in a concrete tunnel under the stockpile. An emergency vibratory feeder will be provided in the tunnel to ensure continuity of Preparation Plant operation should the reclaimer fail.

3.5.2 Preparation Plant

3.5.2.1 Introduction

The preparation plant will clean raw coal to provide premium coal products to the required specifications. Expected products are:

- Very low ash coal - 5% ash
- Low ash coal - 7% ash
- Provision to extract moderate ash fuel coal (middlings) up to - 20% ash

Design considerations placed emphasis on:

- Noise attenuation
- Acceptable visual impact.
- Acceptable disposal and containment of tailings and other waste.
- Attention to plant water run-off and the elimination of pollution risk.

The raw coal has a low ash content. Only a low level of coal preparation is required to achieve a marketable product specification of 10% ash. To achieve the required premium grade coal with 5-7% ash to consistent specification, a higher level of preparation is needed. The Preparation Plant is designed to achieve the lower ash levels for premium grade coal.

The properties of the coal enable various seams at Vickery to be processed simultaneously.

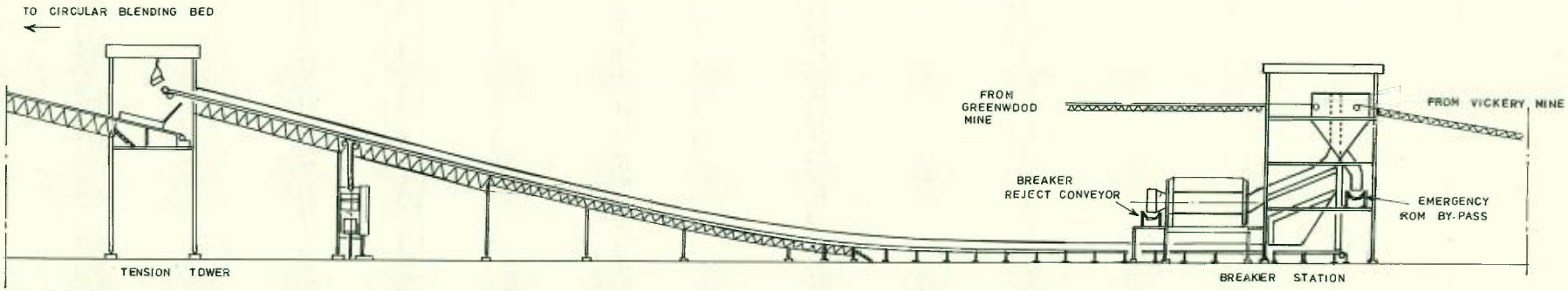
Results of sample testing from the Red Hill Sampling Operation will assist in obtaining final Preparation Plant process design.

VICKERY JOINT VENTURE

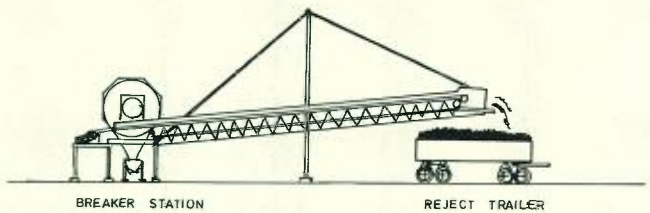
THE COAL CLIFF COLLIERIES PTY LTD PROJECT MANAGERS

BREAKER STATION

FIGURE 3.13



SECTION A-A,
FIGURE 3-11



SECTION B-B
FIGURE 3-11

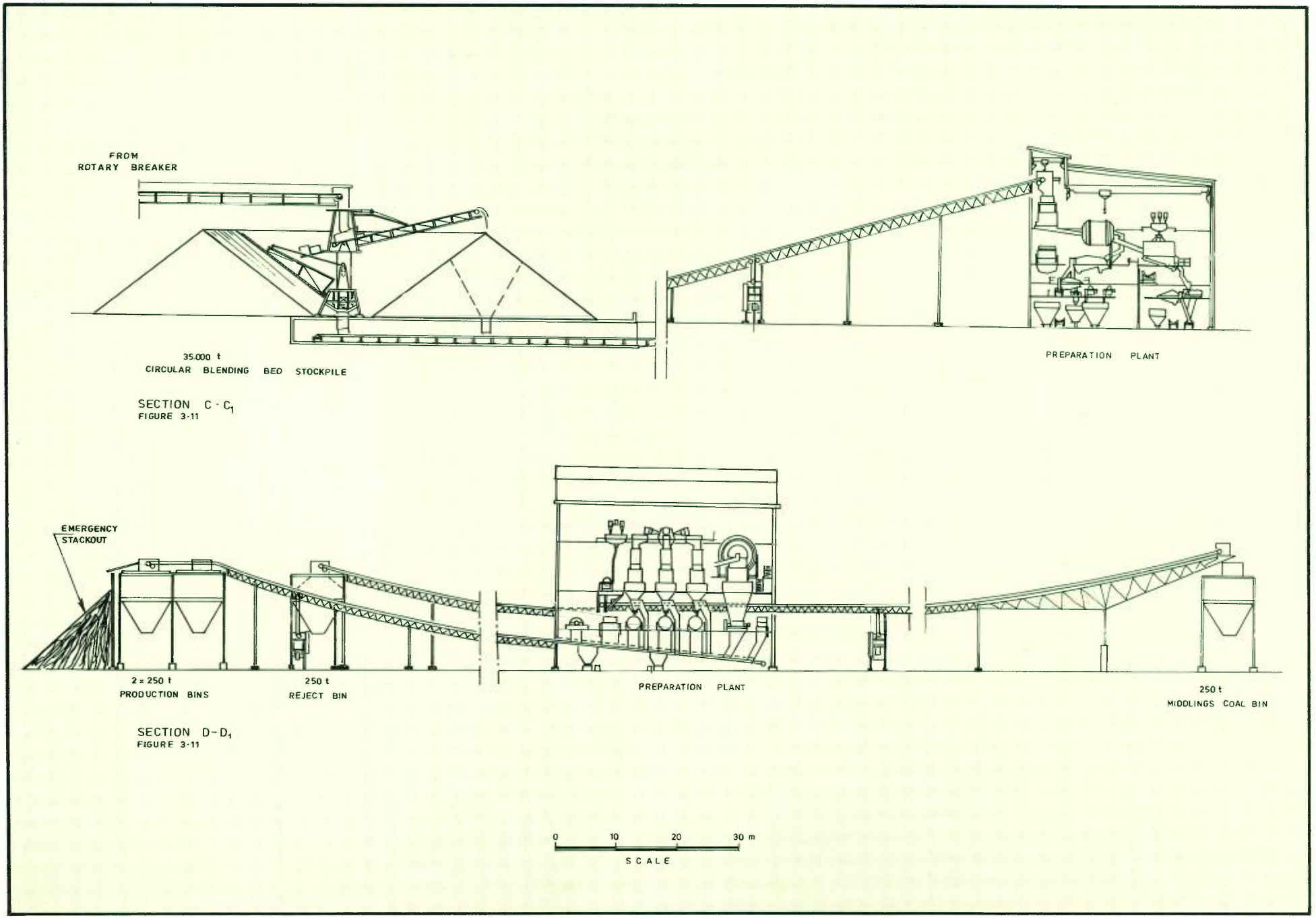


FIGURE 3.14

VICKERY JOINT VENTURE

THE COAL CLIFF COLLIERIES PTY LTD PROJECT MANAGERS

COAL HANDLING PLANT SECTIONS

3.5.2.2 Washed Coal and Rejects Properties

Washed coal will have top size of 40mm. A cubic metre of stockpiled coal will weigh 1.0 t. The angles of repose are 37° stacking and 50° reclaim. The moisture content of the coal is 10.5% maximum.

The Preparation Plant reject will range in size from 0.1mm to 100mm. The ash content range is 60-80% and the moisture content is 18-20%.

The tailings have a top size of 2mm with a range of 0 - 2mm.

3.5.2.3 Preparation Plant Operation

The Preparation Plant will be designed to operate continuously 24 hours per day.

To achieve the annual ROM coal throughput, the Preparation Plant will operate at a rate up to 550 tph. On the average, 550 t ROM coal is converted into 480 t product coal, 56.4 t rejects and 13.6 t tailings, which includes an allowance for mining dilution.

Raw coal fed to the plant will be sized and washed in the following systems:

100 x 13mm	Heavy medium bath (then crushed to -40mm)
13 x 1mm	Heavy medium cyclones (primary and secondary)
1 x 0.1mm	Classifying cyclones and spirals
0.1 x 0mm	Thickening and Disposal as tailings

Washed and dewatered low ash coal will report via a product conveyor to 2 x 250 t capacity bins for truck loading and transport to the product stockpiles at the Train Loader.

Any middlings coal will be delivered by conveyor to another 250 t capacity bin on the opposite side of the preparation plant.

A bypass system will enable raw coal to be crushed and discharged as unwashed product.

A flocculant will be fed to the tailings thickener to help clarify water.

Tailings will be extracted from the thickener and pumped to the settling ponds. Clarified water overflowing from the thickener will be passed into a water sump. The clarified water from the sump will be used to provide sluicing, screen spray, sump make-up, and hose down water for the Plant.

The thickener tank and the clarified water sump will be constructed of concrete. The concrete apron surrounding the plant at ground floor level will be extended to the thickener and sump walls to facilitate area cleanliness.

Flocculant storage and the water neutralisation plant will be installed on a concrete slab adjacent to the plant building and thickener.

A system will be installed to control and monitor all items of plant and equipment associated with the preparation plant. The system will be controlled from a central control room to be located adjacent to the Preparation Plant.

3.5.2.4 Plant Buildings

The design and construction of buildings will comply with regulations of statutory authorities having appropriate jurisdiction. Building frames will be able to withstand all normal erection and operating stresses. Particular attention will be paid to screen floors and lifting beams to minimise vibration.

The ground floors will be graded to be self draining and the drain system will collect in floor sumps with the floor sump pumps returning spillage and effluent to the process.

The control room building will be close to, but structurally separated from the washery building.

3.5.2.5 Waste Disposal

Waste is generated as solids and tailings. The solids reject will be discharged on the plant rejects conveyor. The material will be relatively dry with 18-20% moisture content. It will provide competent and acceptable material for land fill in the reject disposal area. Although Vickery coal has no apparent spontaneous combustion problems, refuse material will be placed and compacted to eliminate risks of self heating.

The location of the rejects disposal area is shown in Figure 3.3.

The method would involve removing the topsoil and clay from the first 0.5 m of the site. This will be placed in two separate stockpiles. Reject will be placed and compacted within the cleared area. Construction will occur downslope and 3.97×10^6 t of reject will be placed during the 21 years of the Project.

3.5.2.5 Waste Disposal (Cont)

Soil material from the next strip of reject area will be placed on the surface of the previously stacked and compacted reject. This process will continue for the duration of the 21 year operation.

The rejects disposal area is located in a wide valley. It has adequate capacity to handle all coarse rejects. The area is presently used for grazing. A diversion bank and catch dam will be provided at the base of the reject disposal area to catch runoff water.

The tailings will consist of flocculated ultra-slimes and will be pumped into a tailings pond. Decantered water from the tailings pond will be returned to the process circuit resulting in a fully closed water circuit.

Figure 3.15 shows details of the tailings pond system.

Water from the tailings pond passes through a decanting pond back to the preparation plant.

The tailings ponds will be constructed from onsite material. The ponds measure approximately 330 m x 330 m internally and are 11 m deep. Tailings from the Preparation Plant flow into either of the ponds through a number of outlets. The tailings settle out and water then passes through outlets at the far end of the tailings ponds. The outlets can be raised as the tailings ponds fill. Four water outlets are provided, two in each pond. This enables further division of the tailings disposal area into four ponds at a future date if required. Water passing into the outlets flows to a sump. A pump is activated by the levels within the sump and this pumps water to a decant pond. The decant pond is approximately 150 m x 150 m and 5 m deep.

The ponds will be operated with 7 to 14 day cycles. This time will be modified as necessary to achieve a crusting on the surface of the tailings. This indicates the moisture content of the tailings is reaching the stage where dust generation may occur. When crusting commences, tailings will be redirected into the pond, overcoming any potential dust problems.

A freeboard depth of 1 m has been allowed to prevent overtopping due to wave action or heavy rain.

The system described covers 13 ha and provides adequate volume and area for the disposal of tailings for the first 21 years of the Project. Approximately 0.96×10^6 t of tailings will be placed in the ponds during the 21 years of the Project.

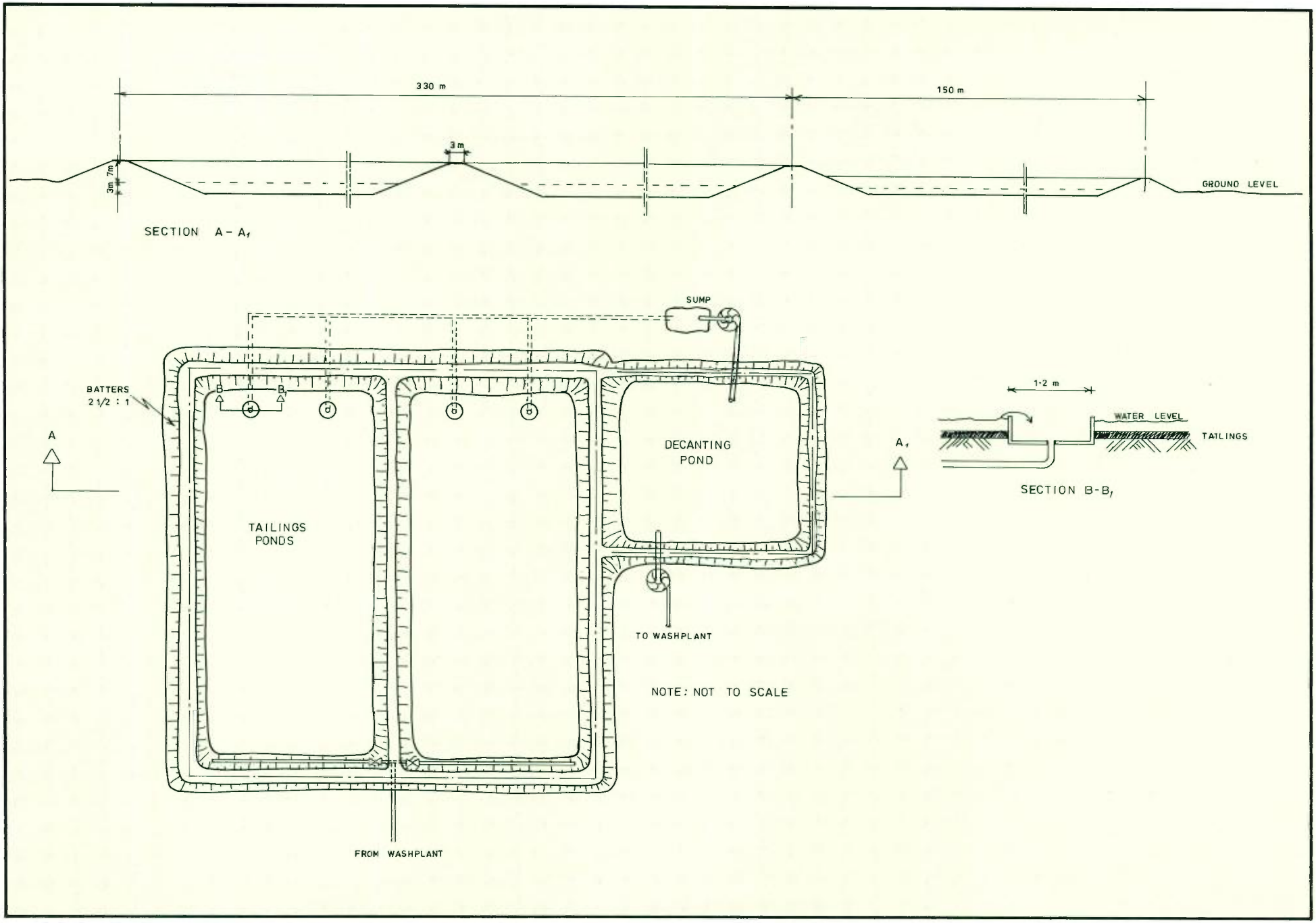


FIGURE 3.15

VICKERY JOINT VENTURE

THE COAL CLIFF COLLIERIES PTY LTD PROJECT MANAGERS

PLAN AND SECTION OF
TAILINGS POND

3.5.2.5 Waste Disposal (Cont)

The tailings pond system will be built to full capacity in Year 1 of the Project. This approach minimises the volume of earth moved and the area disturbed for tailings disposal. It also enables revegetation of the batters and suitable screen plantings from the earliest time of the Project.

The tailings pond site is presently used for cropping. It is located away from flood prone land.

After drying and consolidation in the tailings dam, the area will be reclaimed with a cover of solid rejects and top soil, sown, and returned to productive use. (Refer Section 6.1.5.1).

3.5.2.6 Site Water

Process water will be maintained in closed circuit without discharge to surface streams. The immediate plant area surface drainage will be directed through a sump from where water and solids will be returned into the plant as process water.

All fugitive material, coal spillage, and flocculant will be drained into the plant floor area for return to the process.

A neutralisation plant using inert carbonate will be installed. This plant will correct any decreases in the pH value of process water due to pyrite oxidation. This eliminates any risk of acid water. Vickery Coal has low levels of pyrite and therefore is unlikely to generate acid water (Refer Section 6.1.2.1).

The wet process used for beneficiation eliminates dust.

3.5.2.7 Noise Levels

Noise levels will be approximately 85 dB(A), 15 m from the building. Acoustic lining will not be used because the wet environment tends to destroy these linings. The design of the plant does not require the continuous presence of personnel within the building during operation.

Noise levels at property boundaries will be well within SPCC acceptable levels (Refer Section 6.1.6).

3.6 TRANSPORT

3.6.1 Transport Proposal

The Vickery Joint Venture proposes to haul coal by conventional road trailers along an upgraded Blue Vale Road to a train loader located adjacent to the North Western Rail Line, 3 km north-west of Gunnedah.

This route provides the shortest link to Port Newcastle. The route is also favoured as it does not require acquisition of additional private land.

Mine personnel and delivery of goods will require a suitable access road and selection of this option can serve both requirements. The Blue Vale Road to the north will provide general access to Boggabri.

Road haulage is the most flexible and economic transport alternative for development up to the proposed maximum tonnage.

3.6.2 Train Loader

The Train Loader will be required to handle the increased tonnage of coal from the Project and will replace existing coal loading arrangements for the Red Hill Sampling Operation. It will be required at the start of the Project.

The product coal handling and train loading system at the Train Loader Site is a high capacity reclaim system with a 500 t loading bin (Refer Figures 3.16 and 3.17).

The storage system is based on a stacker / reclaimer servicing 2 x 100,000 t adjacent stockpiles. The coal is delivered to the site by trucks which unload into a dump hopper in the road truck discharge station. The coal is then discharged from the dump hopper through two vibratory feeders onto the stockpile conveyor.

The proposed stacker / reclaimer is a slewing, luffing boom stacker with bucket wheel reclaimer. It is capable of accessing all areas of either product stockpile for stacking or reclaiming functions. A by-pass facility is incorporated into the conveyor tripper chute and this enables the incoming coal to bypass the stockpile and report to the loading bin either during train loading operations or as a contingency arrangement in the event of machine failure.

Product coal to be stockpiled will discharge from the stockpile conveyor at the stacker tripper and will be elevated by the stacker transfer conveyor to discharge onto the boom conveyor. The boom conveyor will deposit the coal onto the stockpile with minimal free fall.

Coal will be reclaimed from the stockpile by the bucket wheel and transferred by the reversible boom conveyor onto the stockpile conveyor. When reclaiming from the stockpile while coal is being received from the dump station, the fresh product will remain on the stockpile conveyor and combine with the reclaim product at the boom conveyor discharge point.

VICKERY JOINT VENTURE

THE COAL CLIFF COLLIERIES PTY LTD PROJECT MANAGERS

TRAIN LOADER SURFACE LAYOUT

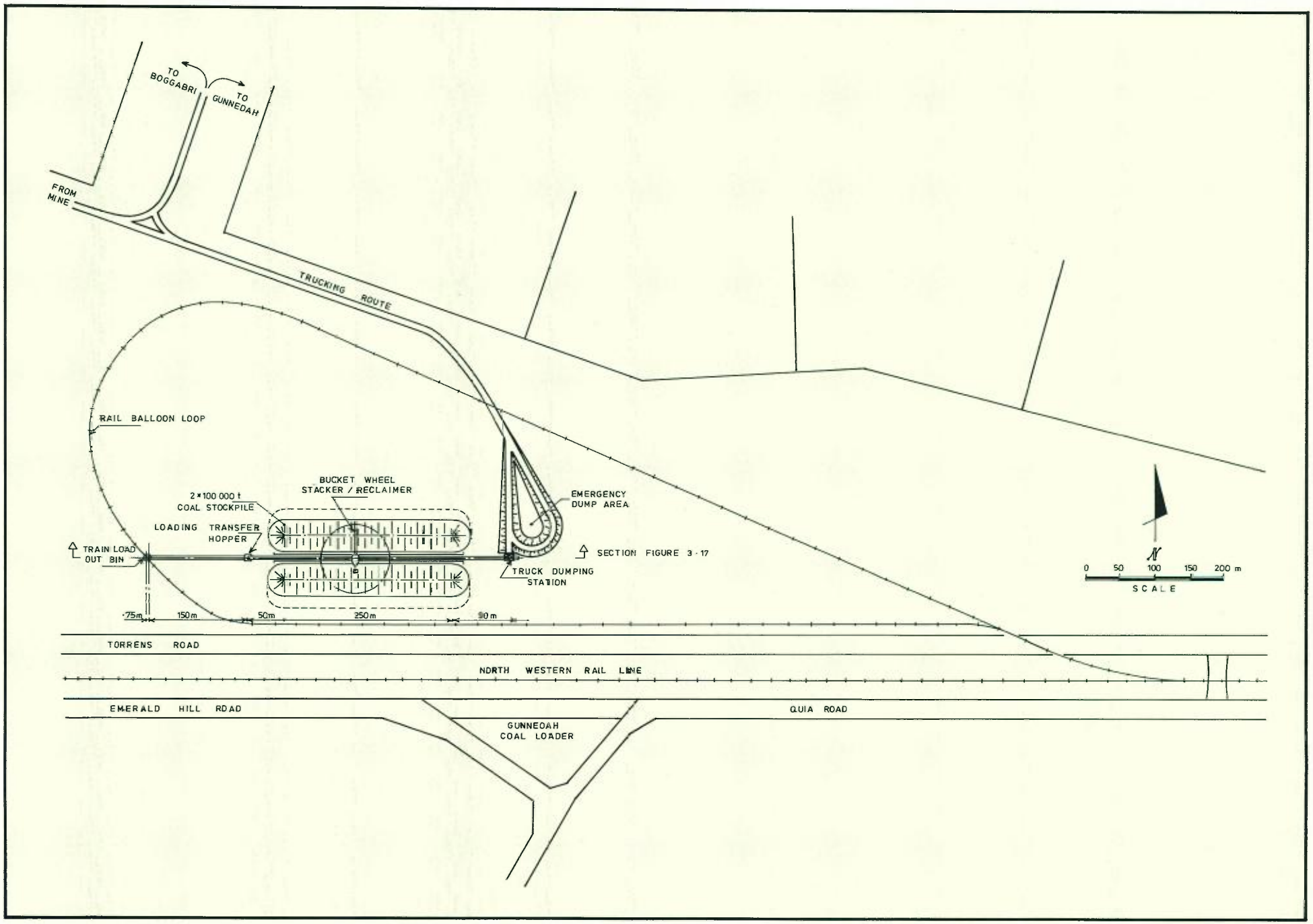


FIGURE 3.16

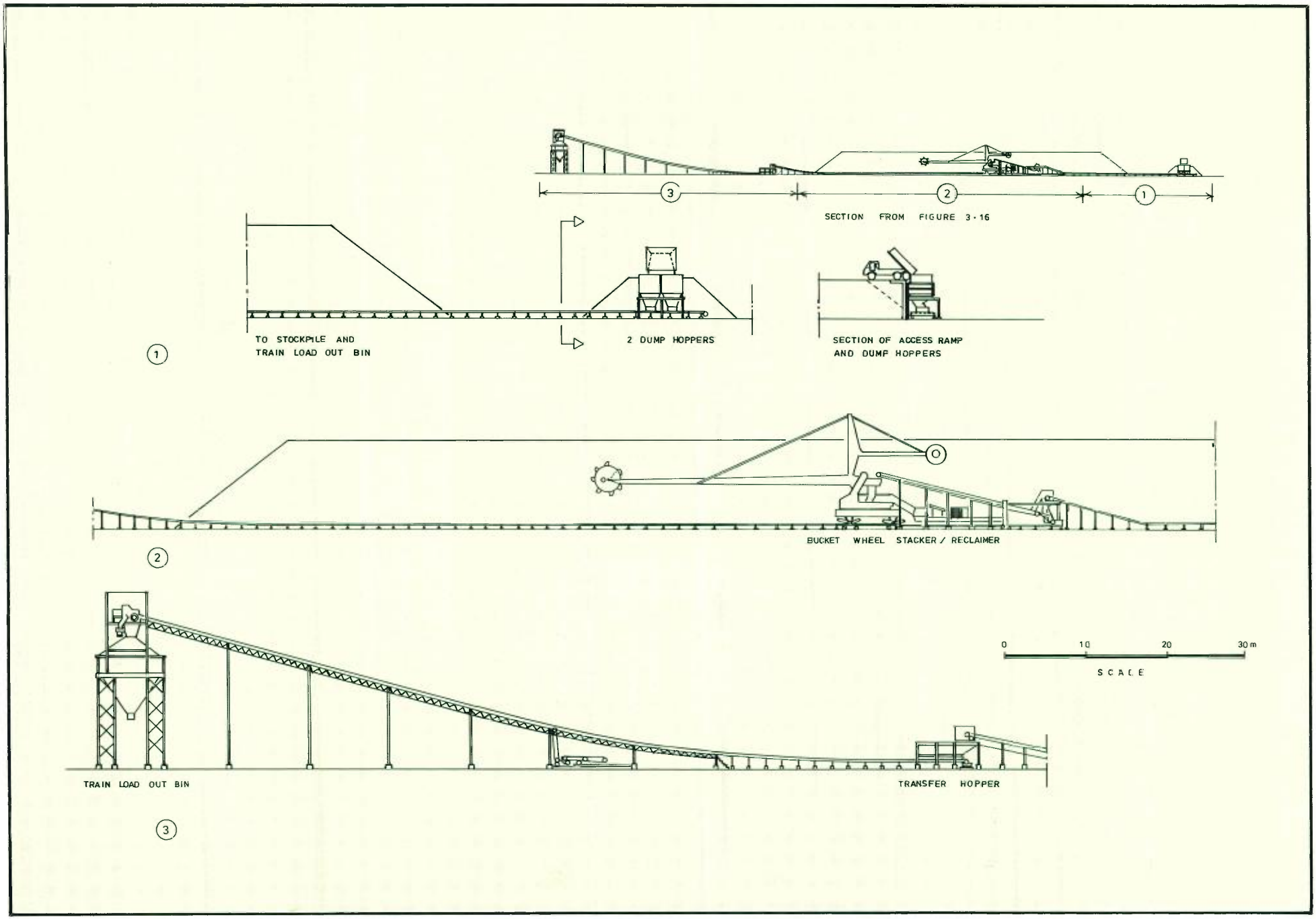


FIGURE 3.17

VICKERY JOINT VENTURE

THE COAL CLIFF COLLIERIES PTY LTD PROJECT MANAGERS

TRAIN LOADER SECTION

3.6.2 Train Loader (Cont)

The bucket wheel reclaim rate will automatically adjust to deliver a total of 2,750 tph product coal to the transfer station or loading hopper. Vehicle access is provided around each stockpile for inspection and maintenance purposes.

A loading hopper of $30m^3$ capacity will be provided to allow emergency train loading by front end loader and conveyor during breakdowns.

All coal reporting to the hopper will be elevated by a conveyor into the train loading bin where samples will be taken for subsequent analysis.

Trains will be loaded using a conventional flood loading gate system.

Detailed discussion of impact and ammelioration is included in Sections 6.1.2.3, 6.1.3.3, 6.1.4.3, 6.1.5.2, 6.1.6.5, and 6.1.7.3.

3.6.3 Coal Haul Route

The location of the haul route is shown in Figure 3.18.

A report on an engineering investigation of the proposed coal haulage route was completed in May 1983.* This report looked at construction of a truck haul road along the existing Blue Vale Road between the Vickery Site and the existing train loading facility. The length of that route is 23 km.

The Vickery Project will use a slightly shorter route distance of approximately 20 km, achieved by modifying the loading and delivery points.

An upgraded road system that will accommodate the requirements of heavy vehicle use will also be a long term benefit for general community use. It provides a shorter route to the Gunnedah Sale Yards and Grain Terminal for those presently using the Blue Vale Road (Refer Sections 6.1.2.2, 6.1.4.2, 6.1.6.4, and 6.1.7.2).

3.6.3.1 Pavement Design

The pavement requirements will vary throughout the 20 km length of road. Three basic pavement conditions occur with differing Californian Bearing Ratio (CBR) values. Table 3.6-1 summarises pavement design.

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* GHD 1983 - Vickery Mine Project - Haul Road Proposal - Blue Vale Road - Gunnedah.

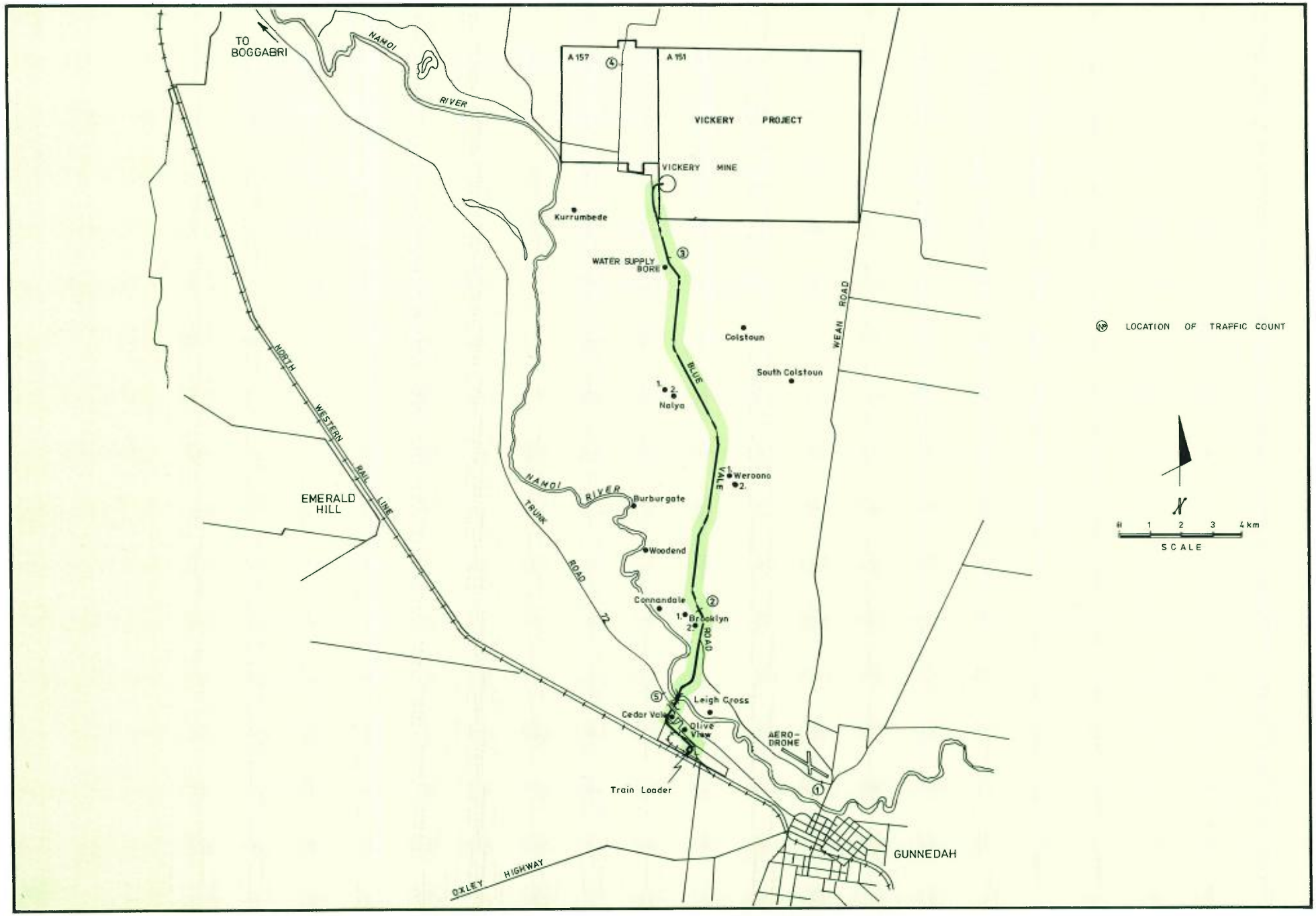

FIGURE 3.18

VICKERY JOINT VENTURE

THE COAL CLIFF COLLIERIES PTY LTD PROJECT MANAGERS

COAL HAULAGE ROUTE AND
TRAFFIC COUNT LOCATION

3.6.3.1 Pavement Design (Cont)

TABLE 3.6-1 PAVEMENT DESIGN PARAMETERS

PAVEMENT TYPE AND LOCATION	DESIGN PARAMETERS Length	Thickness
A: Conglomerate subgrade near the mine site (CBR 38%)	0.7 km	150 mm (Minimum)
B: Existing gravel pavement (CBR 3%)	15.6 km	620 mm
C: New pavement subgrade (CBR 2.7%)	3.7 km	620 mm

3.6.3.2 Alignment

The design speed adopted for the Blue Vale Road is 100km/h in accordance with DMR design standards*. Figure 3.19 shows typical cross sections of the upgraded Blue Vale Road.

Apart from the area near the Mine Site, the road is flat. The maximum grade is 6% and all vertical curves meet stopping sight distance standards.

3.6.3.3 Hydrology and Drainage Structures

A two year recurrence interval which approximates likely bank discharge from the Namoi River during floods was adopted for design. Multiple cell box culverts and causeways are proposed at low points and creek crossings. Causeway design will need further refinement to determine the most suitable structure for large flows at lagoons near the Namoi River.

Main Roads Form 371A was used to estimate the waterway areas for culverts. Design levels are required to determine the exact location of these structures. The discharge flows were calculated using the rational method, Talbots Formula, and discharges per km^2 for inland catchments. Further study will refine the design of drainage structures.

Design features of the Namoi River Bridge are shown in Figure 3.20.

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* Department of Main Roads Form No. 892, March 1981. Data for Design of Two Lane Rural Roads.

3.6.3.4 Trunk Road 72 Intersection

Trunk Road 72 will pass over the proposed haulage route. The bridge and approaches required to achieve this will be built at the present Trunk Road 72 and Torrens Road intersection (Refer Figure 3.21).

Figure 3.22 shows design details of the overpass.

Public traffic will gain access to the proposed haulage route through a "T" intersection off TR 72 approximately 350 m south of the overpass.

Beyond the overpass, toward the railway, Torrens Road is only a track providing access to one property.

Traffic analysis data indicated relatively low traffic levels on TR 72 at periods of maximum mine generated traffic ie: daylight shift change periods at 6-7 am and 2-3pm.

3.6.3.5 Construction

All material for road construction will be won and stockpiled on the Mine Site for cartage direct to road works.

Fine crushed rock and aggregate will be produced from onsite basalt and conglomerate. Conglomerate will be used for the road pavement. Selected conglomerate material will be suitable for embankment fill and sub-base.

Basalt material (large sizes) could be used for causeway construction and ballast over poor sub-grades.

The existing gravel pavement thickness is 100 to 250 mm. This will provide a good working platform for road reconstruction.

3.6.3.6 Required Road Fleet

The VJV propose to transfer a maximum of 1.94 Mtpa of saleable coal by semi-trailer from the Vickery Mine to the Train Loader. This will be achieved by trucking 24 hours per day over five days per week with some Saturday trucking when required (Refer Section 6.1.8).

A round trip will take 45 minutes.

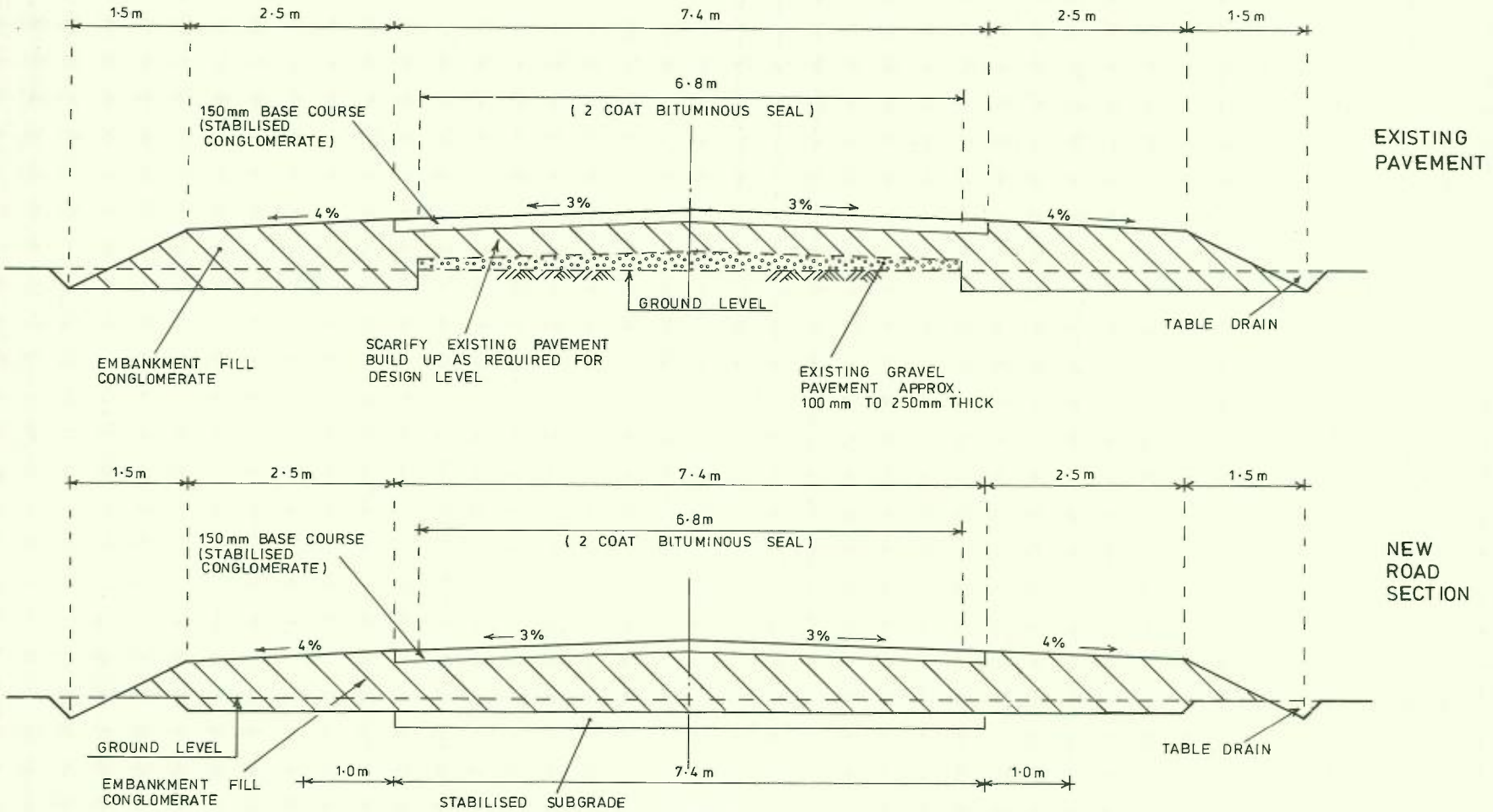
Trucks will carry 25 t of coal per trip, requiring 345 round trips per day. Fourteen to fifteen truck trips per hour will be required to transfer the coal.

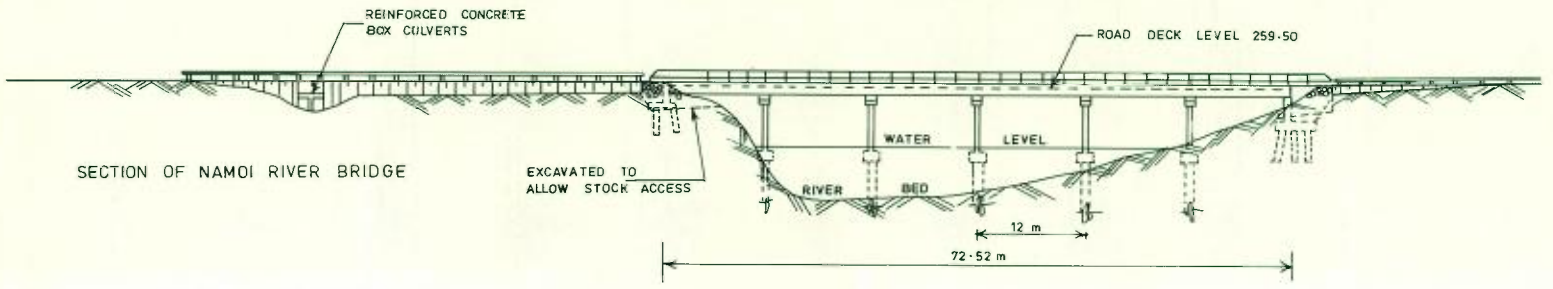
VICKERY JOINT VENTURE

THE COAL CLIFF COLLIERIES PTY LTD PROJECT MANAGERS

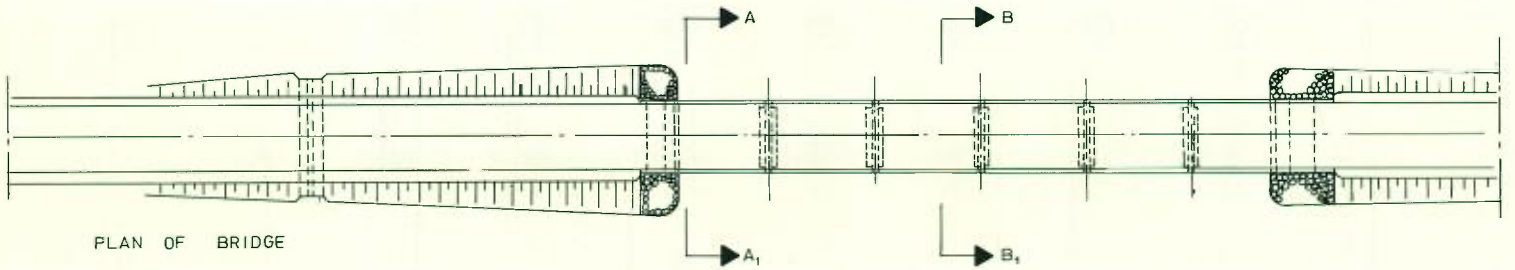
BLUE VALE ROAD – TYPICAL CROSS SECTIONS

FIGURE 3.19

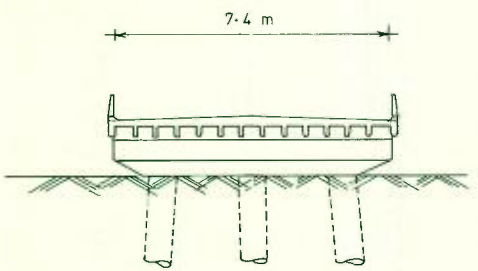




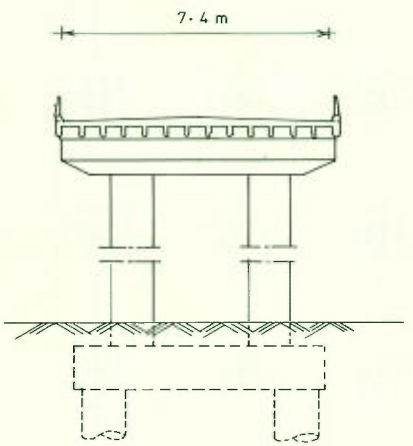
SECTION OF NAMOI RIVER BRIDGE



PLAN OF BRIDGE



SECTION A - A_1



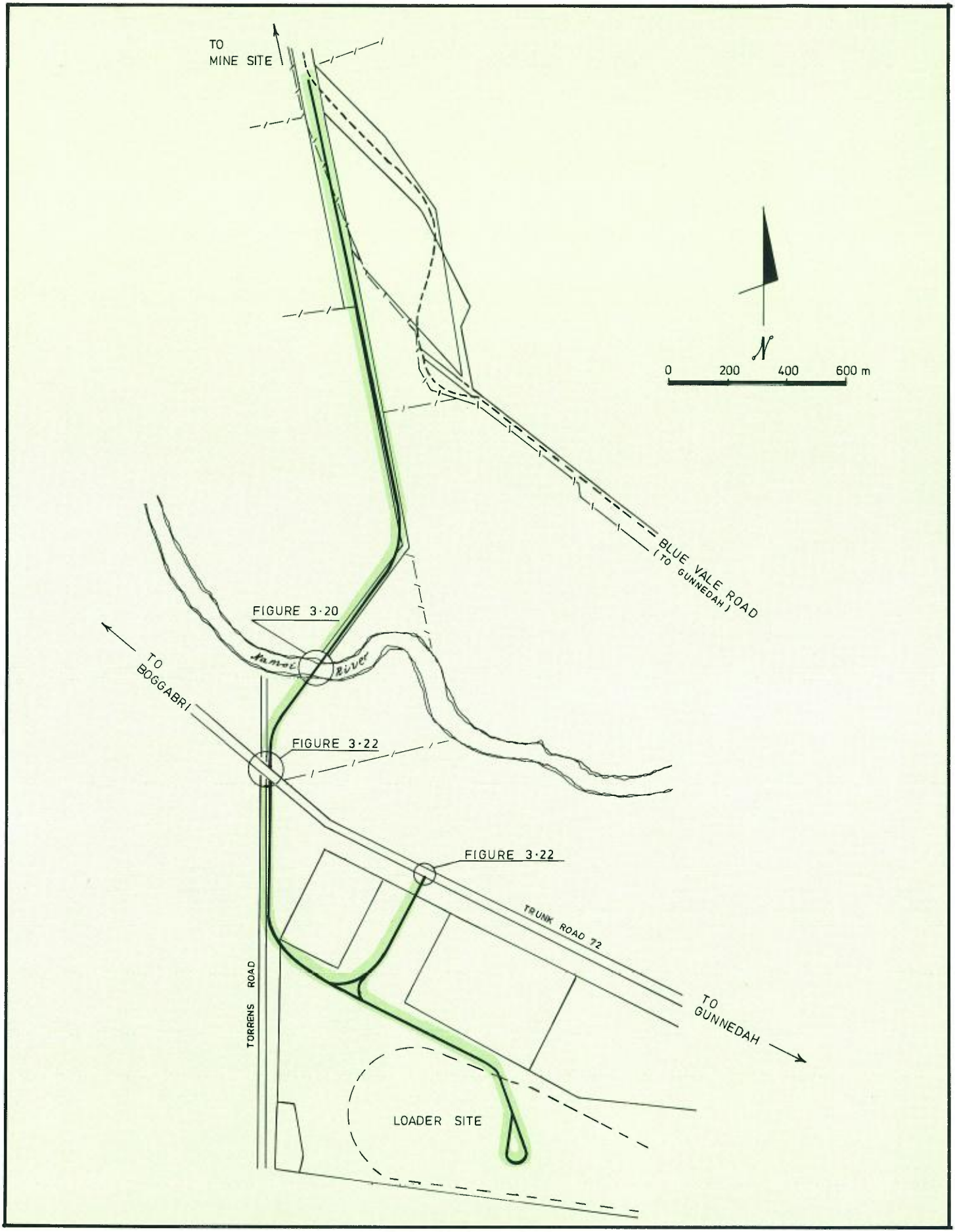
SECTION B - B_1

FIGURE 3.20

VICKERY JOINT VENTURE

THE COAL CLIFF COLLIERIES PTY LTD PROJECT MANAGERS

NAMOI RIVER BRIDGE

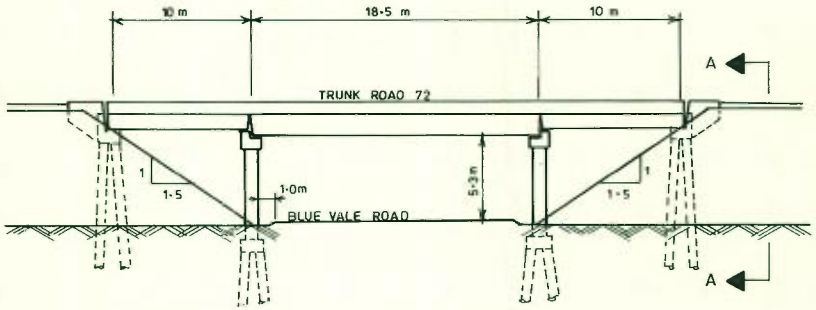


VICKERY JOINT VENTURE

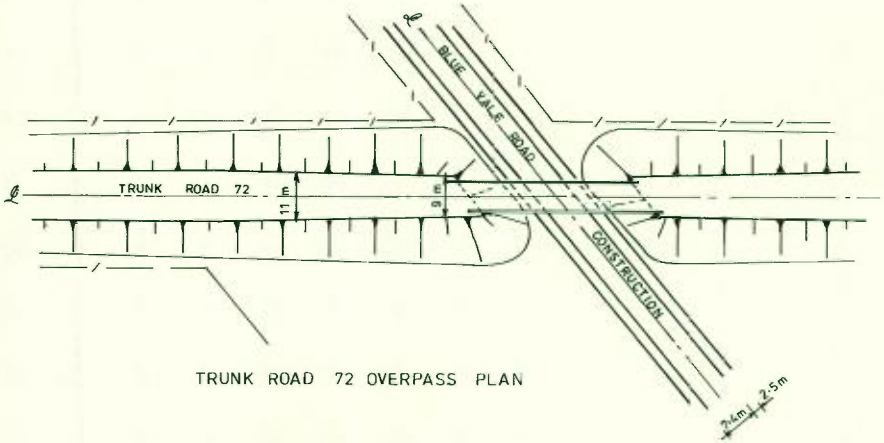
THE COAL CLIFF COLLIERIES PTY LTD PROJECT MANAGERS

HAULAGE ROUTE BLUE VALE ROAD
TO TRAIN LOADER

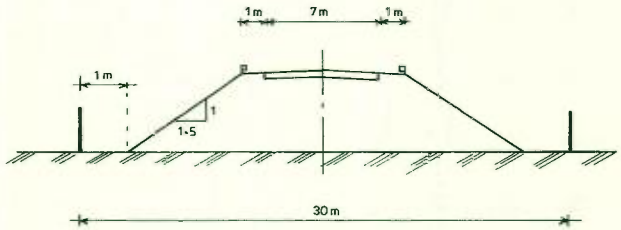
FIGURE 3.21



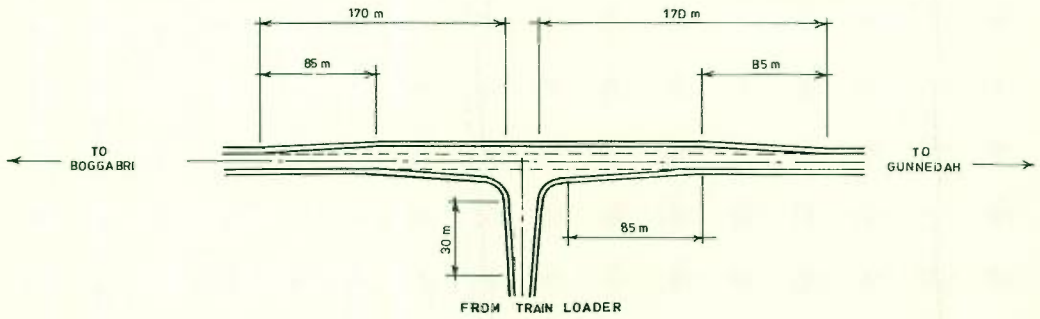
TRUNK ROAD 72
BRIDGE ELEVATION



TRUNK ROAD 72 OVERPASS PLAN



SECTION A-A ROAD RESERVE



TRUNK ROAD 72 AND TRAIN LOADER ACCESS INTERSECTION

FIGURE 3.22

VICKERY JOINT VENTURE

THE COAL CLIFF COLLIERIES PTY LTD PROJECT MANAGERS

TRUNK ROAD 72 BRIDGE
AND INTERSECTION

3.7 LANDSCAPING

All permanent facilities will be landscaped to screen components of the Project. Major structures will not be completely screened and will be painted or constructed of material of a suitable colour.

Topsoil will be stored for use in landscaping. Local native species will be used as a vegetation component of the landscaping. These will blend with existing remnant vegetation.

Concentrated plantings of trees and shrubs will be used to screen the tailings ponds and Greenwood Mine surface facilities.

Landscaping at the Train Loader will be undertaken to reduce visual impact from Trunk Road 72 and to vegetate acoustic mounds located around the site. Indigenous tree and shrub species will be used.

3.8 WATER MANAGEMENT

The VJV is committed to optimising use of site generated water and mine plans will reflect this commitment.

A production bore will be developed 2 km south of Vickery Mine. This will provide a total available capacity of 2.4 Ml/day. This is approximately 60% of the average capacity of agricultural irrigation bores on the Namoi floodplain.

Borewater will be pumped to a storage dam north of the Vickery Mine from where it will be reticulated around the site.

In an average rainfall year at maximum production the Mine will require 1.00 Ml/operating day. During a dry year this may approach 2.00 Ml/day. Maximum water requirement for the opencut operations is 0.5 Ml/day.

Borewater will be used to make up the difference between the estimated total water requirement (1.00 Ml/day) and water obtained from the site.

The borewater will be used for domestic supply. It has a total dissolved solids content of 447 mg/l.

No toxic runoff waters will result from the spoil placements. During construction, and until surface stabilisation is complete, runoff water from spoil areas will be high in suspended solids. A system of catch drains will be established to direct surface runoff into sediment dams. Discharge will occur for storm events in excess of a 1 in 20 year storm occurrence.

3.9 POWER AND COMMUNICATIONS

The Electricity Commission of New South Wales has constructed a new 132 kV to 66 kV substation approximately 8 km east of Gunnedah to augment the existing system. A connection to this substation will supply a substation at the Vickery Mine. The actual route will be determined by the Namoi Valley County Council.

Power at Red Hill Mine will continue to be supplied by a generator. The Greenwood Mine will have surface and underground reticulation at 11kV.

The Vickery Mine washery, workshop, bathhouse and office will be supplied at 11kV and transformed to 415 volts for general distribution.

The Mine will be connected to the Boggabri telephone exchange.

3.10 WORKFORCE

3.10.1 Construction Workforce

Construction will occur in three distinct stages. The first stage will be in the first year of the Project.

Table 3.10-1 outlines the construction workforce during this stage.

TABLE 3.10-1 CONSTRUCTION WORKFORCE - YEAR 1 OF PROJECT

Month	1	2	3	4	5	6	7	8	9	10	11	12
Number	54	63	86	85	104	100	98	74	83	86	93	98

The second stage is during Year 3 of the Project when an average 25 people will be on site for 12 months constructing the Vickery Mine surface facilities and access.

The third stage will be during Year 6 of the Project when the Vickery Mine shaft and drifts will be constructed. This will require 54 people for approximately 12 months.

3.10.2 Operation Workforce

The Red Hill Sampling Operation has an existing workforce of 33. The proposed Project will require an increased workforce of 186.

Table 3.10-2 outlines the Operation Workforce for the Project.

TABLE 3.10-2 OPERATION WORKFORCE

CLASSIFICATION	RED HILL	YEAR 1	YEAR 2	YEAR 7
Miner	24	81	126	134
Trades	5	25	48	50
Staff	4	28	35	35
TOTAL	33	134	209	219

The workforce should remain constant between Years 2 and 7. The workforce employed in Year 7 should be sufficient to produce 1.94 Mtpa.

3.11 ENERGY BALANCE

The energy output of the Project is saleable coal with specific energy of 29.0 MJ/kg as received at 8% moisture. Full production is 1.94 Mtpa of saleable coal, with an energy content of 563×10^{14}J.

The direct energy consumption of mining, preparation, and transport to Gunnedah represents about 0.5% of the total energy produced.

3.12 BUFFER ZONE

An area of 3660 hectares of agricultural land has been purchased by the Joint Venture. Part of this will provide an effective buffer zone around the Project.

The buffer zone farming objective is to ensure maximum land utilisation while accommodating mining requirements.

SECTION 4

ALTERNATIVES TO THE PROPOSED ACTION

4.1 MINING

A number of mining alternatives have been considered with different proportions of open cut and underground operations.

The selected option has been chosen on the basis of:

- Preferred scale of operation,
- Overburden to coal ratios within Domain 1,
- Coal quality within each Domain,
- Capital and operating costs for various sized underground and opencut mines.
- Environmental impact of each mining option.

The scale of initial development has been under review over recent years. Changing market conditions and the high risk factor associated with initial large scale development, have influenced the VJV to commence operations with a medium sized production capacity. The scale of development is considered to be an optimal balance that will achieve:

- Economic viability and acceptable economies of scale,
- Market acceptability,
- Flexibility,
- Acceptable environmental management.

The mine plan has been influenced by the need to access shallow and deep seams and minimise sterilisation of reserves. The chosen underground option provides multi-seam access at the shallowest point. The deepest seam at the chosen entry lies at 180 m compared with over 400 m further to the east within A151. These entries are situated on land owned by the VJV and they are adjacent to the preferred coal transport route. This option does not create any coal quality or marketing problems.

As there are no significant environmental constraints to this approach, no further underground alternatives were considered.

The option to open cut reserves in A157 has been investigated by the VJV. These reserves have high stripping ratios and are overlain by very strongly cemented conglomerate that cannot be stripped economically by conventional techniques. The economic viability of extracting the open cut reserves depends on the development of a cost efficient means of removing the overburden. The development of a suitable technique requires field testing of new equipment technologies.

4.1 MINING (Cont)

A cautious approach to future market forces and the need to prove the viability of extracting the open cut reserves, have been influential in the decision to develop three experimental open cut operations. These trials are necessary before further opencut options can be given serious consideration.

4.2 COAL PREPARATION AND WASTE DISPOSAL

Coal preparation is required to produce a consistent and optimal coal product. Some consideration has been given to different options associated with washery plant construction and operations. The production rate necessitates one large plant rather than a modular arrangement.

The site of the plant was selected on the basis of:

- Proximity to Vickery Mine entry,
- Proximity to the coal transport route,
- Proximity to power and water,
- Proximity to suitable refuse disposal sites,
- Minimal sterilising of reserves,
- A suitable construction site.

No environmental constraints affected the desired location, so no further alternatives were considered.

Waste disposal sites were selected with particular regard to:

- Disposal of coarse reject over underground workings and
- Disposal of tailings to minimise coal sterilisation.

Suitable locations close to the Preparation Plant were limited and the most appropriate options selected. No environmental constraints affected the chosen locations, so no further investigation of alternatives was warranted.

Fluidised bed combustion provides an option to use preparation plant waste to generate power. This option will remain under review as both a means of waste utilisation and a source of power generation. The method of disposal proposed will not preclude future recovery of the rejects for use in adoption of this technology.

4.3 TRANSPORT

4.3.1 Introduction

The selection of a transport corridor and transport mode were recognised as one of the major environmental aspects of the Vickery Project. A transportation study was undertaken by consultants in 1981 and 1982 (Ref. GHD 1982).

The hydrological aspects of transportation across the floodplain were fully investigated in studies by Coffey and Partners (1982) and by the Snowy Mountains Engineering Corporation (SMEC - 1983). The latter study involved a physical model study of the floodplain to assess the impact of various structures on flood flow and direction.

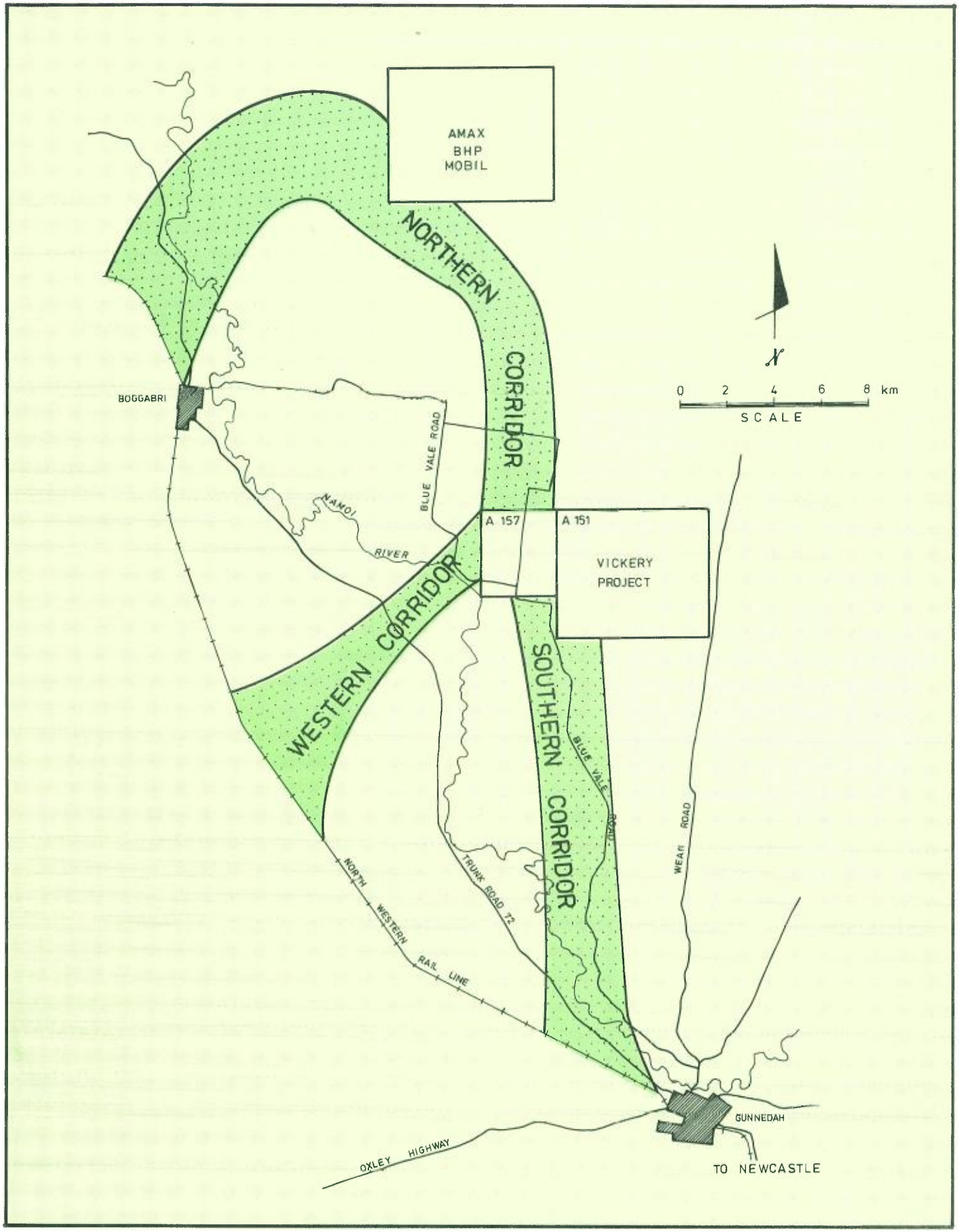
The following discussion of the various transport options refers principally to the effects of land acquisition, flooding, and economics on the choice of transport option.

The southern route option is selected primarily because of the ability of the developer to obtain access from the Mine Site to the Train Loader along Crown Land. The availability of Crown Land has eliminated the need to acquire private land. Acquisition of private land for the Vickery Project has been difficult.

The effect of transportation structures on flood flows was a major factor in the selection of the favoured transport mode and transport corridor. Acceptable structures have to be capable of withstanding serious flooding without affecting flood behaviour.

The economics of establishing and maintaining the transport mode and corridor played a vital part in the selection process.

The alternative access routes for coal haulage and general access requirements are indicated in Figure 4.1 and tabulated in Table 4.3-1.



VICKERY JOINT VENTURE

THE COAL CLIFF COLLIERIES PTY LTD PROJECT MANAGERS

POTENTIAL TRANSPORT CORRIDORS

FIGURE 4.1

TABLE 4.3-1 ALTERNATIVE TRANSPORT MODE MATRIX

	NORTH		WEST		SOUTH	
	Advantages	Disadvantages	Advantages	Disadvantages	Advantages	Disadvantages
Common to all Modes	. Flood free loader site	. 13 properties to cross, not owned by VJV . Tied to AMAX/BHP Mobil development . 3 roads to cross . 1 river to cross . Longest distance to Newcastle . Flood affected route . High cost option	. Shortest distance to rail line	. 5 properties to cross, not owned by VJV . 2 roads to cross . 1 river to cross . Structure at 90° to flood flow . Flood affected option	. Flood free loader site . Shortest distance to Newcastle . VJV owned land for loader	. 1 road to cross . 1 river to cross . Flood affected option
Rail	. Loading at Mine site . Unimodal transport	. Longest distance of new rail line . Less flexible than road	. Loading at Mine Site . Unimodal transport	. High cost to avoid flood flow redirection from embankments . Less flexible than road	. Loading at Mine Site . Unimodal transport	. Not cost effective at proposed tonnages . Inflexible mode . Land ownership problem . Major flood re-direction from structure
Road	. Flexible	. Bimodal transport	. Reduced cost over rail to avoid flood redirection . Flexible	. Bimodal transport . Loader on flood-plain	. Maximum flexibility . Most economic option . Property owned by VJV or Crown	. Truck traffic on public road system . Bimodal transport
Pipeline/ Aerial Ropeway/ Conveyor	. Greater ability to avoid flood problems than rail option	. Bimodal transport	. Greater ability to avoid flood problems than rail option	. Bimodal transport . Loader on flood-plain	. Most economic option for large scale production . Better environmental options . Greater ability to avoid flood problems	. 13 private landholder agreements required . Not flexible to account for production variations

4.3.2 Alternative Routes

Three possible routes exist for the transport corridor:

- North to the AMAX / BHP / Mobil proposed development.
- West across the floodplain to the North Western Rail Line
- South along the Blue Vale Road to the North Western Rail Line immediately west of Gunnedah.

Northern Route

The narrowest section of the floodplain occurs 7km north of Boggabri and it has been chosen as the location for a transport corridor to service the proposed Amax / BHP / Mobil Project.

Preliminary rail, road, and conveyor designs for the northern route were prepared. The distance between the Vickery Project and the proposed AMAX / BHP / Mobil Project is 19.8 km. The North Western Rail Line would be accessed via the Amax / BHP / Mobil development.

The total transport length from the loading point at the Vickery Mine site to Gunnedah is 75 km, compared with the proposed route of 20 km.

The development would cross three major creeks and Main Road 357.

This route is not suitable because:

- It is the longest route option.
- Property along the route has not been fully secured.
- It increases the coal haulage distance of Vickery coal by 55 km and this increases freight costs.
- A contribution to the cost of the proposed rail connection between Amax / BHP / Mobil and the North Western Rail Line would be incurred.
- Construction timing of the Amax / BHP / Mobil proposal is uncertain and is most likely to be behind the Vickery time schedule.

Western Route

Another alternative transport corridor is west across the Namoi Floodplain to the Rail Line. This is the shortest route from Vickery to the Rail Line, however it is not the shortest distance to the Port.

Preliminary rail, road, and conveyor designs for this route were prepared by the VJV. The length of this route, including the balloon loop of a rail mode is approximately 16.5 km. The rail spur would join the North Western Rail Line 22 km north of the proposed Train Loader Site. This results in a transport route length of 38.5 km to the proposed Train Loader compared to a length of 20 km using the southern route.

A suitable crossing point on the Namoi River could be selected to minimise bridge structures and Gulligal Lagoon could be passed to the north to avoid any interference to its local environment.

The transport corridor could bridge or cross TR 72 at grade at an acceptable location for traffic. Blue Vale Road is the only other dedicated road intersected by the transport corridor and it could be crossed at grade.

The route crosses the floodplain for approximately 12 km and at right angles to the river flow.

This route was carefully considered as it is the shortest distance from the Mine to the North Western Rail Line. However, it is not economically attractive as it involves an access corridor through private land. Negotiations for economic long term access through private properties were not favourable.

If a transport mode other than rail transport is selected for the western route, an offsite train loader would be required. This train loader would have to be located on land subject to flooding from the Namoi River. This necessitates a bund structure with its associated flood diversion problems.

Red Hill Sampling Operation coal is transported to Gunnedah using part of the western corridor. The route crosses a low level single lane bridge built over the Namoi River and passes through a private property. Coal trucks then travel along TR 72 to the existing Gunnedah Coal Loader.

This route was investigated for mine access and coal transport but was not suitable because:

- It is 36 km from the mine areas to the Train Loader, compared to 20 km for the proposed route.

- Agreement with the landholder only covers the Red Hill Sampling Operation. No agreement exists for long term access.

4.3.2 Alternative Routes (Cont)

Southern Route

Access from the Vickery Mine to the Train Loader Site is possible on Crown Land, eliminating the need to purchase private freehold land.

The Train Loader can be built on flood free land already owned by the VJV. The land is in a developing industrial area.

The majority of vehicle traffic to the Mine will be from Gunnedah. Therefore, the southern route has the dual function of mine access and coal transport.

The southern route is not the shortest route to the North Western Rail Line, however, it does provide the shortest transport distance between the Mine and Port Newcastle.

This is the selected transport route.

4.3.3 Transport Modes

Five transport modes were considered:

- Rail,
- Conveyor,
- Pipeline,
- Aerial Ropeway,
- Road haulage by conventional vehicles.

Rail

A rail connection to the Mine Site would have provided some benefits to the Project. One transport mode would be used to get coal from the Mine to Port. Road traffic on Blue Vale Road would be minimised.

There are aspects of the rail mode that make it less attractive. Coal moved from the Mine to the North Western Rail Line has to cross the Namoi River floodplain. A rail embankment has the potential to cause major redistribution of the flood flows. There is potential to increase flood levels upstream and increase water velocity downstream from a rail embankment.

The flooding problems of a rail line are associated with the southern and western routes. On the northern routes the rail access across the Namoi floodplain would be by high level bridge. This would avoid diversion of major floods. However, with the northern route, the connection between Vickery and the proposed AMAX / BHP / Mobil proposal would have been subject to local flooding from three major streams.

It is not possible to build a rail connection between the Mine Site and the North Western Rail Line along the three alternative transport corridors without acquisition of private freehold land.

Table 4.3-2 lists the commercial ranking at the proposed tonnage of the five options with 1 being the most attractive. Table 4.3-2 shows rail as the fourth most attractive commercial option.

TABLE 4.3-2 COMMERCIAL RANKING - TRANSPORT OPTIONS

MODE	RANKING
Truck	1
Aerial Ropeway	2
Pipeline	3
Rail	4
Conveyor	5

Conveyor

The conveyor option has the least attractive commercial ranking. It would have a positive benefit by minimising the amount of vehicle traffic between the Mine and the Train Loader.

In addition to its poor commercial ranking, the conveyor system is susceptible to flooding. To overcome the susceptibility to flood damage, an expensive structure is required.

On all transport corridors, freehold land would have to be acquired. Alternatively, the conveyor system would need a number of transfer points or incorporate curved conveyors. It would provide a permanent barrier to access and special provision would need to be made to cross the conveyors.

A conveyor system would require a bi-modal transport system and an off site Train Loader.

Pipeline

The VJV has investigated the use of a pipeline for coal transport to the North Western Rail Line. The pipeline system has a commercial ranking of 3.

4.3.3 Transport Modes (Cont)

Pipeline (Cont)

The pipeline system would result in minimal road traffic. A pipeline would be buried and hence out of sight and not affected by flood. There is a low maintenance cost on a pipeline system.

The commercial ranking of the pipeline system is volume dependent. The system is not flexible and economies are only achieved at higher, constant tonnages. The technology for slurry pipelining is untested in situations similar to the Vickery Project and represents an unacceptable risk.

The pipeline system also requires an off site Train Loader.

Aerial Ropeway

An aerial ropeway system could be built that is not affected by floods. It would minimise road traffic.

The aerial ropeway has some features detrimental to its use. Although second in the commercial ranking, its best economies are achieved when operating continuously at high capacity.

An aerial ropeway requires a nearly direct line between its end points. It is difficult to position a ropeway without passing close to several houses. To avoid this would require purchase of freehold land.

The aerial ropeway may create difficulties in areas using crop dusting. The aerial ropeway system would require an off site train loader.

Road Haulage by Conventional Vehicles

This is the selected transport mode.

The positive aspect of road haulage is the provision of an improved road system. This infrastructure is available for public use.

The road haulage system enables variations in the volume of coal moved to be handled economically. Capital is not invested in a system that is underutilised.

Overseas experience and initial trial experience in Australia suggests imminent changes in truck technology. This may include carrying larger tonnage in modified dual trailer configurations. If these changes were applied to the Vickery Project, the impact of road haulage would reduce and its commercial ranking would be enhanced.

The road across the floodplain can be designed to minimise the flood flow effects.

The negative aspects of road transport are the increase, in road traffic and the requirement to have a train loader off site.

4.4 FINAL LAND USE

Three major considerations concerning final land use involve:

- Placement of overburden dumps,
- Treatment of final voids,
- Proposed future land use.

Overburden dumps present no particular disadvantages in the proposed locations. Dump locations have been selected according to the criteria:

- No permanent sterilisation of reserves,
- Suitable topography,
- Minimal transport distance.

The Shannon Hill dump is on coal bearing ground with volumetric stripping ratios greater than $12m^3$ rock / t coal. If this area becomes economic to mine, the absolute volume to be rehandled becomes insignificant in a major operation.

The Blue Vale dump is located on non coal-bearing ground and is permanent. The Greenwood dump is on coal bearing ground but the volume involved does not warrant transport to an alternative location. Should the decision be taken to develop a large open cut mine on the site, the volume of overburden would be handled in conjunction with overburden stripping and placement at a more suitable site.

Filling the final void has not been considered a desirable option. The Maules Creek Formation has further potential to be developed as a coal resource. The existing voids would disappear in any major opencut proposal.

An alternative final landuse for the site other than grazing and forestry is not justified.

The establishment of vegetation on rehabilitated areas will be completed in accordance with Soil Conservation Service and Forestry Department Standards.

4.5 CONSEQUENCES OF NOT PROCEEDING

The Vickery Joint Venture has explored A151 and A157 and demonstrated the feasability of mining the coal resource. If the project were not to proceed the following would occur:

- Changes to the environment discussed in this document would not happen,
- Job opportunities for 219 people in an underground mine would be lost,
- Alternative overseas coal sources could be developed and affect Australian export income.

SECTION 5

THE EXISTING ENVIRONMENT

5.1 PHYSICAL AND BIOTIC ENVIRONMENT

5.1.1 Topography

The Mine site is gently sloping to undulating. Maximum height above sea level is 480 m at Bull Mountain, northeast of Al5l.

Gentle slope angles of between 1^{o} and 3^{o} predominate over the site. From Bull Mountain and other locations in the north-eastern corner of the Authorisations, the land slopes quickly flatten out onto the adjoining plains. Local relief (i.e. the difference between the highest and lowest points) is 236 m.

A number of intermittent streams flow across the Authorisations toward the Namoi River. These streams can be dry for many years and only flow for short periods after prolonged or heavy rain.

The Train Loader Site is elevated above the Namoi River flood plain and of a consistent low grade. Two minor catchments flow across the site.

The transport corridor is flat and subject to flooding.

5.1.2 Soils

5.1.2.1 Authorisation Soils

Six major soil types occur on the Authorisations. Whilst there is a correlation between rock and soil types at most sites, the combination of lateral surface movement and agricultural practices have considerably altered some natural soil profiles. Soils are fully discussed in a report compiled by Dr S. Miller of Dames & Moore (1982).

Figure 5.1 indicates soil distribution and location of soil test sites. Figure 5.2 shows depths of soils suitable for rehabilitation purposes. Figure 5.3 shows the soil profiles and estimates of rehabilitation suitability.

5.1.2.2 Transportation Corridor Soils

Two major soils occur along the Transportation Corridor. They are known locally as black and red soils. Both soils are depositional and occur on the Namoi River floodplain. The red soils are associated with the immediate floodplain, whilst the black cracking clay soils form from basaltic alluvium. The red soils are similar to the black soils, except that a thin band of recent alluvium occurs on the surface.

5.1.2.3 Train Loader Soils

Three dominant soil types occur within the site (Refer Figure 5.4). The soils are Euchrozems, Euchrozems overlain by alluvium, and Clay Soils with overlying alluvium. These soils have been described in detail by the Soil Conservation Service in the Gunnedah District Manual (1976).

5.1.2.4 Experimental Opencut Mine Soils

Soils and overburden analyses have been performed on material to be extracted during the opencut mine experiments at Shannon Hill, Greenwood and Blue Vale.

The **weathered upper zone** of the profile was sampled by using airlifted cuttings from boreholes.

All analyses were done on saturation extracts of the samples.

Table 5.1-1 details the important geochemical properties of the weathered overburden at Blue Vale.

TABLE 5.1-1 GEOCHEMISTRY OF UNCONSOLIDATED BOREHOLE MATERIAL - BOREHOLE WVK 526 AT BLUE VALE OPENCUT

SAMPLE NUMBER	SAMPLE INTERVAL	pH	EC mS/cm	Ca me/l	Mg me/l	Na me/l	SAR
1	0- 2	7.6	1.5	2.7	2.9	8.0	5.0
2	2- 4	7.3	2.1	1.7	3.0	12.7	8.4
3	4- 6	7.6	1.8	1.3	2.3	11.5	8.8
4	6- 8	7.4	1.7	1.1	1.9	9.4	7.8
5	8-10	7.3	1.3	1.0	2.2	8.2	6.7
6	10-12	7.6	1.2	0.9	2.7	6.4	5.0
7	12-14	7.6	1.5	1.2	4.9	6.3	3.9
8	14-16	7.8	1.5	1.6	5.5	5.3	3.1

Borehole WVK5, adjacent to the Shannon Hill Pit, was sampled to determine geochemical properties of the **unweathered overburden.** Again the saturated extract was used for analysis. Figure 5.5 shows the results of this analysis which is also representative of the Greenwood Opencut.

5.1.2.5 Soil Erosion

The Mine Area is extensively affected by sheet erosion with areas of minor gullying around major drainage lines.

The transport route is very flat and not affected by soil erosion.

The Train Loader Site has been heavily cultivated and minor gully and sheet erosion has occurred.

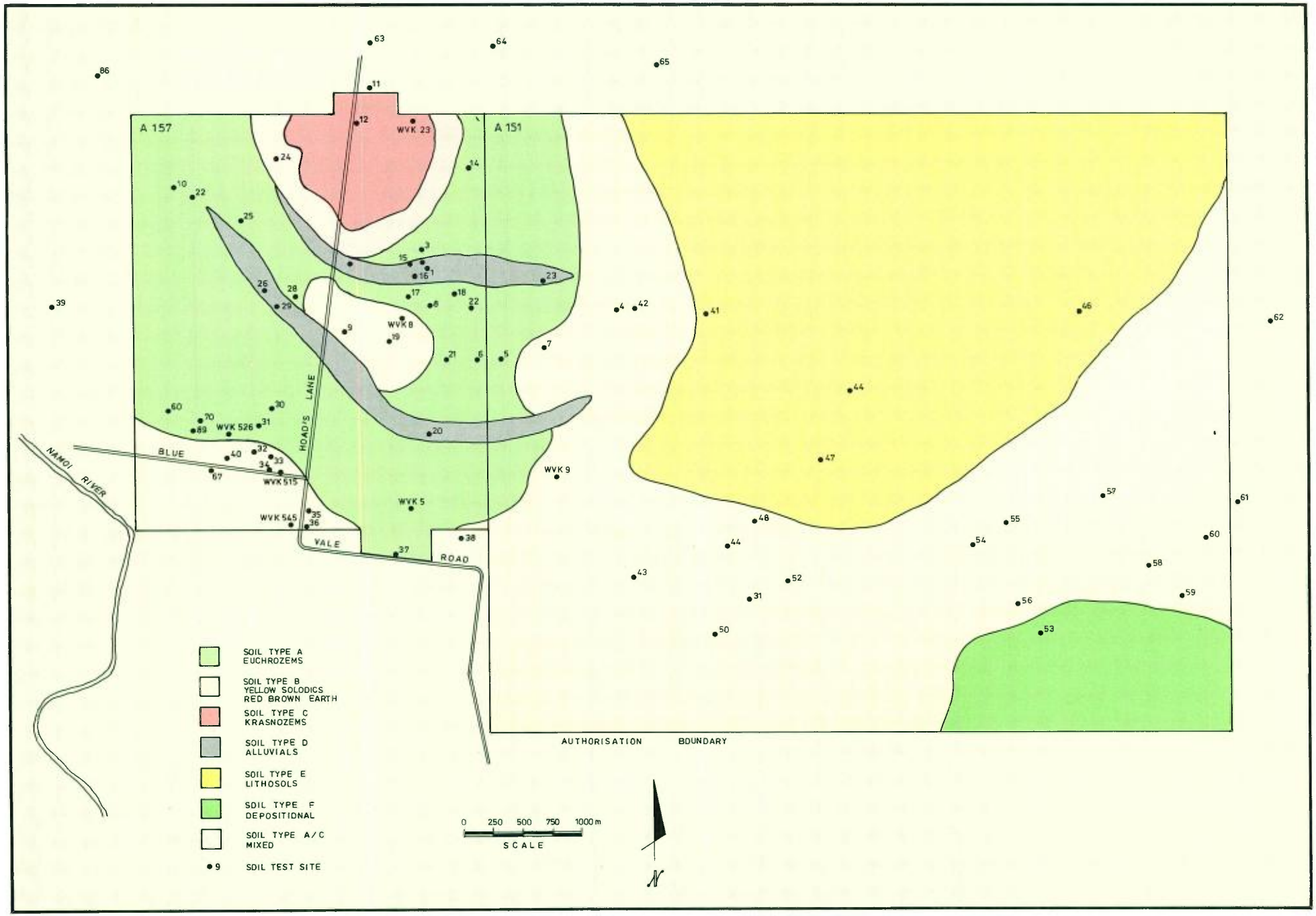


FIGURE 5.1

VICKERY JOINT VENTURE

THE COAL CLIFF COLLIERIES PTY LTD PROJECT MANAGERS

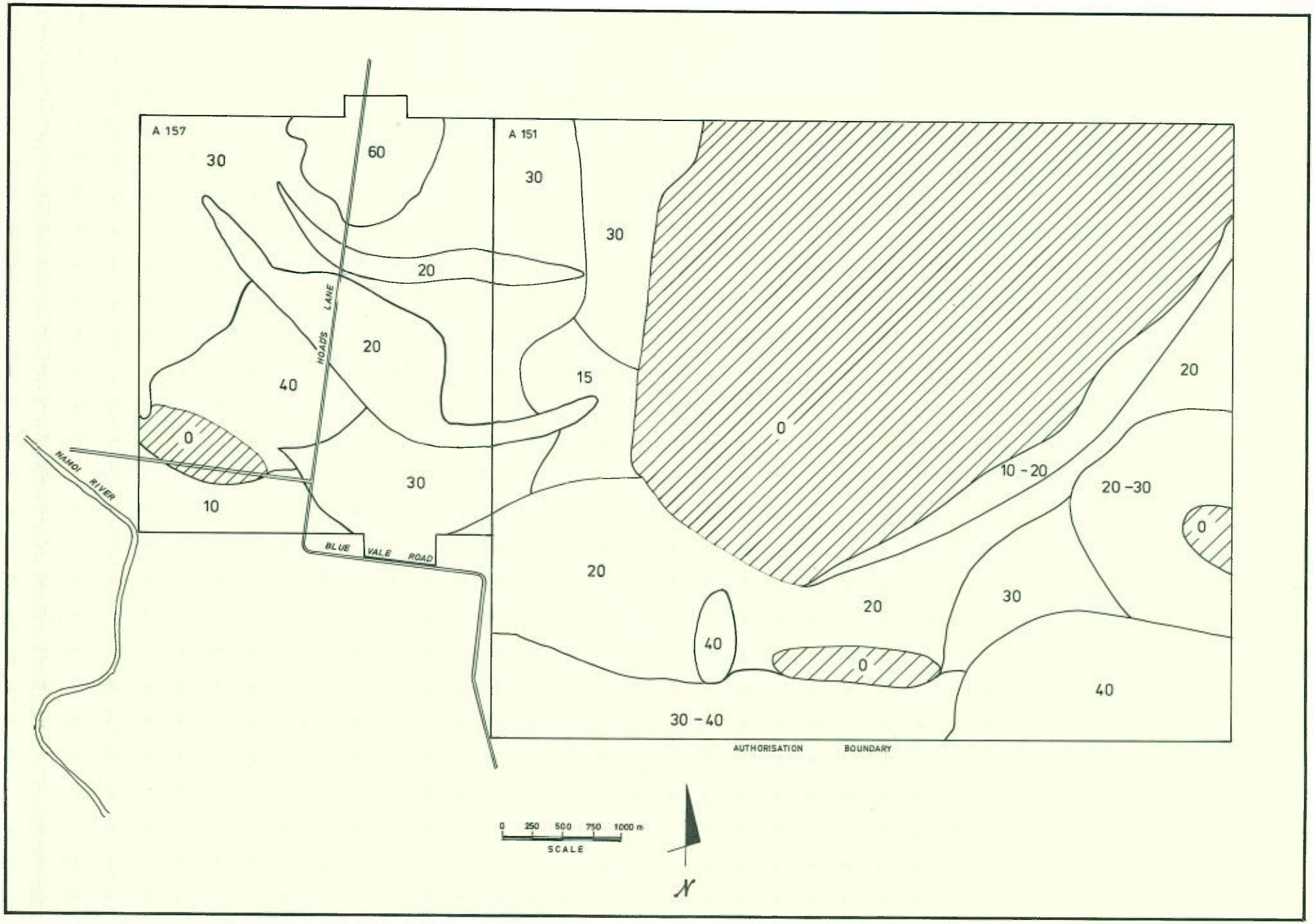
SOIL DISTRIBUTION

VICKERY JOINT VENTURE

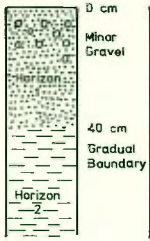
THE COAL CLIFF COLLIERIES PTY LTD PROJECT MANAGERS

DEPTH OF TOPSOIL (cm) SUITABLE FOR REHABILITATION

FIGURE 5.2

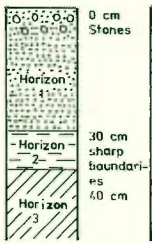


SOIL TYPE A — EUCHROZEMS



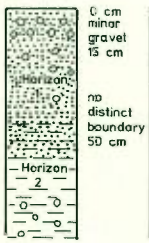
Horizon	Texture, Description	Preliminary Estimate for Suitability as Topdressing Material
1 Depth variable 10-40 cm	dark clay loam, some coherence and structure: gravel iron rich	suitable
2	dark red clay, coherent and structured, breaks to small irregular peds (2 cm), nondispersive	suitable

SOIL TYPE B — YELLOW SOLODICS; RED BROWN EARTHS



Horizon	Texture, Description	Preliminary Estimate for Suitability as Topdressing Material
1	stony loose loam commonly light brown in colour	may be unsuitable due to high stone content
2	structureless bleached loam hardsetting ; not always present	unsuitable
3	hardsetting orange / yellow mottled clay	generally unsuitable due to low moisture holding and hardsetting characteristics

SOIL TYPE C — KRASNOZEMS



Horizon	Texture, Description	Preliminary Estimate for Suitability as Topdressing Material
1	gravelly red clay loam	suitable
2	dark red clay firm and structured nodules of kaolin and fragments of basalt content	suitable however high clay content may require this soil to be mixed with less structured material

SOIL TYPE D — ALLUVIAL SOILS

Horizon	Texture, Description	Preliminary Estimate for Suitability as Topdressing Material
1	variously coloured lightbrown occasional gravel stringers and raunded rock fragments	surface 20 cm generally suitable
2	bleached or light loam, clay loam not always present	generally unsuitable or of negligable value
3	hard, mottled clay loam clay frequent cobbles and pebbles	unsuitable

SOIL TYPE E — LITHOSOLS

Horizon	Texture, Description	Preliminary Estimate for Suitability as Topdressing Material
1 depth variable 30-60 cm	very bleached, structureless sandy loam - loam; high stone content, low nutritent value	unsuitable

SOIL TYPE F — DEPOSITIONAL SOILS

Horizon	Texture, Description	Preliminary Estimate for Suitability as Topdressing Material
1	dark brown clay loam grading into brown clay goad crumbly structure and non dispersive	suitable although large quantities of black clays may swell and crack

FIGURE 5.3

VICKERY JOINT VENTURE

THE COAL CLIFF COLLIERIES PTY LTD PROJECT MANAGERS

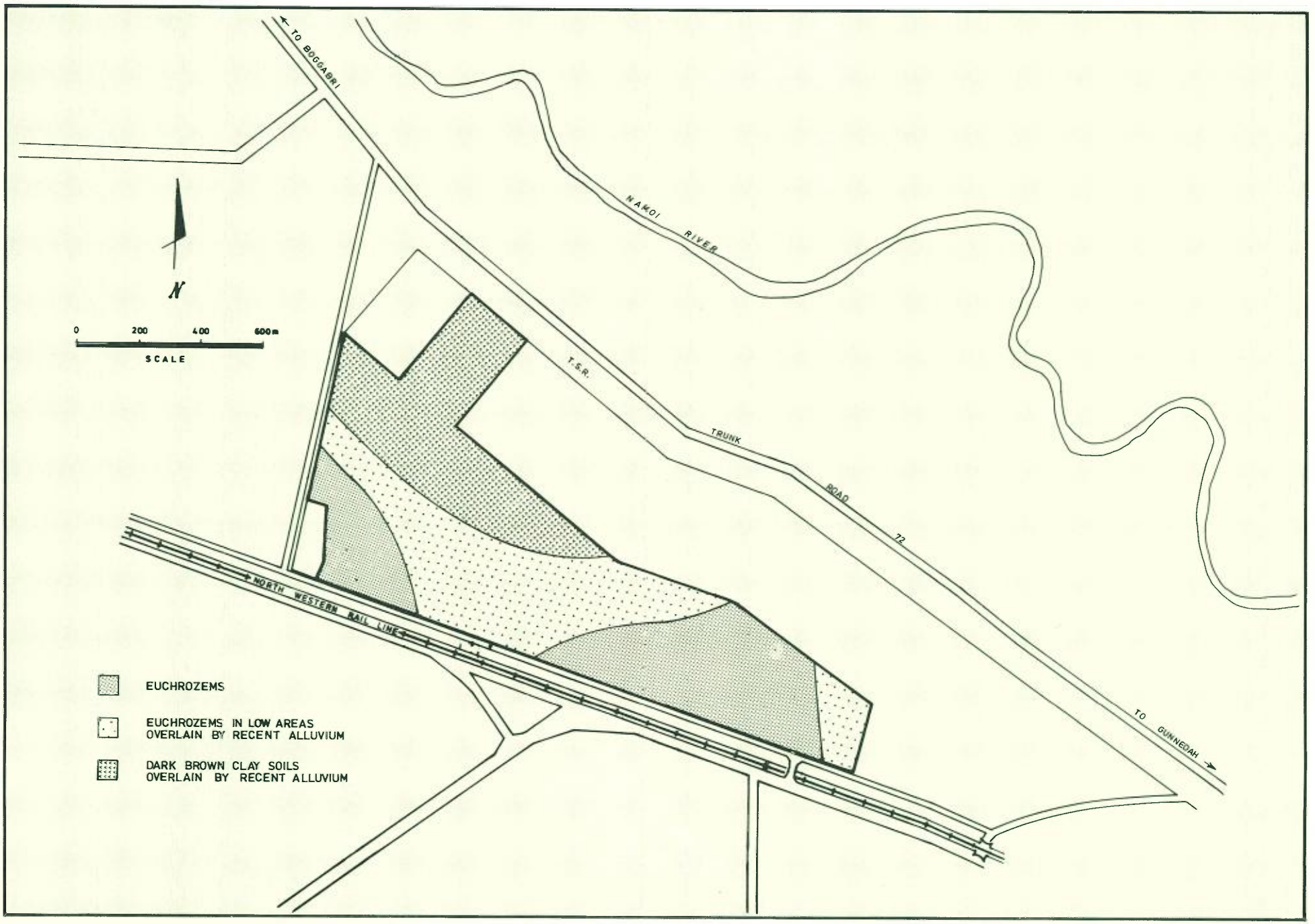
SOIL PROFILES

VICKERY JOINT VENTURE

THE COAL CLIFF COLLIERIES PTY LTD PROJECT MANAGERS

TRAIN LOADER SITE SOILS

FIGURE 5.4



LITHOLOGY	SAMPLE NO	SATURATION EXTRACT ANALYSIS																	TOTAL ELEMENTS						HOT WATER SOLUBLE
		pH	EC mS/cm	Ca me/l	Mg me/l	Na me/l	SAR	Cl me/l	CO_3 me/l	HCO_3 me/l	SO_4 me/l	Se µg/l	B µg/l	Mo µg/l	As µg/l	Cd µg/l	Pb µg/l	Zn µg/l	Se ppm	Mo ppm	As ppm	Cd ppm	Pb ppm	Zn ppm	B ppm
Pebble conglomerate, interbedded mudstone, weathered towards top	1	7·7	1·2	0·53	0·48	9·0	12·7	7·7	NIL	0·75	1·52	2	0·11	42	1·0	0·12	38	50	0·2	1	2·5	0·1	12	46	0·27
Pebble conglomerate and sandstone interbedded mudstone, siltstone	2	7·2	1·0	2·29	2·14	3·12	2·2	0·30	NIL	0·54	7·60	6	0·11	1	3·2	0·52	21	400	0·2	2	2·7	0·1	20	78	0·34

LEGEND

- CONGLOMERATE
- SANDSTONE
- SILTSTONE
- MUDSTONE
- UNCONSOLIDATED MATERIAL
- CORE LOSS

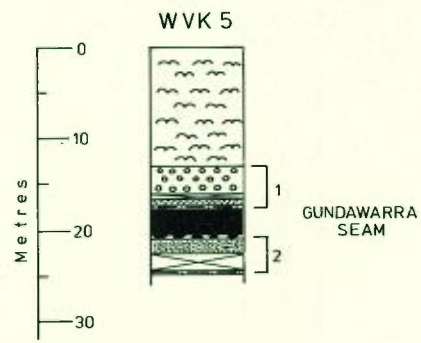


FIGURE 5.5

VICKERY JOINT VENTURE

THE COAL CLIFF COLLIERIES PTY LTD PROJECT MANAGERS

GEOCHEMICAL PROPERTIES OF UNWEATHERED OVERBURDEN

5.1.3 Hydrology

Hydrological investigations were carried out as part of mining feasibility studies (Coffey and Partners, 1982) and were concerned with:

- Flooding in the Namoi River,
- Surface water inflow to the Mine,
- Discharges at minor stream crossings east of Boggabri,
- Mine water supply,
- Groundwater quality,
- Local and regional water use.

5.1.3.1 Surface Hydrology - Transport Route and Authorisations

The Namoi River at Gunnedah has a catchment of 17,000 km^2, of which 5,700 km^2 is regulated by Keepit Dam. Between Gunnedah and Boggabri the Namoi is characterised by a wide floodplain and gentle catchment slopes.

Table 5.1-2 shows the monthly distribution of major flooding of the Namoi River at Gunnedah. A major flood occurs when the Namoi River breaks its banks.

TABLE 5.1.2 MONTHLY DISTRIBUTION OF FLOODING AT GUNNEDAH FROM 1892 to 1985

MONTH	NO. OF EVENTS
January	12
February	11
March	8
April	2
May	5
June	17
July	15
August	9
September	8
October	14
November	8
December	9

Major floods at Gunnedah occur between January and March. Moderate flooding can occur in any month, but is rare in April and May. Major flooding generally results from heavy rain associated with cyclonic depressions and persists for several days to several weeks.

During major flooding, extensive areas of the floodplain are inundated by shallow, slow-moving water.

A Water Resources Commission stream gauge is located at Gunnedah. Eighty percent of total discharge during major floods occurs as overbank flow (WRC 1980). Peak flood height and discharge data are listed in Table 5.1-3.

TABLE 5.1.3 PEAK FLOOD HEIGHT AND FLOOD DISCHARGES - GUNNEDAH

	Flood Ht. (m)	Peak Discharge (m^3/s)
Feb 1955	9.65	9300
Jan 1971	8.95	4700
Jan 1984	8.80	3600
Jan 1976	8.70	3400
Jan 1964	8.65	3300
Jan 1974	8.45	2600

Source: WRC - Gauge (Flood) height data.

Stream catchments within the Authorisations are shown on Figure 5.6. All proposed mine facilities are above the 100 Year Flood Level. The vehicular transport routes between the Mine and both Gunnedah and Boggabri are subject to Namoi River flooding.

5.1.3.2 Surface Hydrology - Train Loader Site

The Train Loader Site is located 1 km south of the Namoi River, approximately 7 km downstream from the confluence of the Namoi and Mooki Rivers. The Water Resources Commission flood inundation map of Gunnedah indicates the 50 to 100 year flood line encroaching on the northern boundary of the site. The majority of the site remains flood free.

The Draft Local Environmental Plan for Gunnedah shows the extent of local inundation which occurred in the 1984 flood. Local inundation comprises drainage from land south of the Train Loader Site (Refer Figure 5.7). The difference between the 100 year flooding and the waterlogging of the 1984 flood (a 1 in 14 year flood) demonstrates the extent of land affected by water draining onto the site from the south.

Local drainage onto the site passes through culverts beneath the North Western Rail Line. The catchment above the culverts has an area of 3,650 hectares. The culvert capacity controls the rate of stormwater flow onto the site.

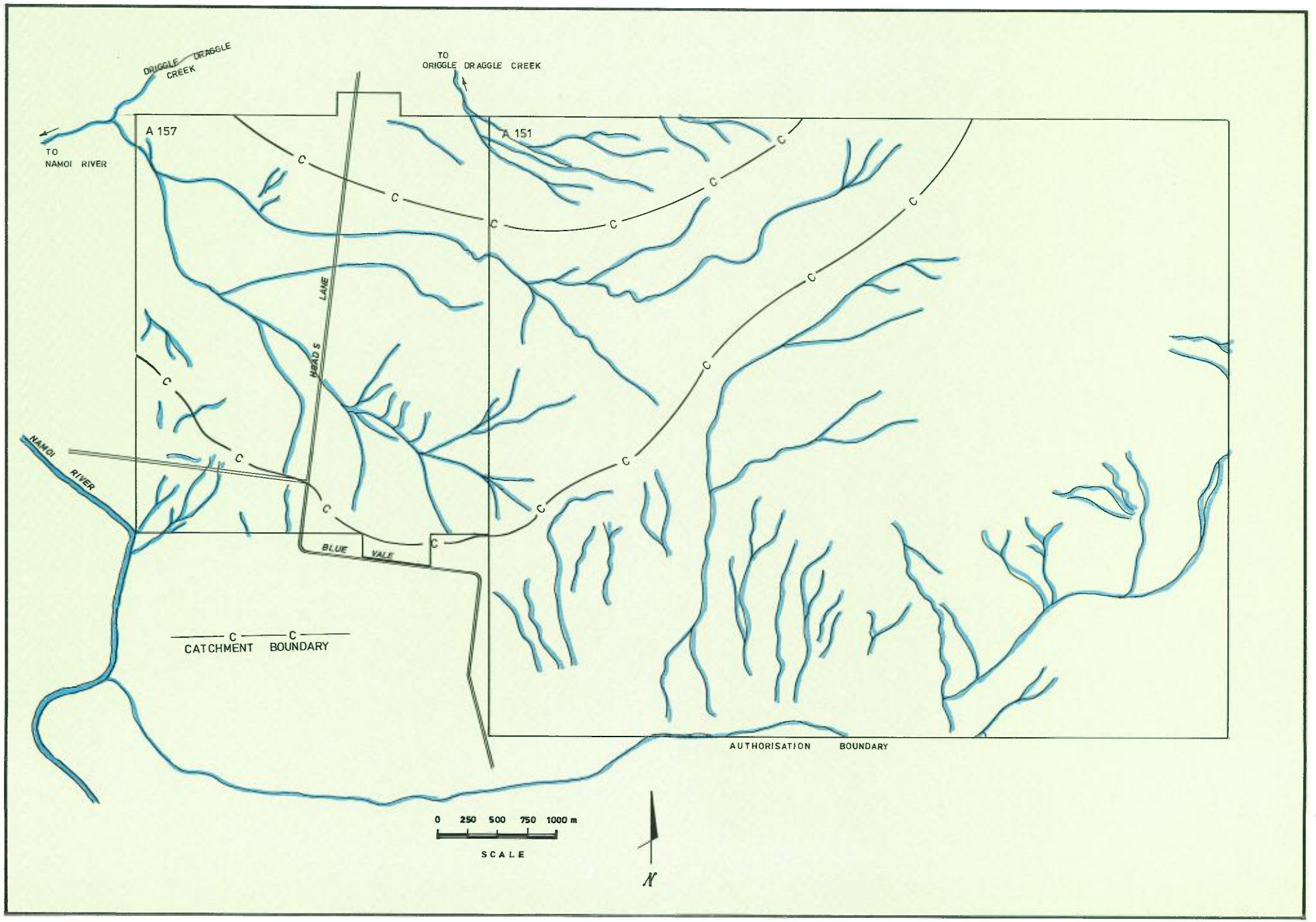
Drainage works adequate to cope with the water flow from the south will render the Train Loader floodfree.

VICKERY JOINT VENTURE

THE COAL CLIFF COLLIERIES PTY LTD PROJECT MANAGERS

AUTHORISATION STREAM CATCHMENTS

FIGURE 5.6



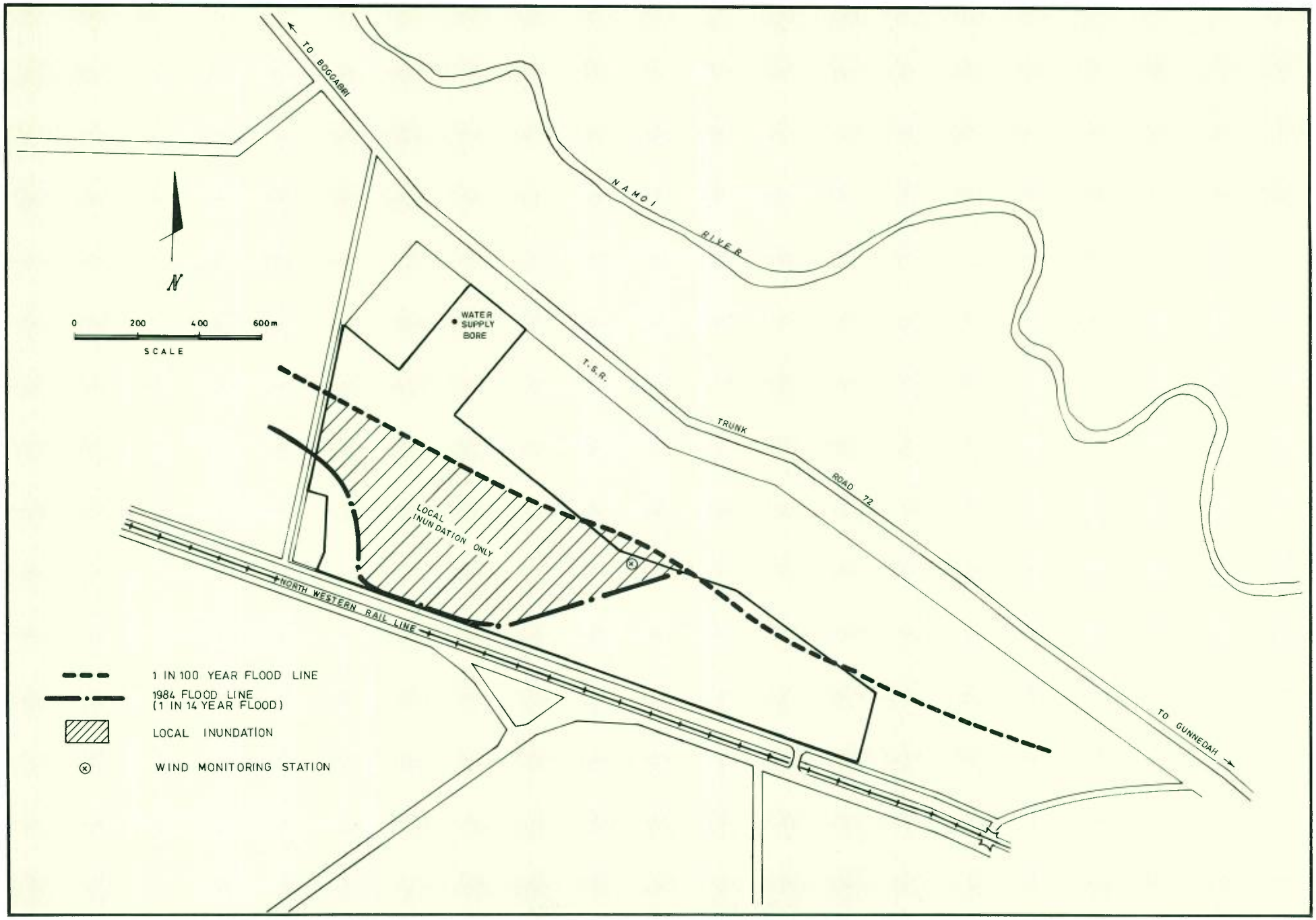


FIGURE 5.7

VICKERY JOINT VENTURE

THE COAL CLIFF COLLIERIES PTY LTD PROJECT MANAGERS

TRAIN LOADER SITE
FLOOD LEVELS

5.1.3.3 Groundwater Hydrology

There are two main types of aquifers in the region:

- Unconsolidated alluvial sediments of the Namoi Valley characterised by high permeability and good water quality (less than 500 mg/l Total Dissolved Solids [TDS]).

- Fractured basement rock aquifers with relatively low permeability with good to medium water quality (between 500 and 2500 mg/l TDS).

The unconsolidated alluvial Namoi Valley sediments between Gunnedah and Boggabri contain about 40 million Ml of groundwater. This occurs in an upper zone of sandy gravels and in a lower sandy aquifer within a palaeochannel of the Namoi River. The lower zone has the greater groundwater potential. The alluvial aquifers are recharged from the Namoi River, particularly during flooding. Direct aquifer recharge through rainfall and infiltration is minor.

Discharge takes place through groundwater extraction, by evapotranspiration, evaporation through the soil profile and by regional flow down the Valley. Regional flow is controlled by a constriction at Heathcliff, 7 km downstream from Boggabri.

Groundwater levels in the Valley are in equilibrium with normal river levels. The waters have similar salt content, with TDS normally below 500 mg/l. The water is used extensively for irrigation and town supply.

The alluvial aquifers were sampled by a test bore, 2 km south of the proposed Vickery Mine. The site is located in a stock reserve and is more than 1 km from the nearest outcrop of basement rocks.

The closest irrigation bore is 1.7 km south of the test bore. The irrigation bore is on property owned by the VJV and is not operating.

The main aquifer in the test bore occurs between 22 m and 36 m. It is comprised of cobbles, grading up to gravels then sand. Pump testing indicated the aquifer could produce up to 5.0 Ml/day. Step Testing verified a long-term pumping rate of 2.4 Ml/day.

Hardrock aquifers are present in the mining area. A census of existing bores in this area indicated an unconfined aquifer within the weathered zone, flowing at the rates of 0.5 - 1.0 l/s into stock water supply bores. The coal seams are the deeper aquifers.

Water table levels are monitored in geological exploration wells. The depth to the water surface varies from 16 to 50 m and is not related to rock type. Groundwater contours reflect topographic contours. There are groundwater elevations beneath Red Hill, on the ridge from Shannon Harbour to Blue Vale, and beneath the Vickery Forest. The major flow directions of underground water are similar to surface water patterns.

A groundwater use survey identified all bores in the vicinity of the Project*. The majority are shallow windmill equipped stock bores. Groundwater withdrawals in the vicinity of the Vickery site are low, particularly south of the Authcrisation.

The Namoi floodplain between Gunnedah and Boggabri is used extensively for irrigated agriculture. This does not apply to the floodplain immediately south of the Project. The Mine will draw its potable and make up water from this adjacent southern area. The water supply for the Train Loader will come from a groundwater source (Refer Figure 5.7).

Groundwater withdrawals in the immediate vicinity of the Mine are low. Withdrawals near the Train Loader are for domestic and small irrigation acreages.

A comparison of the proposed Mine and Train Loader withdrawals with existing water use is presented in Table 5.1-4. The Mine will not be a major user of water in the Region.

TABLE 5.1-4 COMPARISON OF EXISTING USES AND PROPOSED MINE AND TRAIN LOADER WATER USE. (Megalitres)

USER	ANNUAL USE (Ml)
Mine	496
Gunnedah Town	3600
Boggabri Town	600
Train Loader	97
Single Irrigation Farm	
a) Groundwater	500-2000
b) River Water	1200

The groundwater below the Train Loader Site occurs within the overlying alluvium or in aquifer zones within solid rock below the alluvium. A groundwater supply of 1Ml/day/bore could be obtained.

* Coffey & Partners 1982 - Hydrological and Hydrogeological Studies.

5.1.3.4 Water Quality

Table 5.1-5 shows water quality data determined by the Vickery Project Water Monitoring Programme. The location of the water sampling sites are shown in Figure 5.8.

Surface Water

Surface water in the Vickery Area is suitable for common uses, including livestock watering, crop irrigation, industry or domestic purposes.

Two main surface water types are present:

- Namoi River water, which has a TDS level of 300-400 mg/l, principally calcium, sodium, bicarbonate and sulphate, and 1-2 mg/l iron;

- Site runoff, with a TDS level of 150-180 mg/l (TDS above 200 mg/l usually attributable to dissolved inorganic matter) principally calcium, sodium, potassium, bicarbonate and sulphate, and 1-30 mg/l iron.

The waters would be suitable for agricultural uses, except for watering the most salt sensitive crops.

Groundwater

The shallow hard-rock aquifers are generally of moderate to poor quality. They are moderately saline, with high alkalinity and dissolved iron levels. TDS levels range between 900-5700 mg/l. The major ions are sodium, bicarbonate and chloride. Some areas of potable quality hard rock aquifer groundwater occur.

The moderate to poor quality groundwater is unsuitable for domestic use, irrigation of salt sensitive crops or some industrial purposes. This water would be suitable for dust suppression.

Groundwater from the unconsolidated alluvial sediments of the Namoi floodplain will supply the Mine with its potable and makeup water.

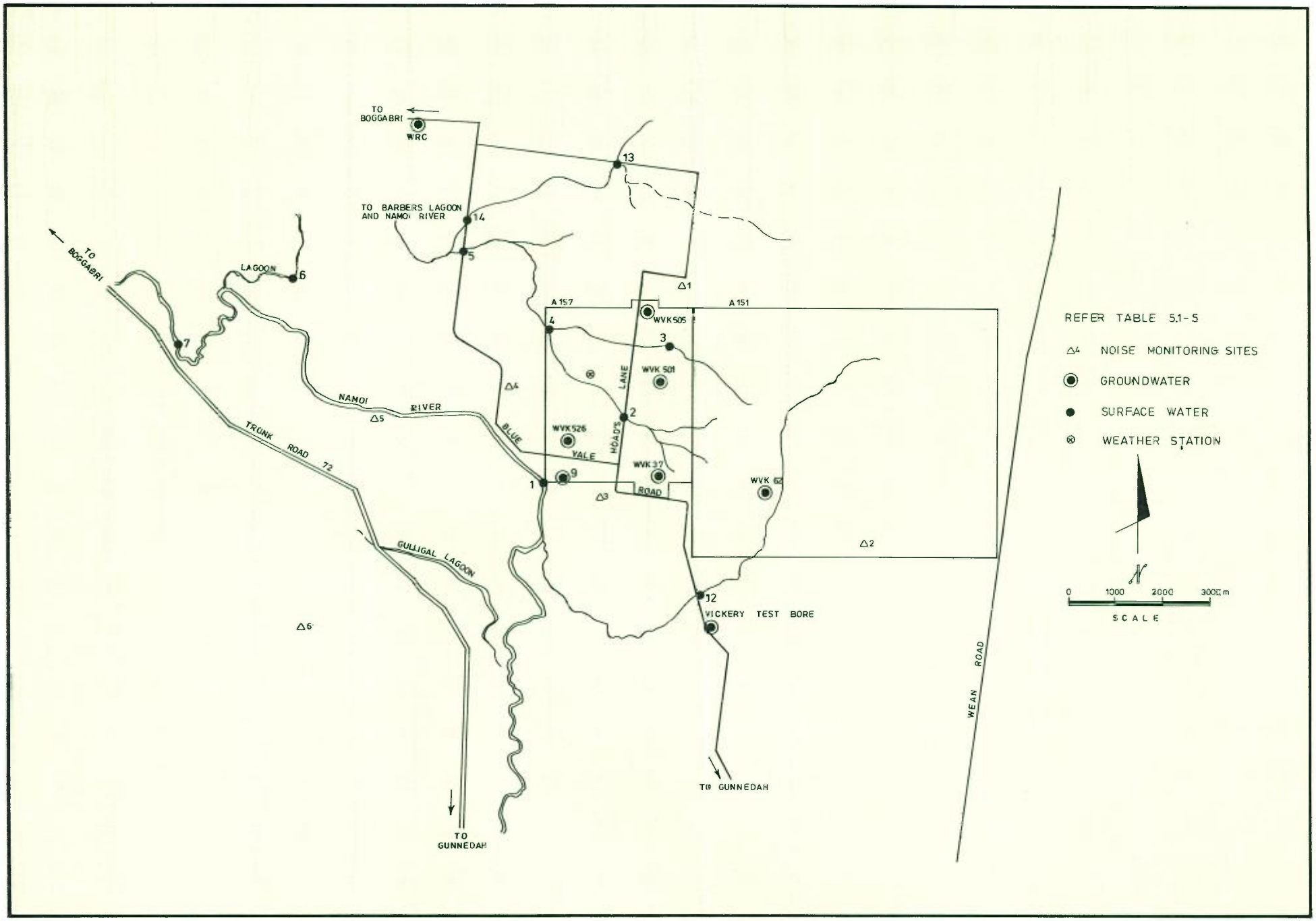


FIGURE 5.8

VICKERY JOINT VENTURE

THE COAL CLIFF COLLIERIES PTY LTD PROJECT MANAGERS

MINE SITE WATER SAMPLING SITES
WEATHER STATION LOCATION AND
NOISE MONITORING SITES

TABLE 5.1-5 WATER QUALITY

BOREHOLE/MINE LOCATION	WVK505 Red Hill	WVK501 G'wood O/C	WVK 37 G'wood U/G	WVK526 B.Vale O/C	WVK 62 Vick'y U/G	1	2	3	4	5	6	7	9	12	13	14	Vick'y Test Bore	WRC
pH (Method 423*)	6.9	7.4	7.0	6.8	6.8	8.0	8.8	8.4	9.1	8.4	8.5	7.7	7.4	7.8	6.8	7.8	7.3	8.0
Specific Conductance at 25°C, microSiemens/cm (Method 205*)	2039	1140	798	1140	2290	511	151	165	185	154	273	517	2489	373	96	98	773	X
Total filtrable residue, 180°C, mg/l Method 209B*)	1147	682	686	2570	1360	315	468	376	284	540	285	311	1456	686	78	492	X	X
Non-filtrable residue, mg/l (Method 209D*)	90	54	52	100	21	43	50	32	18	221	74	39	39	179	X	X	1	X
Total alkalinity, to pH 4.5, as $CaCO_3$m mg/l (Method 403*)	620	465	377	--	--	170	92	93	104	99	154	167	607	315	X	X	358	X
Calcium, Ca, mg/l (Method 311A*)	104	46	62	64	140	40	12	12	19	9	27	41	120	21	6	5	53	46
Magnesium, Mg, mg/l (Method 318A*)	138	36	30	38	101	22	5	10	5	4	10	22	76	17	2	2	31	19
Sodium, Na, mg/l (Method 325A*)	126	149	66	142	225	36	12	13	14	42	14	35	32	59	11	19	77	81
Potassium, K, mg/l (Method 322A*)	5	8	18	19	11	3	14	9	13	7	9	3	24	6	5	5	1	2
Total Iron, Fe, mg/l (Methods 302D*, 315A*)	3	4	2	45	2	2	13	8	7	19	10	2	3	26	5	20	0.6	X
Total Manganese, Mn, mg/l (Methods 302D*, 319A*)	0.14	0.36	0.11	--	--	0.09	0.15	0.05	0.12	0.20	0.53	0.08	0.13	0.24	X	X	0.14	X
Total Copper, Cu, mg/l (Methods 302D*, 313A*)	0.01	0.02	0.01	--	--	0.02	0.00	0.01	0.01	0.01	0.01	0.01	0.02	0.02	X	X	0.01	X
Total Zinc, Zn, mg/l (Methods 302D*, 328A*)	0.11	0.06	0.08	--	--	0.02	0.02	0.02	0.01	0.02	0.02	0.02	9.38	0.04	X	X	0.03	X
Total Lead, Pb, mg/l (Methods 302D*, 316A*)	0.07	0.02	0.01	--	--	0.02	0.02	0.02	0.00	0.02	0.01	0.01	0.03	0.03	X	X	0.04	X
Total Cadmium, Cd, mg/l (Methods 302D*, 310A*)	0.00	0.00	--	--	--	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	X	X	0.00	X
Chloride, Cl mg/l (Method 307D*)	334	151	37	38	310	36	6	4	5	8	11	36	435	38	2	3	20	47
Bicarbonate HCO_3 mg/l (Method 403*)	702	402	488	739	866	199	81	96	107	73	157	199	740	220	48	50	437	316
Sulphate, SO_4, mg/l (Method 426C*)	46	50	19	23	120	54	10	9	9	8	18	58	106	8	1	1	46	34
Nitrogen-nitrate, NO_3 mg/l (Method 418D*)	1.1	2.1	4	--	--	2	6	2	4	5	4	2	1	2	X	X	0.1	X
Total Phosphorus, P, microgram/l (Methods 424Ciii*, 424F*)	0.13	0.76	0.60	--	--	0.16	0.32	0.20	0.20	0.37	0.51	0.15	0.04	0.04	X	X	0.13	X
Cations / Anions, %	101.5	99.9	101.1	98.3	99.3	100.8	96.0	97.2	98.7	102.3	95.3	100.2	100.5	101.2	X	X	X	X

* Standard Methods for the examination of Water and Wastewater, 15th Edition, 1980

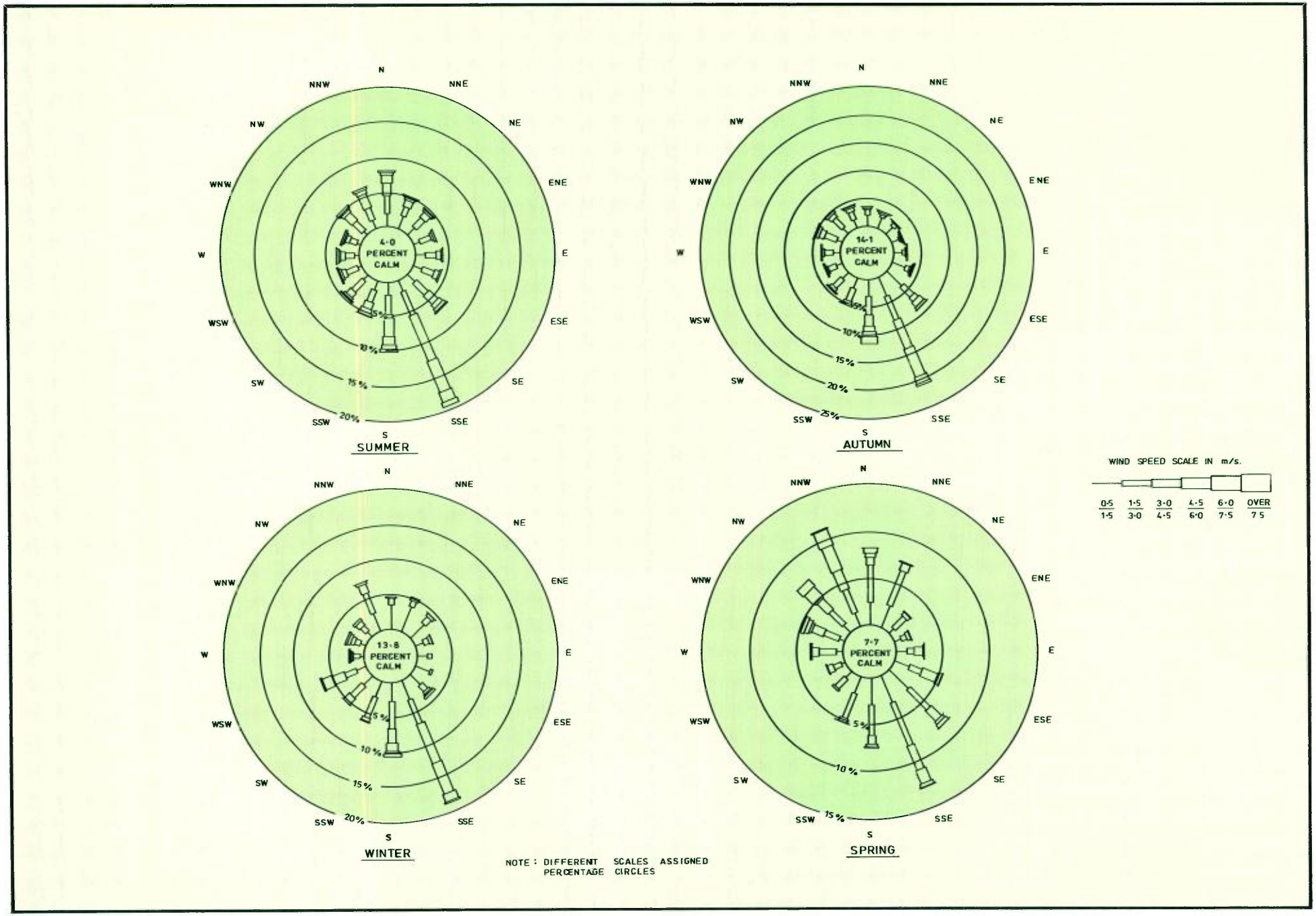


FIGURE 5.9

VICKERY JOINT VENTURE

THE COAL CLIFF COLLIERIES PTY LTD PROJECT MANAGERS

MINE SITE
SEASONAL WIND ROSES

5.1.4 Climate

VJV installed an automatic weather station at the Mine Site and a wind monitor at the Train Loader Site (Refer Figures 5.8 and 5.7 respectively).

The automatic station electronically records the following parameters at half hourly intervals:

- Temperature,
- Rainfall,
- Wind direction,
- Wind Speed,
- Relative humidity.

In addition, maximum and minimum daily temperatures, air stability parameters, peak wind gusts, and rainfall intensity are recorded.

The wind monitor graphically records wind direction and velocity at 2 second intervals.

The following data on climate and meteorology summarises site specific records and records from established meteorological stations at Gunnedah, Boggabri, and Narrabri.

5.1.4.1 Wind

Seasonal wind roses were developed from half hourly observations of wind speeds and direction during the period February 1983 to July 1985 at the Vickery meteorological station. Wind roses are presented in Figure 5.9.

Strongest winds will generally come from the S to SSE in summer, autumn, and winter and from either NNW or SSE in Spring. Strong winds can be expected from the above directions at any time of the year.

The Train Loader Site has similar wind patterns, however there is a tendency for more winds from the south to east quarter.

Table 5.1-6 shows the number of days at the Mine Site when peak wind gusts exceeded 10m/s, 10 m above ground level.

TABLE 5.1-6 ANNUAL DISTRIBUTION OF PEAK WIND GUSTS ABOVE 10m/s (days)

Month	J	F	M	A	M	J	J	A	S	O	N	D
Days	8	12	9	4	3	2	3	4	5	6	5	13

Winds are strongest in summer.

5.1.4.2 Rainfall and Evaporation

The area has variable rainfall. Tables 5.1-7 and 5.1-8 show the last eight years of rainfall on a monthly and annual basis for Boggabri.

TABLE 5.1-7 TOTAL MONTHLY RAINFALL (mm) FOR BOGGABRI POST OFFICE - 1978 to 1985

	J	F	M	A	M	J	J	A	S	O	N	D	Yr
1978	152	17	51	4	83	62	52	29	75	30	67	162	784
1979	35	6	73	7	82	55	9	17	69	38	90	8	489
1980	61	32	16	4	95	22	26	12	0	57	3	115	443
1981	9	110	0	11	89	-	35	7	29	117	69	26	502
1982	41	31	82	1	12	8	14	7	14	12	7	30	259
1983	88	12	30	73	128	34	38	47	53	57	121	64	745
1984	232	114	37	49	2	3	138	11	32	10	134	39	801
1985	14	57	11	35	12	21	23	78	15	61	31		

Source: Bureau of Meteorology Records.

TABLE 5.1-8 LONGTERM MONTHLY AND ANNUAL RAINFALL FOR BOGGABRI (Median mm) (1948 - 1983)

	J	F	M	A	M	J	J	A	S	O	N	D	Yr
Median	49	42	34	31	29	36	32	35	35	45	43	60	588

Source: Soil Conservation Service of New South Wales - Gunnedah

Rainfall data has been measured in the meteorological monitoring studies. Long term annual rainfall averages about 600 mm per year.

Evaporation from an A-class evaporation pan at Gunnedah is presented in Table 5.1-9.

5.1.4.2 Rainfall and Evaporation (Cont)

TABLE 5.1-9 A-CLASS EVAPORATION (mm) FOR GUNNEDAH (1948 - 1983)

Month	J	F	M	A	M	J	J	A	S	O	N	D	Yr.
Evaporation	227	196	171	125	78	55	56	75	106	151	193	230	1663

Source: Soil Conservation Service of New South Wales Gunnedah

Maximum evaporation occurs in January and December. Minimum evaporation occurs in June.

5.1.4.3 Temperature and Humidity

Summers are hot and winters mild. Humidity is moderate during both seasons. Frosts can be expected to occur occassionally in the period May to September. Table 5.1-10 shows the average number of days of frost recorded at the Soil Conservation Station at Gunnedah.

TABLE 5.1-10 LONG TERM AVERAGE NUMBER OF DAYS OF FROST - 1948 - 1983

Month	J	F	M	A	M	J	J	A	S	O	N	D	Yr
No. of days	0	0	0	0	2.0	5.1	10.7	5.6	1.3	0	0	0	24.7

Source: Soil Conservation Service of New South Wales - Gunnedah

5.1.5 Air Quality

There are no major industrial centres near the Mine Site. The only significant dust source is agricultural activities.

The VJV has monitored air quality in the Project area since September 1981. The location of dust fallout gauges is given in Figure 5.10.

The results of the continuing air quality monitoring programme are presented in Table 5.1-11.

5.1.5 Air Quality (Cont)

Figure 5.10 presents contours of the background dust levels (Non Combustible Material) at the Mine Site. The peaks in dust concentration are associated with cultivation areas. A minor increase in concentration occurs around the Red Hill Sampling Operation.

The Train Loader Site is located within predominantly agricultural surroundings but is in close proximity to the Municipal Abattoir, Gunnedah Colliery Coal Loader, Gunnedah Industrial Area, and the future garbage depot.

The VJV has monitored the air quality at the proposed Train Loader Site since February, 1984. The location of the Train Loader dust gauges is given in Figure 5.14. The results of the continuing air quality monitoring programme for the site are presented in Table 5.1-12.* The results are typical for the edge of a country town.

The monitoring programme shows individual non-combustible material fall-out rates varying between 0.01 g/m^2 month and 11.04 g/m^2 month with averages varying between 0.44 g/m^2 month and 6.91 g/m^2 month.

Dust levels recorded depend on a combination of wind intensity and direction, ground and weather conditions.

The lowest levels were recorded in June 1984. This was a moist period with good ground vegetation cover. Strong winds were experienced during the period of lowest dust fallout. The vegetation cover and soil moisture prevented dust generation.

The highest recorded dust levels occurred in December, 1982, this coinciding with widespread duststorms. Rainfall prior to this period was low. Strong winds and lack of groundcover enabled dust generation.

Sites 25 and 26 are in the middle of an irrigation farming area. Average dust levels recorded are higher than surrounding areas recording levels of ash of 6.91 and 4.54 g/m^2 month respectively.

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* Dust Monitoring is performed in accordance with Australian Standard 2724.1 - 1984 "Ambient Air - Particulate Matter. Part 1 Determination of Deposited Matter Expressed as Insoluble Solids Ash, Combustible Matter, Soluble Solids and Total Solids."

VICKERY JOINT VENTURE

THE COAL CLIFF COLLIERIES PTY LTD PROJECT MANAGERS

DUST FALLOUT GAUGE LOCATION
AND MONITORED DUST LEVELS
NON COMBUSTIBLE MATERIAL (g/m² month))

FIGURE 5.10

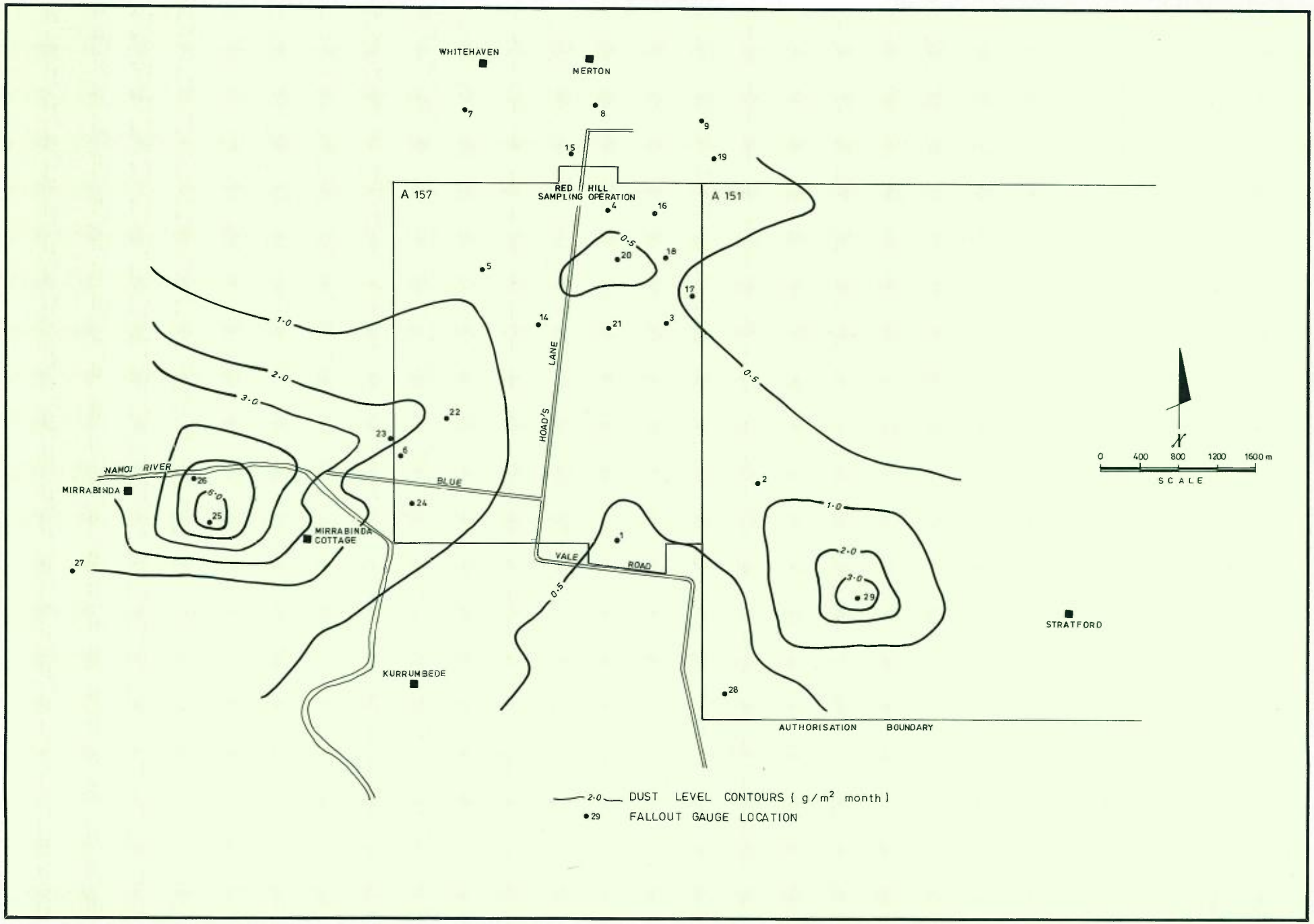

TABLE 5.1-11 AVERAGE MEAN MONTHLY FALLOUT (g/m^2 month) SEPTEMBER 1981 TO MAY 1985 - (Mine Site)

SITE NUMBER	1	2	3	4	5	6	7	8	9	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29
Total Insoluble Solids (Non filtrable Residue)	0.82	1.15	1.45	1.40	1.35	1.56	0.92	1.43	1.34	1.75	1.50	3.03	2.04	6.62	4.30	1.84	5.01	3.61	3.98	2.95	11.22	5.60	2.47	0.46	6.12
Total Combustible Solids (Organic Material)	0.38	0.35	0.67	0.69	0.48	0.65	0.47	0.77	0.48	0.62	0.70	1.77	0.67	3.81	2.68	0.96	2.17	1.92	1.25	1.45	4.31	1.06	0.67	0.17	2.03
Non Combustible Material (Ash)	0.44	0.80	0.78	0.71	0.87	0.91	0.45	0.66	0.86	1.13	0.80	1.26	1.37	2.81	1.62	0.88	2.84	1.69	2.73	1.50	6.91	4.54	1.80	0.29	4.09

TABLE 5.1-12 AVERAGE MEAN MONTHLY FALLOUT (g/m^2 month) FEBRUARY 1984 TO MAY 1985 - (TRAIN LOADER SITE)

SITE NUMBER	10	11	12	13
Total Insoluble Solids (Non filtrable Residue)	2.29	1.91	2.29	2.34
Total Combustible Solids (Organic Material)	1.19	0.95	1.09	1.11
Non Combustible Material (Ash)	1.10	0.96	1.20	1.23

5.1.5 Air Quality (Cont)

The samples were taken during periods of land levelling and cultivation activity. The monitoring programme has confirmed that cultivated areas are dustier than non-cultivated areas. Further confirmation comes from the Hunter Valley where deposition rates up to 22.0 g/m^2 month have been attributed to agricultural sources adjacent to, the CSR Lemington Colliery.*

Project Site and Train Loader figures can be compared with figures of 0.4 to 4.8 g/m^2 month for the Sydney area, 3.0 to 9.0 g/m^2 month for Newcastle, 2.0 to 8.0 g/m^2 month for Wollongong and 1.5 to 3.0 g/m^2 month for several towns in the Hunter Valley (SPCC 1980).

5.1.6 Acoustics

5.1.6.1 Existing Conditions

To evaluate the existing acoustic environment at the **proposed Mine Site**, a series of 24 hour noise surveys were conducted (Dames & Moore 1981/82).

Sites 1 to 6 shown in Figure 5.8 are all located near farm homesteads. Surrounding land is flat to slightly undulating and is utilised for cropping and grazing. Descriptions of topography, vegetation and landuse are included in Section 5.1.1, 5.1.7 and 5.2.4 respectively.

Background noise is pervaded by the natural sounds generated by insects, birds and rustling vegetation. Occasional high noise level punctuations are created by the passage of vehicular traffic.

Sites 1 to 4 show a generally higher L_{90} level than sites 5 and 6. The higher background levels are due to an abundance of insects and birds, which flourish as a result of peak grain production. Measurements in December recorded background L_{90} levels ranging from 39 to 41 dB(A) during the day and from 38 to 42 dB(A) during the night. Measurements in January, after most grain has been harvested, reveal a range of 31 to 35 dB(A) during the day and from 31 to 40 dB(A) during the night.

A series of ambient sound level measurements around the **Train Loader Site** and along the transport route recorded the existing acoustical environment.

---

* (EIS Northern Open Cut Extensions - CSR Lemington Mine - September, 1984).

The Train Loader Site is considered typical of the fringe of a rural town. Primary industrial noise sources in this environment are the abattoirs, existing coal loader, tannery, and stock feed depot. The primary transportation noises are trains on the Main North Western Rail Line, coal trucks travelling to and from the existing coal loader, trucks from the abattoirs, and traffic on Trunk Road 72. The transport route varies from a quiet rural acoustic environment to that typical of the fringe of a rural town.

5.1.6.2 Attenuation

An investigation of noise attenuation at the Mine Site was carried out. This was done by recording noise levels at various locations around a pre-recorded constant noise source.

Figure 5.11 presents the results of the noise attenuation study.

An open field rate of noise attenuation of 6dB(A) per doubling of distance has been applied to the Vickery site. This rate of attenuation is modified by many factors, but most significantly by wind speed, wind direction, topography, and vegetation. Noise levels reduce more rapidly south of Blue Vale Opencut, Shannon Hill Opencut, Greenwood Opencut, and Greenwood Underground than to the north due to a ridge.

At the Vickery Mine, topographic conditions cause noise levels to reduce more rapidly east and west of the Mine.

5.1.7 Flora

Remnant vegetation of the Mine and Train Loader Areas derives from two main groups of the original vegetation.*

The two main groups are:

- White Cypress Pine woodlands (Callitris columellaris and E. albens)
- Yellow, White and Poplar Box woodlands (Eucalyptus melliodora, E. albens and E. populnea).

A number of plant associations are defined within each group, depending on the character species at any given point. For example, pine and box may occur monospecifically.

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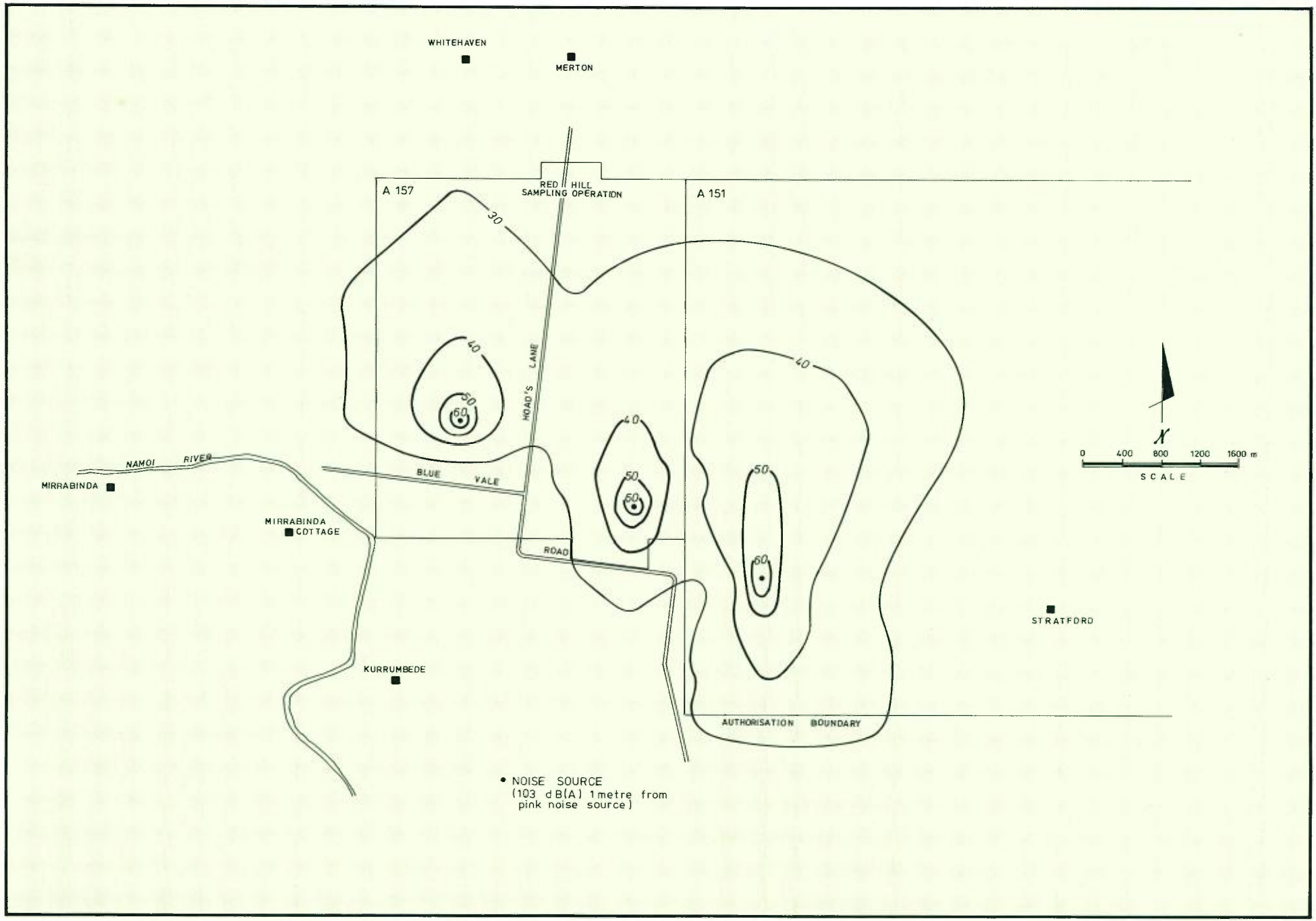
* Dyson and Marston in "The Soil Conservation Service of NSW, Gunnedah District Technical Manual, June 1976".

VICKERY JOINT VENTURE

THE COAL CLIFF COLLIERIES PTY LTD PROJECT MANAGERS

NOISE ATTENUATION CONTOURS

FIGURE 5.11



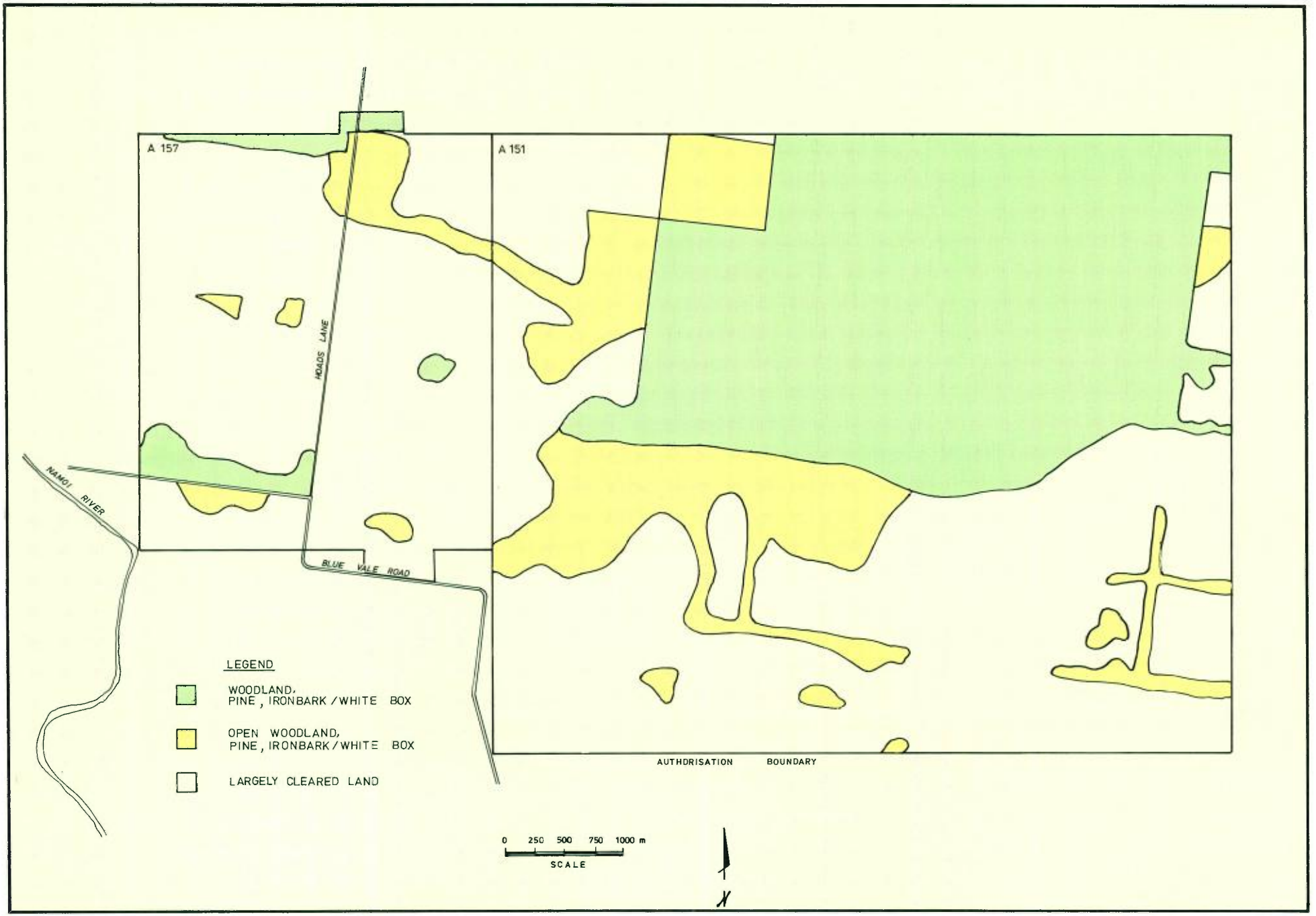


FIGURE 5.12

VICKERY JOINT VENTURE

THE COAL CLIFF COLLIERIES PTY LTD PROJECT MANAGERS

VEGETATION DISTRIBUTION

5.1.7 Flora (Cont)

The groups are also characterised by intermingling and continuous variation of dominance from one species to another, accompanying slight changes in soil and topography. As well as floristic variation, considerable structural variation occurs within both groups.

The frequency and distribution of the original vegetation of the treeless Liverpool Plains has been reduced by cropping and irrigation. No areas within the Mine Site and Train Loader boundaries contain this community.

The Cypress Pine and the Box group can be placed in a wider regional context as an eastern, relatively well watered component of the Poplar Box lands of Eastern Australia (Beeston et al 1980). Of the 31 communities identified by Beeston et al, five may be recognised within the Gunnedah / Boggabri area. None are unusual or of limited distribution. The Mine Site has been cleared extensively for agriculture. Remnant pockets of woodland remain and even these have been modified by grazing and timber production.

The Train Loader Site also has been cleared extensively for agriculture, and few remnants remain of the previous White Box Savannah Woodland. Over the 87 hectare site, only six specimens of Eucalyptus populnea (Poplar Box) and four specimens of Callitris columellaris (White Cypress Pine) remain. Natural ground cover has been completely removed by previous crop production and there is no evidence of Plains Grass Community (Stipa aristiglumus).

Vegetation of the Mine Site and surrounding areas is shown in Figure 5.12.

5.1.8 Fauna

The faunal survey located 11 mammal, 69 bird, 8 reptile and 4 amphibian species within the proposed Vickery Coal Mine Area. (Tables 5.1-13, 5.1-14, 5.1-15).

TABLE 5.1-13 MAMMALS FOUND ON VICKERY PROJECT AREA

Native	
Echidna*	Tachyglossus aculeatus
Eastern Grey Kangaroo	Macropus giganteus
Wallaroo*	Macropus robustus
Brush-tailed Possum	Trichosurus vulpecula
Introduced	
Rabbit	Oryctolagus cuniculus
Hare	Lepus capenis
Fox	Vulpes vulpes
Dog*	Canis familiaris
Horse	Equus caballus
Cattle	Bos taurus
Sheep	Ovis aries

* Indirect evidence.

TABLE 5.1-14 BIRDS FOUND ON VICKERY PROJECT AREA, TOGETHER WITH INFORMATION ON HABITAT PREFERENCES AND STATUS DURING SURVEY

Explanation of Symbols

Habitats:		Status:	
	1 = Tall Woodland		A = abundant
	2 = Low Woodland		C = common
	3 = Pasture		U = uncommon
	4 = Aquatic		S = scarce

	Habitat	Status
Wedge-tailed Eagle (Aquila audax)	2	U
Little Eagle (Hieraaetus morphnoides)	2,3	U
Spotted Harrier (Circus assimilis	3	S
Nankeen Kestrel (Falco cenchroides)	3	U
Masked Plover (Vanellus miles)	3	C
Black-fronted Dotterel (Charadrius melanops)	4	U
Little Grebe (Podiceps ruficollis)	4	U
Pelican (Pelecanus conspicillatus)	4	S
White Faced Heron (Ardea novaehollandiae)	4	U
White Ibis (Threskiornis molucca)	4	U
Straw-necked Ibis (Threskiornis spinicollis)	4	U
Yellow-billed Spoonbill(Platalea flavipes)	4	U
Black Duck (Anas superciliosa)	4	A
Grey Teal (Anas gibberifrons)	4	C
Wood Duck (Chenonetta jubata)	4	C
Black-necked Stork (Xenoirhynchus asiaticus)	3	S
Silver Gull (Larus novaehollandiae)	4	S
Peaceful Dove (Geopelia striata)	1,2	C
Common Bronzewing (Phaps chalcoptera)	2	S
Crested Pigeon (Ocyphaps lophotes)	2,3	C
Galah (Cacatua roseicapilla)	2,3	A
Sulphur-crested Cockatoo (Cacatua galerita)	3	A
Cockatiel (Nymphicus hollandicus)	3	C
Eastern Rosella (Platycercus eximius)	2	U
Mallee Ringneck (Barnardius barnardi)	2	U
Red Rumped Parrot (Psephotus haematonotus)	2	C
Brush Cuckoo (Cuculus variolosus)	1	U
Boobook Owl (Ninox novaeseelandiae)	2	U
Tawny Frogmouth (Podargus strigoides)	2	C
Kookaburra (Dacelo gigas)	2	C
Dollarbird (Eurystomus orientalis)	2	U
Singing Bushlark (Mirafra javanica)	3	U
Welcome Swallow (Hirundo neoxena)	3	C
Richards Pipit (Anthus novaeseelandiae)	3	C
Black-faced Cuckoo Shrike (Coracina novaehollandiae)	1,2	C
White-winged Triller (Lalage sueurii)	2	U
Red Capped Robin (Petroica goodenovii)	2	U
Hooded Robin (Melanodryas cucullata)	1,3	U
Rufous Whistler (Pachycephala rufiventris)	1	U

	Habitat	Status
Jacky Winter (Microeca leucophaea)	2,3	U
Restless Flycatcher (Myiagra inquieta)	2	U
Grey Fantail (Rhipidura fuliginosa)	2	C
Willie Wagtail (Rhipidura leucophrys)	2	U
Rufous Songlark (Cinclorhamphus mathewsi)	1,2	C
Brown Songlark (Cinclorhamphus cruralis)	2,3	C
Western Warbler (Gerygone fusca)	1	U
Weebill (Smicrornis brevirostris)	1	U
Eastern Spinebill (Acanthorhynchus tenuirostris)	1	S
Buff-Rumped Thornbill (Acanthiza reguloides)	2	U
Yellow-Rumped Thornbill (Acanthiza chrysorrhoa)	1,2,3	C
Yellow Thornbill (Acanthiza nana)	3	U
Spiny-cheeked Honeyeater (Acanthgenys rufogularis)	2	U
White-naped Honeyeater (Melithreptus lunatus)	2	S
Noisy Miner (Manorina melanocephala)	1,2,3,	A
Crimson Chat (Ephthianura tricolor)	3	C
Sparrow (Passer domesticus)	3	C
Zebra Finch (Poephila guttata)	3	U
Starling (Sturnus vulgaris)	3	A
White-browed Wood Swallow (Artamus superciliosus)	2,3	C
Dusky Wood Swallow (Artamus cyanopterus)	2	S
Magpie Lark (Grallina cyanoleuca)	1,2,3	C
Apostle Bird (Struthidea cinerea)	1,2	C
White-winged Chough (Corcorax melanorhamphos)	1,2	U
Pied Currawong (Strepera graculina)	2	U
Pied Butcherbird (Cracticus nigrogularis)	1,2	C
Grey Butcherbird (Cracticus torquatus)	2	S
Magpie (Gymnorhina tibicen)	1,2,3	C
Australian Raven (Corvus coronoides)	3	U
Pied Stilt (Himantopus himantopus)	4	C

TABLE 5.1-15 REPTILES AND AMPHIBIANS FOUND ON VICKERY PROJECT AREA

Site Reptiles	
Long-necked Tortoise	Chelodina longicollis
Red Bellied Black Snake	Pseudechis porphyriacus
Eastern Brown Snake	Pseudonaja textilis
Eastern Blue-tongued Lizard	Tiliqua scincoides
Shingle Back	Trachydosaurus rugosus
Lace Monitor *	Varanus varius
Bearded Dragon	Amphibolurus barbatus
Skink	Ctenotus robustus
Amphibians	
Salmon-striped Frog	Limnodynastes salmini
Red-groined Toadlet	Uperoleia rugosa
Broad-palmed Frog	Litoria latopalmata
Peron's Tree Frog	Litoria peronii

* In Vickery Forest only

The Project is on the boundary between the western slopes and inland plains. Several of the species found were at the eastern or western edge of their range.

The Vickery State Forest, with its scattered middle and lower strata vegetation, offers a diversity of habitats for birds and reptiles. Several species additional to those normally found in the woodlands in the Gunnedah Region were found in the Vickery State Forest. Bird species diversity is greatest in the woodlands and least in cultivated habitats.

A number of birds, small mammals and reptiles expected to be in the area, were not sighted. Their absence partly reflects the reduced occurrence of vegetation brought about by farming and pastoral activity, as well as the original, largely grassy nature of the lower vegetation strata.

Of the mammals, kangaroos occur mainly within woodland habitats, with movements into pasture habitats. The Brush-tailed possum was only found in trees associated with the Namoi River.

Apart from the burrowing salmon-striped frog, which was found in the tall woodland habitat, the amphibians were found in water habitat. The majority of bird species were located within woodland habitats, except the water birds and waders. Fish were not surveyed, but those known to occur in the Namoi include the bony bream (Nematolasa erebri), common carp (Cyprinus carpio), cat fish (Tandanus tandanus), golden perch (Plectroplites ambiguus), Murray cod (Maccullochella peeli) and silver perch (Bidyanus bidyanus), (SPCC 1980).

5.1.8 Fauna (Cont)

None of the animals sighted during the survey could be classed as rare. They may be uncommon within the study area, but are common within the main part of their range.

Owing to the extensive clearing of the Train Loader Site and surrounding land, wildlife habitats are limited. The habitat at the Train Loader Site is equivalent to the pasture habitat at the Mine Site. On this basis, the native mammals, reptiles and amphibians expected to be found in the Train Loader Site are not rare or endangered.

5.1.9 Aesthetics

Views of the Mine Site are restricted by tree stands, ridges and distance.

The low density of settlement and the distances involved minimise observation of the Mine Site by the general community.

The various components of the Mines are not visible from any occupied residence. The Project is only visible to traffic travelling along Blue Vale Road and Hoads Lane.

The upgraded Blue Vale Road will be visible from the overpass constructed on Trunk Road 72.

The Train Loader Site is visible from Torrens Road, Trunk Road 72, six rural homesteads on small adjoining acreages, and from passing trains on the North Western Rail Line.

The aesthetic impact of the Project and ameliorative measures are discussed in Section 6.1.4.

5.1.10 Land Tenure

Figure 5.13 details land tenure adjacent to the Vickery Mine Site. Figure 5.14 details land tenure adjacent to the Train Loader Site.

5.2 HISTORIC AND CURRENT LAND USE

5.2.1 Archaeology

The distribution of aboriginal relics within land affected by the proposal has been investigated (Haglund 1985).

Occupation sites and scarred trees are the site types most likely to occur in the area affected by the Project. Sites related to the presence of rock would be unlikely. Carved trees have been found in the region away from the Project. Such trees are generally known and listed, and unlisted examples would be likely in very remote areas only. Prehistoric burials appear unlikely to have occurred or to remain in the heavy soils of the alluvium or the adjacent stony soils.

No sites of mythological/ceremonial significance are indicated within the area.

Surface inspection confirmed that apart from the river flats and lagoons close to the Namoi River, most areas have little evidence of the past aboriginal presence.

Open camp sites are likely to occur on river banks where these are above normal flood level, especially where the river bends to form a good water hole near an area of high bank or where there is a lagoon on the bank.

The Blue Vale Road extension through the Four Mile Stock Reserve will pass through the edge of a possible open camp site. There are a number of trees on this Reserve with coolamon type bark scars apparently associated with the open camp.

Other open camp sites were recognised at Top Rocks, Bottom Rocks, on the Mirrabinda property, on a stock reserve near the Yarralla property and another site just east of Gunnedah. These sites will not be affected by the Project.

A series of minor scatters of stone artefacts have been identified along Greenwood Creek. They are outside the area affected by the Proposal.

The archaeological surveys did not disclose any sites or relics along the Blue Vale Road or on the Train Loader Site.

5.2.2 History

The Namoi Valley was discovered by Captain John Oxley in August 1818. There are few accurate records defining when the Namoi Valley was actually settled by Europeans. It is likely that scattered runs on the Plains were illegally occupied by the 1820's.

Gunnedah was settled in 1838 by John Johnston. During 1835, Edward Cox established the Namoi Hut Station, the forerunner of Boggabri township, at the junction of Cox's Creek and the Namoi River. By 1849 the mid Namoi Valley was largely divided into extensive pastoral runs, with most properties designated as sheep stations. Wheat growing became more prominent in the 1890's through to World War I.

5.2.3 Land Capability

A land capability study of the Vickery Area was prepared by officers of the Soil Conservation Service and the Department of Agriculture, Gunnedah. The study's purpose was to accurately assess the agricultural potential of the Vickery Area, independent of current land use. Present intensive cropping on unsuitable land is due to the smaller properties being unable to provide sufficient income.

5.2.3 Land Capability (Cont)

Table 5.2-1 summarises land use capability.

Land Capability Classes are defined and areas mapped on Figure 5.15.

TABLE 5.2-1 LAND USE CAPABILITY (hectares)

Land Capability Class	II	III	IV	VI	TOTAL
(all farms purchased by Joint Venture)	1085	1307	1181	87	3660

5.2.4 Land Use

The Lower Namoi Valley has traditionally been a major agricultural producer. It has supplied state, interstate and overseas markets for over 100 years. The Region's climate allows both summer and winter crops to be grown. This, plus the availability of surface or groundwater irrigation to many properties, has resulted in a diverse range of agricultural activities. Wheat, sorghum, oil seeds and fodder crops, such as oats and lucerne are grown throughout the area. Large numbers of fat lambs, sheep and beef cattle are raised, together with lesser numbers of pigs, poultry and some dairy cattle.

Land in the Vickery area is used for the following purposes:

- Cropping with some sheep and cattle grazing
- Sheep and cattle grazing with occassional cropping
- Scattered timber with rough grazing
- Heavy timber adjoining State Forest
- State Forest

Table 5.2-2 indicates the change in land use within the Project Area over the last 30 years. The major change has been increased cropping, resulting from many factors including new cereal strains, increased grain demand, reduced livestock prices, inadequate property size, the introduction of summer cropping, and larger farm equipment.

There has been a reduction in property size from the larger sheep runs of the early part of this century, to properties averaging around 240 to 400 hectares. This has made it increasingly difficult for landholders to maintain their income levels in real terms, when relying mainly on livestock for income. Consequently, many farmers have, over the last 30 years, increased cropping area within their properties and introduced summer cereal and oil seed crops. Figure 5.16 details present land use on the proposed Coal Lease.

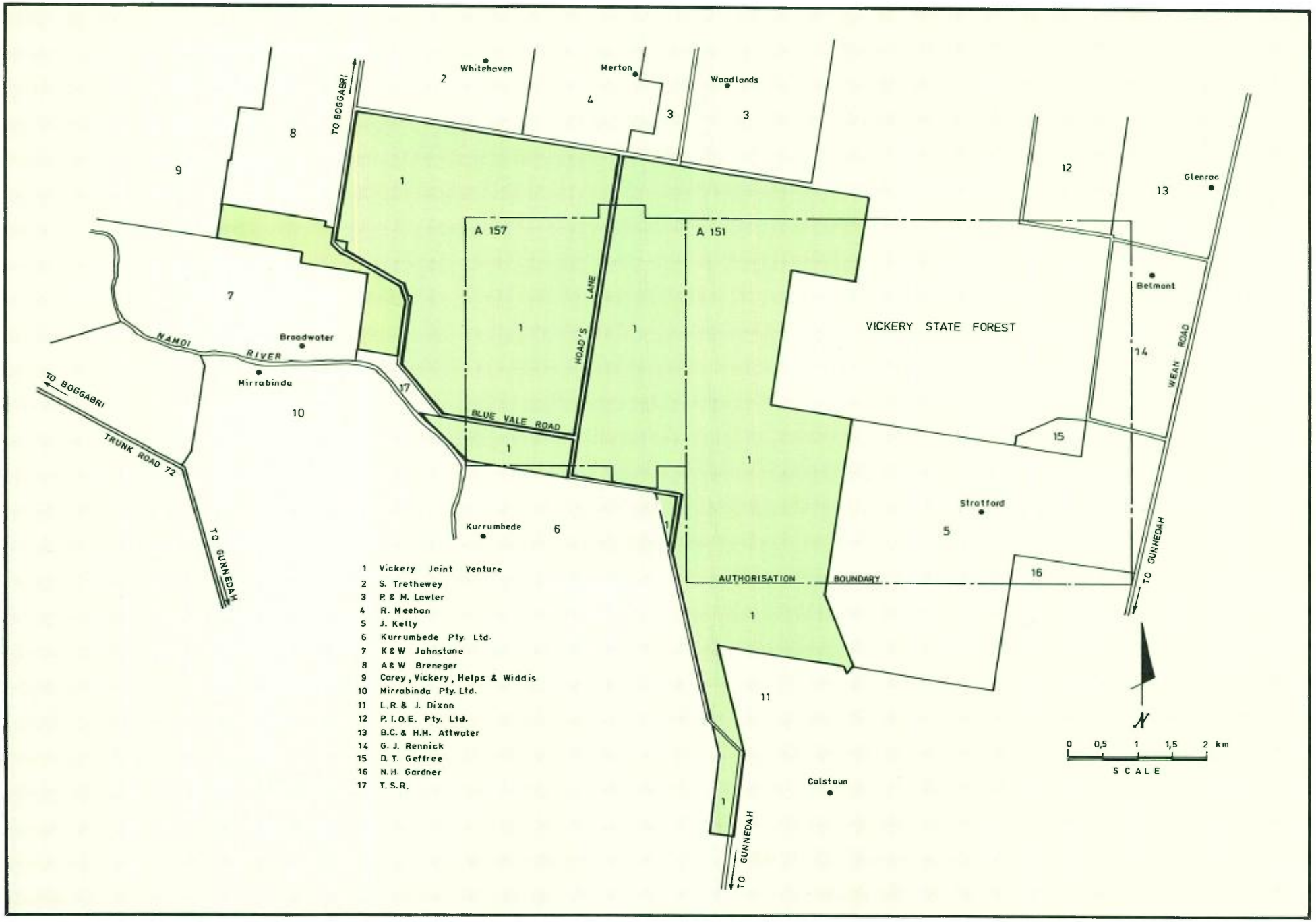


FIGURE 5.13

VICKERY JOINT VENTURE

THE COAL CLIFF COLLIERIES PTY LTD PROJECT MANAGERS

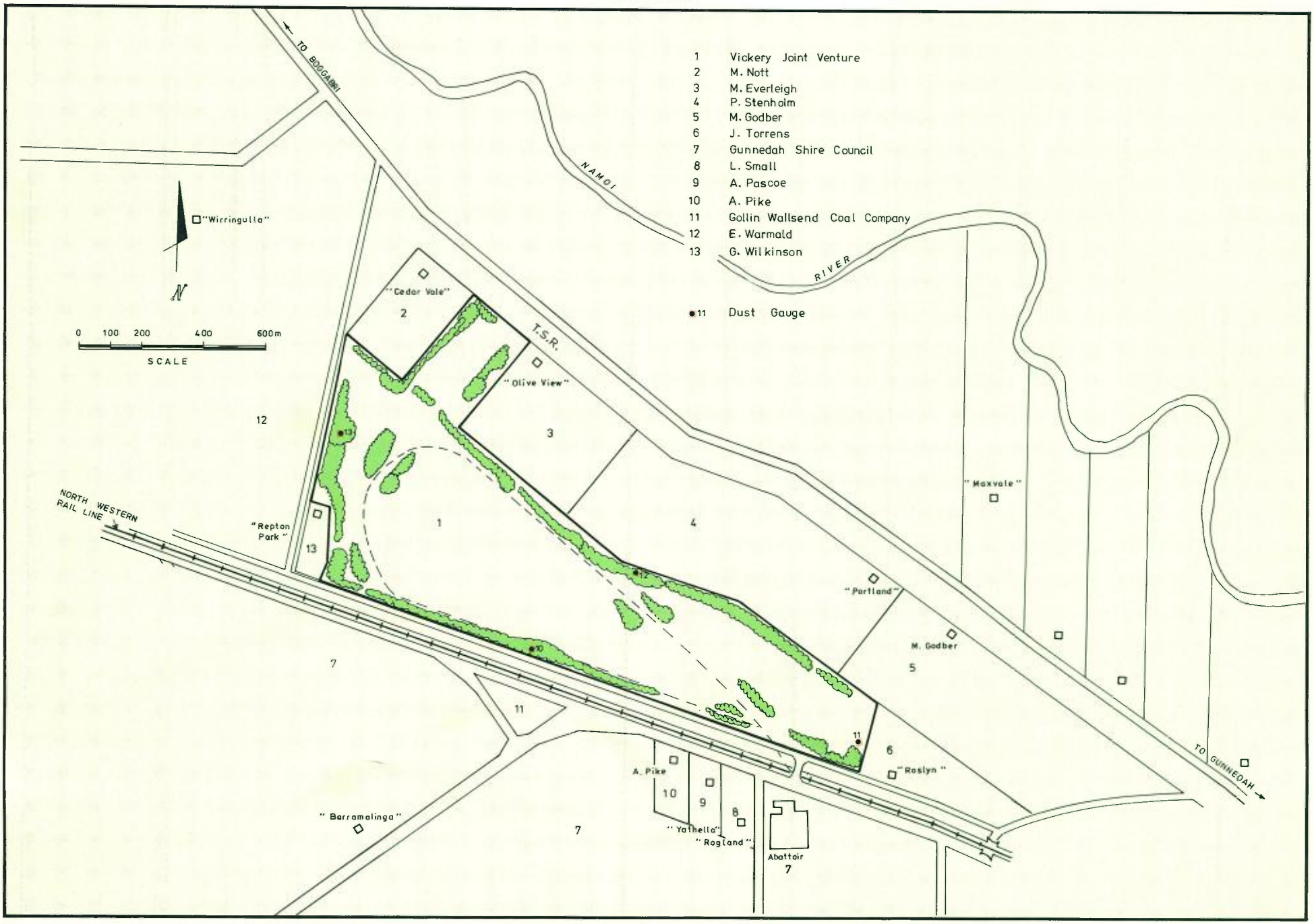
LAND TENURE – MINE

VICKERY JOINT VENTURE

THE COAL CLIFF COLLIERIES PTY LTD PROJECT MANAGERS

LAND TENURE LANDSCAPING
AND DUST MONITORING
TRAIN LOADER

FIGURE 5.14



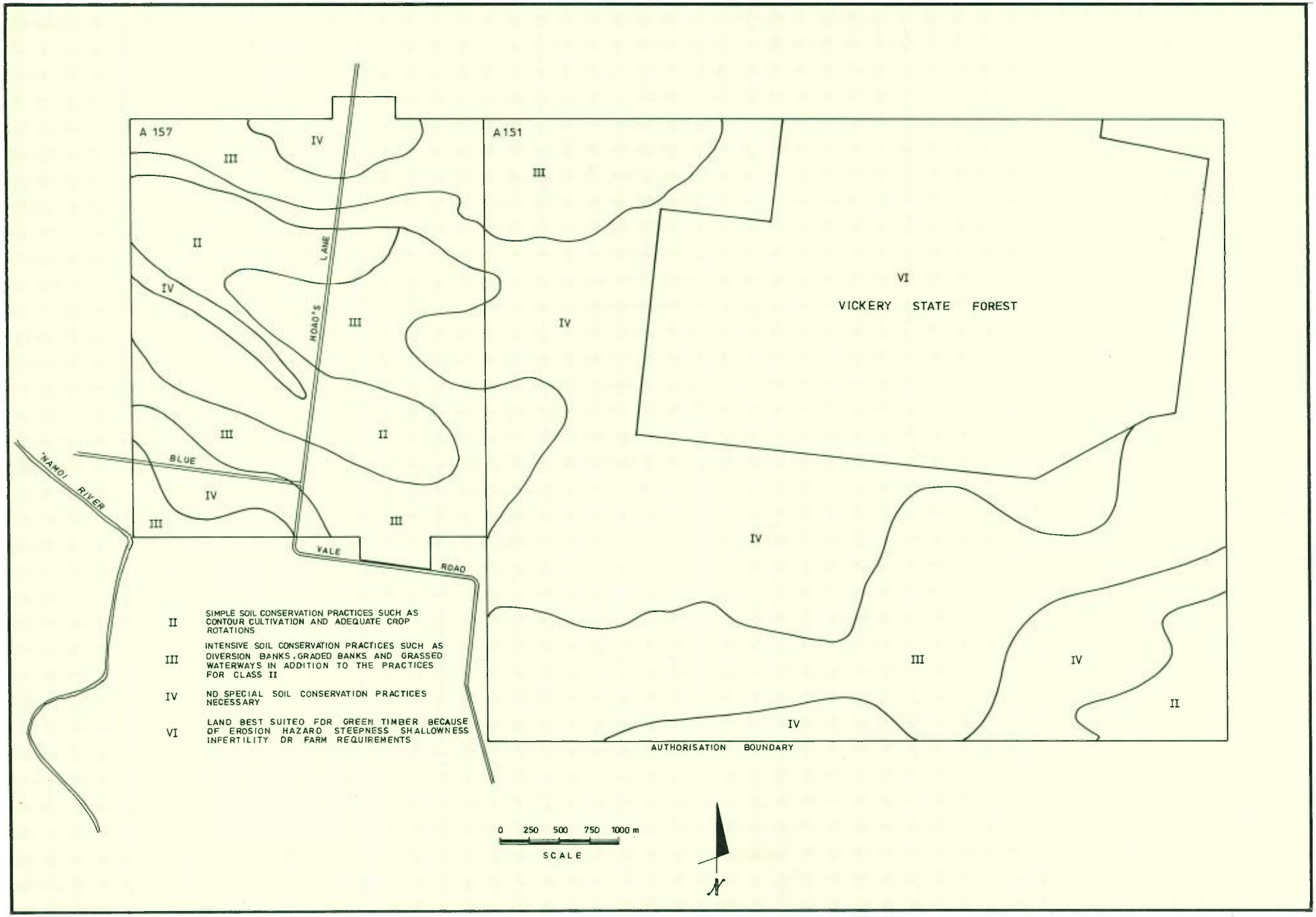


FIGURE 5.15

VICKERY JOINT VENTURE

THE COAL CLIFF COLLIERIES PTY LTD PROJECT MANAGERS

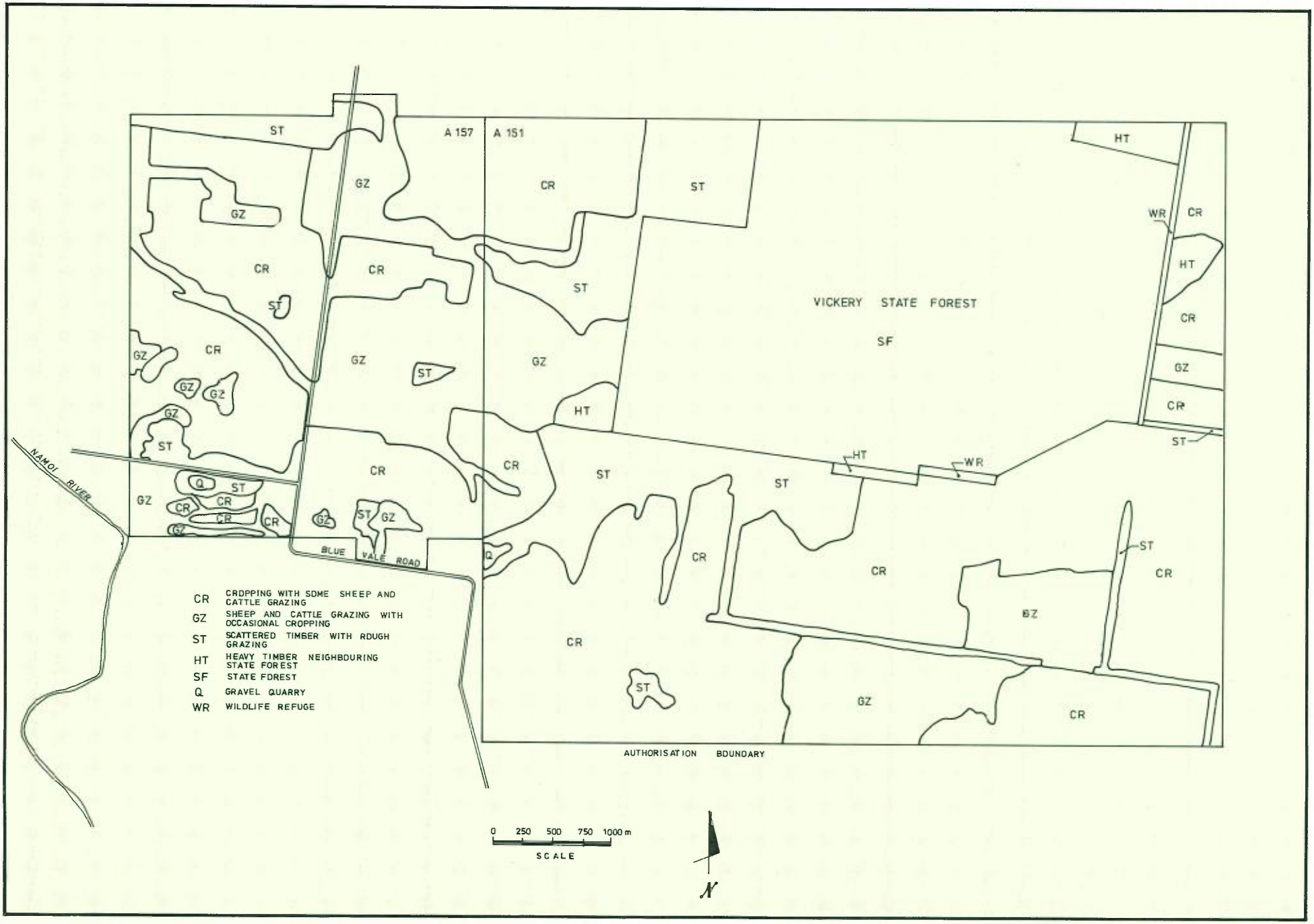
LAND CAPABILITIES

VICKERY JOINT VENTURE

THE COAL CLIFF COLLIERIES PTY LTD PROJECT MANAGERS

LAND USE – 1985 COAL LEASE

FIGURE 5.16



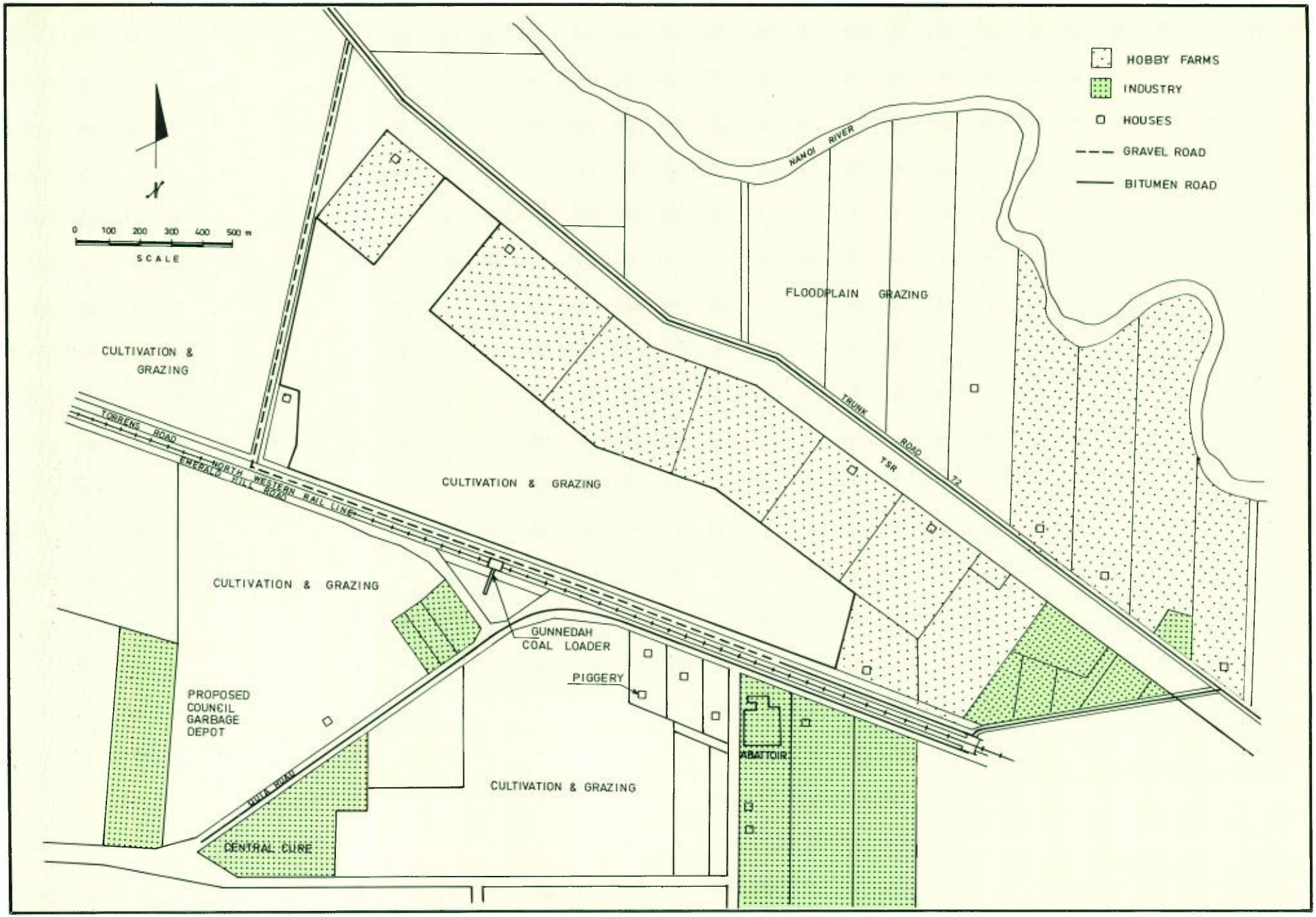


FIGURE 5.17

VICKERY JOINT VENTURE

THE COAL CLIFF COLLIERIES PTY LTD PROJECT MANAGERS

LAND USE – 1985 TRAIN LOADER SITE

5.2.4 Land Use (Cont)

TABLE 5.2-2 AREA OF AGRICULTURAL ACTIVITIES AT VICKERY, 1956 and 1985 (Hectares)

ACTIVITY	1956	1985	CHANGE
Cropping	956	1780	+824
Sheep/Cattle Grazing	1776	1177	-599
Scattered Timber	905	679	-226
Heavy Timber	23	20	-3
Quarry		4	+4
TOTAL	3660	3660	0

The Train Loader Site is presently used for seasonal crop production and the grazing of sheep. This use has resulted in negligible site development other than dams, fences, several small sheds and cleared paddocks.

Figure 5.17 details present land use near the Train Loader Site.

Small rural holdings of approximately 20 hectares adjoin the northern and eastern boundaries of the Site. These small acreages are used for grazing stock and some cultivation, but only five holdings have established residential dwellings. In the south-west corner of the Site a holding of less than 2 hectares contains a brick and tile residence and small piggery. The remainder of the western boundary is defined by a 20 m crown road which links Torrens Road with Trunk Road 72.

The southern boundary of the Site runs parallel with Torrens Road and the North Western Rail Line. South of the Rail Line the land is used for a variety of agricultural and industrial purposes. The Gunnedah Coal Loader is immediately south of the Site at the intersection of Quia and Emerald Hill Road. The Gunnedah loader includes an area for coal to be stockpiled before being transferred by front-end loader onto a conveyor above a rail siding parallel with the main line.

The Gunnedah Shire Abattoir is south-east of the Train Loader Site. It is the largest single employer within the district with 420 employees. The Abattoir operates continuously, with slaughtering conducted between 7 am and 4.30 pm, while the transport of livestock and produce is a 24-hour activity. In an average week, approximately 12 refrigerated trucks and 2 refrigerated rail cars load meat products from the Abattoir. During the same week, 25 stock trucks would unload animals for slaughter. These stock and refrigerated trucks travel to the Abattoir via Quia Road, then Torrens Road, and cross the Rail Line at the level crossing opposite the Abattoir entrance.

5.2.4 Land Use (Cont)

The Centralcure Tannery is 800 m south of the Train Loader. The tannery is another major employer with a total of 90 employees and operates two shifts between 8am and 2am. West of the tannery, the Gunnedah Shire Council proposes to develop a new garbage depot.

Other industries operating in the vicinity of Quia Road include dog kennels, concrete tank manufacturing, seed cleaning, shearing contractors, stock transport operators, saw milling and a timber yard. These uses are interspersed by open grazing land and several residential dwellings.

The pattern of rural and industrial land uses which surround the Site is reflected by the provision of utility services within the area. High capacity, 22 kV power lines service the industrial users to the south of the Rail Line. Power transmission to the north of the Rail Line is limited to 11kV rural feeder lines.

Water supply is via a trunk main on Quia Road and a small connection main which services rural allotments east of the Site.

The Blue Vale Road traverses level cleared agricultural land. Land use is cropping and grazing with some areas developed for irrigation of crops. Figure 3.18 shows the location of farm houses accessed by the Blue Vale Road.

5.2.5 Zoning Provisions

The Project is located primarily in Gunnedah Shire. Only a small proportion of the Coal Lease and Project activity is located in Narrabri Shire.

The portion of the Mine Site in Gunnedah Shire is covered by Local Environmental Plan (LEP) No. 1 gazetted on 27th November, 1981. The Site is zoned Rural 'A' except the area within the Vickery State Forest, which is zoned Rural 'F'. Development approval is subject to consent of the Council.

The Train Loader Site is in Gunnedah Shire and is currently zoned "Non Urban A" under the provision of the Liverpool Plains Planning Scheme.

The portion of the Mine Site within Narrabri Shire is covered under Interim Development Order (IDO) No. 1 (1966). This order adopts the Model Provisions published on 17th July, 1970. The mine area is zoned 1(b) under the IDO, which is a NON URBAN zone. This allows mining, but only with the consent of the Council and concurrence of the DEP.

5.3 SOCIO-ECONOMIC

5.3.1 Introduction

The main towns affected by the Project are Gunnedah and Boggabri with populations of approximately 9,000 and 1,000 respectively.

The economy of the region is rural based. Historically there has been an emphasis on wheat and sheep with some cattle production. Gunnedah has a large abattoir which processes livestock from the area.

In recent years there has been an increase in irrigated agriculture. Irrigation is based on controlled flow of the Namoi River by Keepit Dam, and by groundwater extracted from the Namoi River alluvials.

Coal mining has been established in the area since the late 1800's. There are operating mines at Gunnedah and Curlewis capable of producing 1.25 Mtpa.

Unemployment in the region appears to be lower than on a State wide basis however this does not accurately reflect the real levels of unemployment or underemployment within the region. Employment in agriculture is often seasonal and temporary. A number of people are employed within family farms who would be available for employment outside the farm, but within the district. They would be able to obtain an outside income and still be able to assist in the operation of the family farm.

Employment for youth in the region is difficult to obtain. A characteristic of the population is the large percentage of youth leaving the area to obtain employment in the larger centres including Tamworth, Newcastle, Sydney, and Wollongong.

5.3.2 Employment

5.3.2.1 Employment Structure

Table 5.3-1 presents the Employment Structure for the Gunnedah Shire for the ABS Census Years 1971, 1976, 1981 and for the Boggabri Urban Centre and the Northern Statistical Division for 1981.

Gunnedah Shire incorporates the towns of Gunnedah, Carroll, Kelvin, Mullaley, Tambar Springs, Breeza, and Curlewis.

Basic industries in the Gunnedah Shire during the period 1971 - 1981 have been agriculture, mining, manufacturing and the wholesale retail trade. The 1981 ABS figures show Public Administration and Recreation/Entertainment also classified as 'basic' for Gunnedah Shire.

TABLE 5.3-1 EMPLOYMENT STRUCTURE FOR GUNNEDAH SHIRE FOR 1971, 1976 and 1981, BOGGABRI URBAN CENTRE AND THE NORTHERN STATISTICAL DIVISION FOR 1981.

	BOGGABRI		GUNNEDAH SHIRE						NORTHERN STATISTICAL DIVISION	
INDUSTRY	1981	%	1971	%	1976	%	1981	%	1981	%
Agriculture	50	13.6	1249	27.2	1449	27.7	1325	24.2	17004	23.5
Mining	29	7.9	136	3.0	190	3.6	301	5.5	967	1.3
Manufacturing	18	4.9	469	10.2	607	11.6	478	8.8	4657	6.4
Electricity, Gas, Water	6	1.6	31	0.7	31	0.6	54	1.0	1158	1.6
Construction	19	5.2	347	7.5	284	5.4	236	4.3	4235	5.8
Wholesale/Retail	67	18.3	922	20.0	965	18.5	988	18.1	11731	16.2
Transport/Storage	33	9.0	155	3.4	163	3.1	232	4.2	3638	5.0
Communications	16	4.4	110	2.4	65	1.2	79	1.4	1465	2.0
Finance	21	5.7	206	4.5	224	4.3	257	4.7	3868	5.4
Public Admin/Defence	12	3.3	169	3.6	204	3.9	257	4.7	2961	4.1
Community Services	43	11.7	389	8.5	492	9.4	612	11.2	10836	15.0
Entertainment/Recreation	26	7.1	287	6.2	249	4.8	303	5.5	3891	5.4
Other	27	7.3	130	2.8	306	5.9	352	6.4	6008	8.3
TOTAL	367	100.0	4600	100.0	5229	100.0	5474	100.0	72419	100.0

Source: ABS 1971,1976,1981

5.3.2.1 Employment Structure (Cont)

Industries experiencing a decline in the relative share of total employment are agriculture, manufacturing, construction and wholesale/retail.

Agriculture is the major industry in the area producing wheat, barley, sheep, cattle and pigs.

The number of people employed in the coal mining industry has expanded steadily since 1971. Total employment in the industry grew from 3.0% (136 persons) of the employed workforce in 1971 to 5.5% (301 persons) of the employed workforce in 1981. With recent expansion at Gunnedah Colliery, this figure has increased to approximately 330 employees or 6% of the workforce.

The manufacturing industry is a significant employer. In May 1985, the Council Abattoirs employed 270 persons. An additional 150 are employed in the plant. These are boning room employees and Government Officers.

The Centralcure Tannery employs 90 persons (May 1985).

A new Woolworths Store employs 80 people.

Boggabri is within Narrabri Shire.

In Boggabri at the time of the 1981 Census, 50 people were employed in agriculture. This represented 13.6% of the employed workforce of 367. The retail industry employed 67 (18.3%) and the mining industry employed 29 (7.9%) people (ABS 1981).

5.3.2.2 Employment Multipliers

Service industries are necessary to support basic industries. Expansion in the basic sector generates expansion in the supporting service industries. Any changes in basic industry has a multiplier effect on the regional economy.

A historic estimate of service employment* can be determined by economic base analysis. The historic estimate needs modification to accommodate unique aspects of a modern coal mining project. Sydney, Newcastle, and Wollongong are the areas from which specialised service to the coal industry will be supplied. This specialised service component is estimated to be 60% of the historic service employment.

The economies of the Gunnedah and Narrabri Shires, Northern Statistical Division and Boggabri have been divided into basic and service industries. Table 5.3-2 details this division and presents the calculated base multiplier, the historic employment multiplier for each area, and the predicted Vickery Project Local Employment Multiplier.

The Northern Statistical Division base multiplier value is greater than that of the Gunnedah Shire. This indicates larger Regional Centres such as Tamworth provide increased service to smaller towns and surrounding areas. In recent years there has been a significant trend of increased service supply by Regional Centres by both Government and Industrial sectors.

Predicted Local Employment Multipliers calculated from Census data and modified to take account of the unique service requirements of a modern coal development, have been used to estimate increases in service employment caused by the Vickery Project. These multipliers are 0.2 for Gunnedah Shire and 0.3 for Boggabri Urban Area.

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* The **Economic Base Multiplier** is usually calculated in terms of employment (number of jobs) and can be expressed as:

$$\text{Economic Base Multiplier} = \frac{\text{total employed}}{\text{basic employed}}$$

The base multiplier gives a ratio of total employment to basic employment at a particular time.

A **historic estimate of service employment** necessary to support increased basic employment can be calculated using the employment multiplier. The employment multiplier is derived by subtracting 1 from the base multiplier. The 1 represents the base job.

5.3.2.2 Employment Multipliers (Cont)

TABLE 5.3-2 BASE EMPLOYMENT MULTIPLIER FOR BOGGABRI URBAN CENTRE, GUNNEDAH SHIRE, AND NORTHERN STATISTICAL DIVISION FOR 1981

	Gunnedah Shire 1981	Boggabri Urban Area 1981	Northern Statistical Division 1981
Basic Employment	3652	223	27840
Service Employment	1470	117	35184
Other*	352	27	9395
TOTAL EMPLOYED WORKFORCE	5474	367	72419
Base Multiplier	1.5	1.6	2.6
Historic Employment Multiplier	0.5	0.6	1.6
Predicted Vickery Project Local Employment Multiplier	0.2	0.3	N.A.

* Inadequately described or not stated.
Source: ABS 1981.

5.3.2.3 Unemployment

Two sets of unemployment figures are available. ABS unemployment figures represent actual unemployed but are only available every five years. Commonwealth Employment Service figures are available quarterly but are only estimates of unemployment.*

ABS 1981 unemployment figures for Gunnedah Shire and Northern Statistical Division are presented in Table 5.3-3.

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* Commonwealth Employment Service figures refer to unemployed awaiting placement. They comprise all persons who were registered with the CES at the end of each Quarter. Persons referred to employers but whose employment had not been confirmed; and persons who had obtained employment and not notified the CES office are included in the CES figures. The CES figures are therefore only estimates of actual unemployment.

TABLE 5.3-3 ABS UNEMPLOYMENT FIGURES FOR GUNNEDAH AND NORTHERN STATISTICAL DIVISION - 1981

	Gunnedah Shire		Northern Division	
		%		%
Employed	5472	94.0	72419	93.2
Unemployed	352	6.0	5315	6.8
Total Labour Force	5824	100.0	77734	100.0

Source ABS 1981

The 1981 Gunnedah Shire and Northern Statistical Division unemployment rates were higher than the State unemployment rate of 5.6% (ABS 1981).

The 1981 Census unemployment figures for Gunnedah Shire (352) compare with CES figures available for April 1981 (327). CES figures are reliable estimates for actual unemployment even though they are only estimates.

Table 5.3-4 shows CES unemployment figures for the March, June, and September, 1985 quarters.

TABLE 5.3-4 CES UNEMPLOYMENT FIGURES FOR NARRABRI AND GUNNEDAH FOR MARCH, JUNE, AND SEPTEMBER 1985.

Employment District	March 1985	June 1985	September 1985
Narrabri (incl. Boggabri)	1720	1566	1809
Gunnedah	794	628	649

Over 250 people have filled in employment applications at the Vickery Joint Venture Development Office in Gunnedah.

5.3.3 Existing Population Characteristics

The population of main urban areas in the study area are shown in Table 5.3-5

TABLE 5.3-5 POPULATION OF BOGGABRI AND GUNNEDAH URBAN AREAS

	1961	1966	1971	1976	1981	1984*
Boggabri	1256	1199	1065	973	1023	1020
Gunnedah	6543	7507	8232	8689	8909	9039

Source: ABS 1981 * Estimated Figures

ABS figures for 1971 - 1981 for Boggabri show an annual decrease in population of 0.4%. The population of Boggabri would be stable or decline through to the turn of the century. Without mining development, the population would be approximately 1000 in the year 2001.

ABS figures for 1976-1981 for Gunnedah show an annual population growth rate of 0.8%. Assuming this rate continues, the estimated population of Gunnedah in the year 2001 is 10448.

Table 5.3-6 presents characteristics of Boggabri and Gunnedah Urban populations.

TABLE 5.3-6 CHARACTERISTICS OF BOGGABRI AND GUNNEDAH URBAN POPULATIONS

	Boggabri	Gunnedah
% People over 65 yrs	16.8	10.3
% People 45 - 64 yrs	20.0	19.1
% People 15 - 44 yrs	40.4	43.6
% 0-14 yrs	22.8	27.0
% Population married	46.9	45.1
% Tertiary Education	14.8	21.3
% Home Ownership	75.2	65.3

The urban population of Gunnedah is typical of medium sized NSW country towns. Boggabri's population is characterised by a large number of people over 65 years and a lower number of people aged 0-14 years. The incidence of Tertiary education is lower in Boggabri. Home ownership is higher in Boggabri than Gunnedah.

5.3.4 Existing Accommodation and Land Availability

Occupied Dwellings

Trends in the number of occupied dwellings in the Narrabri and Gunnedah Shires, the Northern Statistical Division, and NSW for the years 1971 to 1981 are shown in Table 5.3-7

TABLE 5.3-7 HOUSING TRENDS - OCCUPIED DWELLINGS GUNNEDAH AND NARRABRI SHIRES, NORTHERN STATISTICAL DIVISION AND NSW 1971 - 1981

Occupied Dwellings	1971	1976	% Change 71-76	1981	% Change 76-81
Gunnedah Shire	3394	3536	4.0	3962	12.1
Narrabri Shire	4182	4154	-0.7	4525	8.9
Region	45323	47680	5.2	52645	10.4
NSW	1364950	1491826	9.3	1662758	11.5

Source: ABS Census 1971, 1976, 1981

The number of occupied houses in Boggabri are expected to show similar trends to Narrabri Shire. 1981 ABS figures show 335 occupied dwellings in Boggabri.

The number of occupied dwellings in Narrabri Shire declined during the period 1971 to 1976. The most recent period has shown more growth, slightly below Regional rates and significantly below State rates.

The Gunnedah Shire figures demonstrate an upward trend. The period to 1981 shows a 12.0% increase which is above the Regional and State rates.

House Occupancy Rates

Table 5.3-8 shows the house occupancy rates for Gunnedah and the Boggabri Urban Area, 1981.

TABLE 5.3-8 HOUSE OCCUPANCY RATES FOR GUNNEDAH SHIRE AND BOGGABRI URBAN AREA, 1981.

	Occupancy Rate
Gunnedah Shire	3.3
Boggabri Urban Area	3.0

House occupancy rates have been declining due to reduced family sizes and increased home ownership. In this EIS, an average house occupancy rate and family size of 3.0 has been used to estimate impact.

5.3.4 Existing Accommodation and Land Availability (Cont)

Residential Land and Housing Availability

In March, 1984 there were 66 residential blocks and approximately 131 houses for sale in Gunnedah.* In May 1985, the number of houses available was approximately 130 ranging in price from $40,000 to $150,000. A recent, release of residential land provides a market of approximately 88 residential blocks ranging in price from $13,000 to $30,000.

Gunnedah Shire Council proposes staging residential expansion. This staging indicates the appropriate order in which land will be zoned and released for urban expansion. This land reserve is considered adequate to provide land at existing and increased rates of growth for at least twenty years.

The Gunnedah Shire Local Environmental Plan identifies land for future residential zoning with an approximate capacity of 4221 blocks.

Boggabri supported a population of approximately 1500 in 1951. The population of Boggabri in 1981 was 1023. This population decrease is reflected in a ready availability of housing and community infrastructure.

There is a large bank of residential land currently available in Boggabri. The NSW Government has 300 vacant residential blocks immediately west of the rail line. Narrabri Shire own an area with 500 potential residential sites west of the 300 vacant residential blocks. There are approximately 150 additional vacant blocks within the town.

In May 1985 there were 10 residential blocks available for sale in Boggabri. These ranged in price from $8,000 to $12,000. There were 10 older style homes for sale ranging in price from $30,000 to $50,000.

Semi-Permanent Accommodation

Semi-permanent accommodation available in Gunnedah and Boggabri is presented in Table 5.3-9.

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* Vickery Joint Venture Report "Residential Land, Houses, and Semi-Permanent Accommodation - Gunnedah, NSW. March 1984".

TABLE 5.3-9 SEMI-PERMANENT ACCOMMODATION BOGGABRI AND GUNNEDAH

	BOGGABRI		GUNNEDAH	
Type of Accommodation	Number	Sites/ Units	Number	Sites/ Units
MOTELS & HOTELS	3	27	10	193
CARAVAN PARKS				
Permanent			1	14
Tourist	1	22	1	65

Source NRMA Accomodation Directory.

In addition to the two currently operating caravan parks, Gunnedah Shire Council has a 33 site caravan park which is not operating. This park is available either as a lease arrangement or under Council administration.

5.3.5 Existing Education Facilities

Education facilities in Gunnedah and Boggabri are summarised in Table 5.3-10. These towns are expected to support the non-local component of the construction and operation workforce for the Vickery Project.

TABLE 5.3-10 EDUCATION FACILITIES IN GUNNEDAH AND BOGGABRI

Facility	No.	Capacity	Present Enrolment (1985)	Surplus Capacity
GUNNEDAH				
High School	2	1415	1281	134
Primary School (includes infants)	4	1715	1407	308
Pre-School	2	72/day	342/week	0
Technical College	1	1600	1800	0
Handicapped Children	1	18	14	4
BOGGABRI				
Primary School	2	340	180	160

Gunnedah

The State Education Department operates one High School and two Primary Schools in Gunnedah.

The Catholic Church operates one High School and one Primary School. Another Primary School is run by the Gunnedah Christian Community.

The four primary schools in Gunnedah are operating approximately 308 students below capacity.

Both pre-schools are operating at full capacity.

G.S. Kidd Memorial School is for the intellectually handicapped. This school is supported by the Edith Beasley residential facility with capacity for 12 live-in children. At present (May 1985) there are 8 residents.

Gunnedah Technical College is one of the better equipped and more established TAFE Colleges in the Region.

The commencement of any course at Gunnedah TAFE is subject to sufficient enrolments, with 12-15 enrolments desirable for a practical class.

Courses offered for 1985 include:

- Accounting
- Hairdressing
- Rural Studies
- Home Science
- Small Business Management
- Remedial Reading and Maths

- Pre-apprenticeship and Trade Courses in:
  - Automotive
  - Welding
  - Carpentry and Joinery

Pre-apprenticeship and Trade Courses are conducted each year and enrolments for 1985 are estimated to be 26 for pre-apprenticeship courses, and 30 for Trade courses.

A more extensive range of courses are offered at the Tamworth TAFE. Tamworth TAFE is the Regional Centre where facilities are available for more specialised training.

Gunnedah TAFE has experienced shortages of lecture room and in 1984, some classes were held at Gunnedah High School. An additional venue for classes has been necessary in 1985.

Gunnedah (Cont)

At present, all KCC apprentices, including those from the VJV, commence instruction and basic skill development at the Vale Training Centre.* This will continue for the forseeable future.

These apprentices also attend the relevant TAFE Trade Course on an accelerated programme to supplement their training at Vale. During their second year, apprentices are transferred to the main workshop where they work with tradesmen to further their skills and experience. After a further twelve months minimum, selected apprentices are transferred to KCC mines for further experience.

In the current year, there are 64 apprentices at Vale, and 10 employed in KCC Mines. Nine of the apprentices are from the Gunnedah area. VJV will continue to recruit apprentices from the Gunnedah / Boggabri area.

Boggabri

The State Education Department and the Catholic Church each operate a Primary School in Boggabri. Both are operating below capacity.

There is no High School in Boggabri. Students travel to Gunnedah by bus.

A pre school has recently commenced in Boggabri and a play-group meets regularly.

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* Vale Engineering was established at Moss Vale, NSW by KCC in 1967. This facility provides a centralised apprentice training function aimed at producing trained tradespeople for the underground coal mining industry.

Apprentices are recruited annually from the Gunnedah, Illawarra, and Moss Vale areas. It is intended that Vale Engineering will continue to employ between 12-15 apprentices each year in the trades of Fitting and Turning, Electrical, and Boilermaking.

5.3.6 Existing Health Services and Facilities

Medical Services

Both Gunnedah and Boggabri have a local hospital and fall within the area of the Regional Base Hospital at Tamworth. There are Specialists available at Tamworth Base Hospital.

Gunnedah Hospital has 70 beds, 9 doctors, and 60 nurses. There are 21 long stay geriatric beds. A consultant surgeon visits from Tamworth on a regular basis. Other cases travel to Tamworth, where there are resident obstetricians, gynaecologists, and paediatricians. Facilities at the hospital include two operating theatres, X-ray equipment, and observation wards. There is also a constant care room at the hospital.

Boggabri has a hospital with 22 beds including 8 long term geriatric, 1 emergency obstetrics, 9 acute care, and 4 paediatric observation beds. The operating theatre was closed due to lack of medical staff. There is only one doctor available in the town. Permanent staff at the hospital include 1 Administrator, 4 trained nurses, and 5 nursing aides. One consultant surgeon visits from Tamworth every three weeks. Other visiting medical officers include:

- a dietician from Tamworth every two weeks,
- a physiotherapist from Narrabri as required,
- a four person regional team from Tamworth as required to assist at the Hospital,
- a radiologist from Gunnedah once a week,
- an Area Medical Superintendent from Tamworth on a regular basis.

The Community Nurse at Boggabri Hospital has the support of the social worker, one drug and alcohol counsellor and one social welfare officer.

Boggabri people requiring other specialist services normally travel to Gunnedah or Tamworth. Psychiatric facilities are located at Tamworth and Newcastle.

5.3.7 Other Community and Welfare Services

Welfare and Family Support Services

The area is presently serviced by a number of public and private organisations, the majority of which are based in Gunnedah. The emphasis of much of the Government activity is on family support and people in crisis situations. At the community centre in Gunnedah, there is one social worker supported by the Shire Council, and a small unit run by the NSW Health Commission. This unit consists of a director, one social worker, three community nurses, and one baby health nurse.

The main target group for clinical social work services is the family, dealing with the multiple aspects of family breakdown and normal stress.

People in crisis services available in Gunnedah and to a lesser extent in Boggabri on a rotational basis include:

- emergency accommodation for women and youth,
- marriage counselling,
- homemaker services,
- alcohol rehabilitation,
- other voluntary groups including the Children's Assistance Committee, St. Vincent de Paul, and the Smith Family (Tamworth).

Recreation and Entertainment

The area is well provided with a full range of recreational clubs and activities.

Gunnedah offers a high level of community services and a varied range of recreation facilities. These include: swimming pool, squash courts, indoor cricket arena, picture theatre, Police Boys Club, gymnastics centre, golf course, racecourse, greyhound track, sports ovals, lawn bowls, tennis courts, BMX track, soccer, rugby league, rugby union, baseball, net ball, hockey, Speedway motorcycle track, bushwalking, fishing, and associated clubs.

Boggabri recreational facilities include sporting clubs, sports ovals, racecourse, swimming pool and golf course. Community Service Clubs are very active in both towns.

5.4 TRANSPORT AND INFRASTRUCTURE

5.4.1 Regional Coal Transport

Port Newcastle is the nominated coal export terminal for mines located in the North Western coalfields. It is Government policy that transportation of coal should be by rail, apart from possible short hauls to a nominated point of delivery, or to the nearest railhead. Consequently, the North Western Rail Line and the Main Northern Rail Line operate as the main transport arteries for the movement of coal to port from mines located in the Region.

5.4.2 Existing Rail System

The North Western Rail Line is the existing rail facility serving the Narrabri - Gunnedah region and at its nearest point is approximately 15 km due west of the Vickery Mine site. This Railway joins the Main Northern Rail Line at Werris Creek (Refer Figure 5.18).

The Railway between Narrabri and Muswellbrook is a single line facility with the majority of the Line operated by an electric train staff system. A small 6km section near Muswellbrook is operated by Central Traffic Control (CTC) based in Muswellbrook.

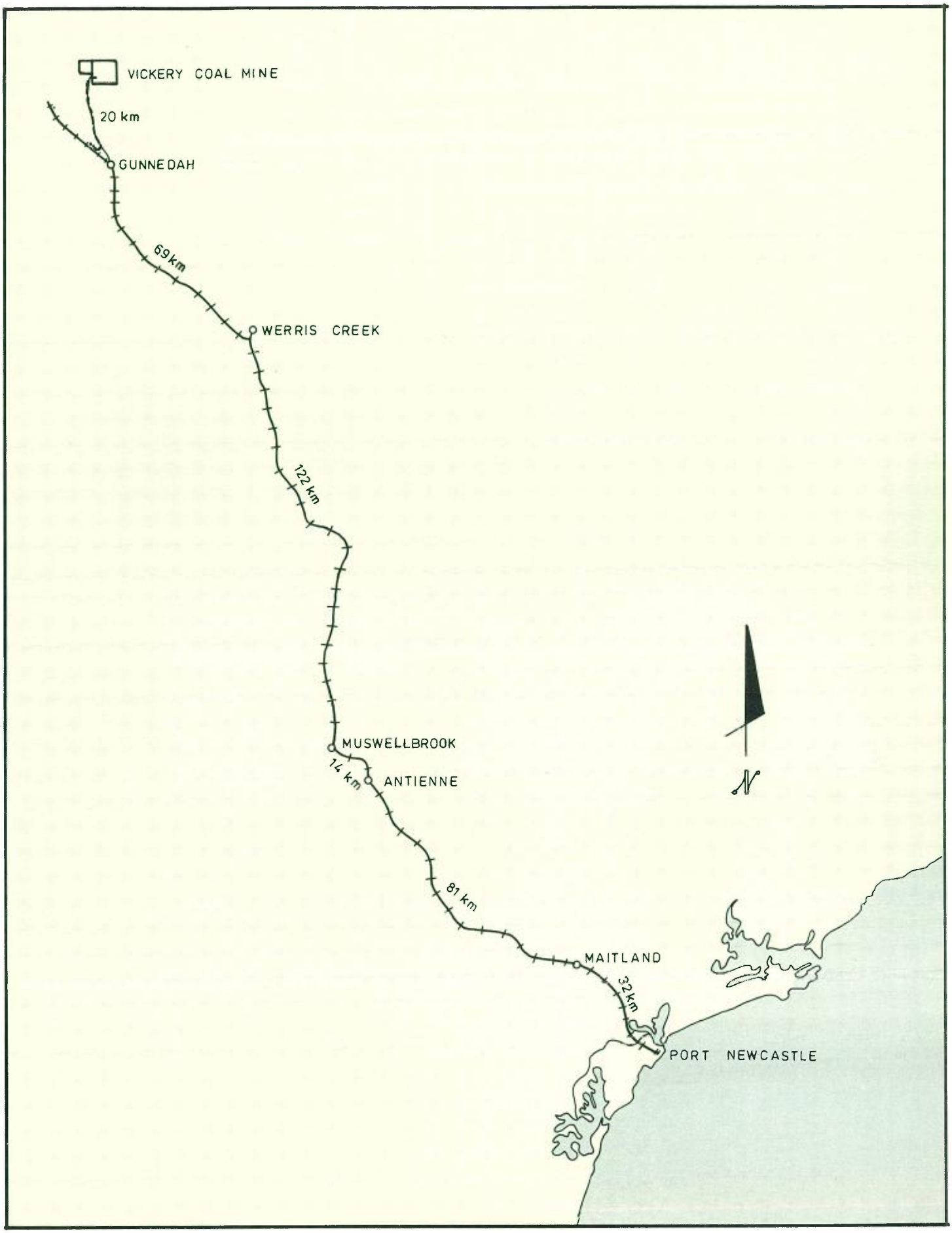
The existing and potential capacity of the rail system is summarised in Table 5.4-1.

The movement of Gunnedah Basin coal to Newcastle is also dependent on the capacity of the Main Northern Rail Line between Muswellbrook and Newcastle and the total loader capacity at Port Newcastle. The proportion of this capacity used for the movement of North Western coal to port will depend on coal mining development in the Gunnedah Basin, Hunter Valley coal mining development, and State Rail Authority (SRA) planning strategies.

Existing port loading facilities, plus the possible further development of the Kooragang Island loader creates a potential port loader capacity at Newcastle of 78 Mtpa. Coal loader capacity at Newcastle does not threaten present and proposed levels of output from the North Western coalfields.

Currently coal is being transported from Gunnedah in 21 CHS waggon trains and the capacity of the existing track using the 9 available coal train paths is 4.3 Mtpa. This amount is slightly higher than the Transmark Report estimate of 3.5 Mtpa, which was based on 17 CHS waggon trains.

The capacity could be further increased by the use of larger trains and extended passing loops. Forty-two CHS waggon trains are expected to be operating in the area by the end of 1986.



VICKERY JOINT VENTURE

THE COAL CLIFF COLLIERIES PTY LTD PROJECT MANAGERS

COAL TRANSPORT ROUTE

FIGURE 5.18

5.4.2 Existing Rail Line System (Cont)

TABLE 5.4-1 EXISTING AND POTENTIAL CAPACITY OF RAIL SYSTEM

RAILWAY SECTION	PRESENT COAL HAULAGE CAPACITY	PRESENT NUMBER OF AVAILABLE PATHS	POTENTIAL CAPACITY **
Narrabri - Werris Creek	3.5 Mtpa with 17 CHS waggons	9	10.5 Mtpa
	4.3 Mtpa with 21 CHS waggons (current practice)		
Werris Creek - Muswellbrook (122km single line track)	4.3 Mtpa (additional locomotives required Willow Tree - Murrurundi)	11	12.9 Mtpa
Werris Creek - Muswellbrook	If Murrurundi - Willow Tree upgraded		16.5 Mtpa
Muswellbrook - Maitland	56.5 Mtpa *		
Maitland - Newcastle	76 Mtpa *		

* 3,200 t nett trains already introduced.
** If 3,200 t nett trains introduced for Muswellbrook to Gunnedah.

By December 1986, 42 CHS waggon trains will increase haulage capacity to 6.2 Mtpa between Gunnedah and Werris Creek and to 7.6 Mtpa between Werris Creek and Muswellbrook.

The proposed 1.94 Mtpa from the Vickery Project would be easily accommodated on existing and proposed rail infrastructure.

5.4.3 Existing Road System

The **Blue Vale Road** has an average 6 m wide conglomerate gravel pavement which is in fair condition.

Apart from the higher section near the Mine Site and the sealed section beyond the 15.7 km point, the pavement is close to natural surface level, with little opportunity for relief culvert drainage.

The natural surface adjoining the pavement in the low areas can become fully saturated and not trafficable.

Sections of the road are subject to flooding.

Traffic analysis data for Blue Vale Road indicates a light traffic flow that markedly drops away beyond the Blue Vale Road Speedway toward the Mine Site (Refer Table 5.4-2 and Figure 3.17). Light vehicles contribute a majority of the traffic flow with minor "peak periods" between 9 and 10am and 5 and 6pm (Refer Tables 5.4-3 and 5.4-4).

Trunk Road 72 is the main road linking Gunnedah and Boggabri. Detailed traffic volume analysis indicates a dominance of light vehicle traffic and a varied but relatively low volume daily traffic flow pattern.

Traffic use of the Blue Vale Road and Trunk Road 72 has been monitored regularly by the VJV.

Average Annual Daily Traffic counts (ADDT) have been recorded at four different locations along the Blue Vale Road at the locations shown in Figure 3.17. Counts have also been taken on Trunk Road 72 at its intersection with Torrens Road.

The results are listed in Table 5.4-2.

TABLE 5.4-2 TRAFFIC COUNTS BLUE VALE ROAD AND TRUNK ROAD 72. AVERAGE ANNUAL DAILY TRAFFIC (AADT) *

1	2	3	4	5
Start of Blue Vale Road	Blue Vale Speedway	Kurrumbede Gate	Hoads Lane	TR 72 - Torrens Rd Intersection
252	112	60	11	1553

* This data collected over 45 days.

5.4.4 Gunnedah Services

Water Supply

Gunnedah has a series of wells and bores to supply its town water. The source of supply is a series of low to medium depth aquifers below the Namoi Flood Plain. The low zone and high zone areas of the reticulation system within Gunnedah are independent, each having a separate set of lines and reservoirs. In the low zone, the centrifugal pump units have reached the end of their economic life. One of the mains is also in poor condition. This zone services the older part of town.

The high zone services the newer area of town, south of the North Western Rail Line. This part of the system does not have major maintenance problems.

When necessary water can be transferred from one system to the other, through a transfer valve or booster pump depending on the required direction of flow.

Existing capacity of the system is shown in Table 5.4-3

TABLE 5.4-3 EXISTING CAPACITY OF WATER SYSTEM - GUNNEDAH

Low Zone Bore Capacity	5.00 Ml/day
High Zone Bore Capacity	12.35 Ml/day
Low Zone Reservoir	3.41 Ml
High Zone Reservoir	14.10 Ml

* Source Sinclair Knight 1981

Residential use comprises 63% of present water consumption.

In Council's water supply development strategy augmentation of the present system is proposed in three stages.

Stage 1 was commenced in early 1983 and involves expenditure of $780 000. This will enable:-

- establishment of a high yield bore along the Orange Grove Road,
- the connection of the bore to the town system using large diameter pipe,
- the construction of booster systems within the town water supply.

This should enable the supply of water to a population of 11,000. This represents a present surplus capacity that could service almost 2,000 additional people.

Sewerage Capacity

The Sewerage Development Strategy (Sinclair Knight & Partners, 1981) reported the existing system at capacity. Major trunk mains and pumping station are overloaded during wet weather. The sewage treatment works is theoretically overloaded, but testing of the facility showed that it has satisfactory effluent quality during dry weather.

A three stage strategy for rehabilitation of the system was proposed in the Sinclair Knight Study. The majority of the work would be carried out in Stage 1 to be completed by 1991.

The Gunnedah Shire have initiated expenditure of $253,000 to undertake sewer trunk main replacement. This will enable the system to service a maximum population of 13,000 which is 3961 above the existing population.

Waste Disposal

Gunnedah garbage disposal site is located approximately 2 km south west of the town on the Wandobah Road. Gunnedah Council have planned a new waste disposal site west of the town close to the proposed Train Loader (Refer Figure 5.17).

Power and Communications

Gunnedah is serviced by the Namoi Valley County Council. A new substation has recently been constructed approximately 8 km east of Gunnedah.

Gunnedah is serviced by an automatic telephone exchange.

Twice daily return flights to Sydney are available from Gunnedah. Additional flights are available from Tamworth.

Gunnedah is located on the North Western Rail Line, and at the junction of Trunk Road 72 and the Oxley Highway.

5.4.5 Boggabri Services

The water supply for Boggabri is obtained from one well and one bore. Their combined pumping capacity is 3.6 Megalitres (Ml) for a 22 hour day. There are two storage reservoirs which provide 1.80 Ml capacity. Summer peak usage is 1900 litres/head/day or 1.94 Ml. Storage capacity is less than the Public Works Department minimum of one days supply at peak demand, although the supply system meets demands. It is estimated that approximately 150 hectares of the town is serviced with water, with some 380 business and private connections being supplied.

5.4.5 Boggabri Services (Cont)

The Boggabri **sewerage system** was completed in 1954 and was designed for a population of 2000 persons and approximately 500 dwellings. Approximately 340 dwellings are connected to the reticulation system. An additional 600 to 650 persons (140 to 150 dwellings) can be supported by this system.

A **garbage disposal** site is located 1.5 km south of Boggabri. The trench fill method is used and the site has a capacity of 20,000 m^3 with an estimated life of 9 to 10 years. Further areas are available for trench fill disposal.

Electricity supply to Boggabri is via a feeder from a substation located north-west of the town. This is fed from a 66 kV transmission line.

Boggabri is serviced by an automatic **telephone** exchange.

SECTION 6

ENVIRONMENTAL IMPACTS, SAFEGUARDS AND MITIGATIONS

6.1 PHYSICAL AND BIOTIC ENVIRONMENT

6.1.1 Surface Subsidence

6.1.1.1 Introduction

During the first 21 years of the Vickery Project, 96% of production will come from underground mines. Subsidence after extraction of the coal will be the main impact from underground mining (Refer Figure 6-1).

The bulk of land subject to subsidence is owned by the VJV. There is some privately owned land in the south-east which will subside. The Vickery State Forest and a small length of Crown Road are also affected by subsidence.

An agricultural dam is the only structure on land affected by underground mining that is not owned by the VJV.

The Mine Subsidence Compensation Act, 1961 sets out the conditions under which people affected by coal mine subsidence may seek compensation.

6.1.1.2 Red Hill

This area will be subject to maximum subsidence of approximately 2.2 m. The subsidence will occur following pillar extraction and will be complete one year after the Red Hill Mine ceases operation.

The surface area affected by subsidence will be characterised by a general reduction in topography and a wavy surface reflecting underground location of remnant pillars.

Subsidence cannot be avoided. Cracks from the coal seam to the surface may develop. Where cracks do appear on the surface, these will be rectified by cultivation and sowing with pasture.

While subsidence is occurring, and until all impacts are corrected, the area will be fenced and notices provided indicating possible danger. It is however most unlikely that any person in the area would be aware of the subsiding process.

Hoad's Lane will be diverted temporarily approximately 180 m to the west. The road will be returned to its present alignment when all subsidence has ceased, approximately 1 year after completion of mining at Red Hill.

6.1.1.3 Greenwood

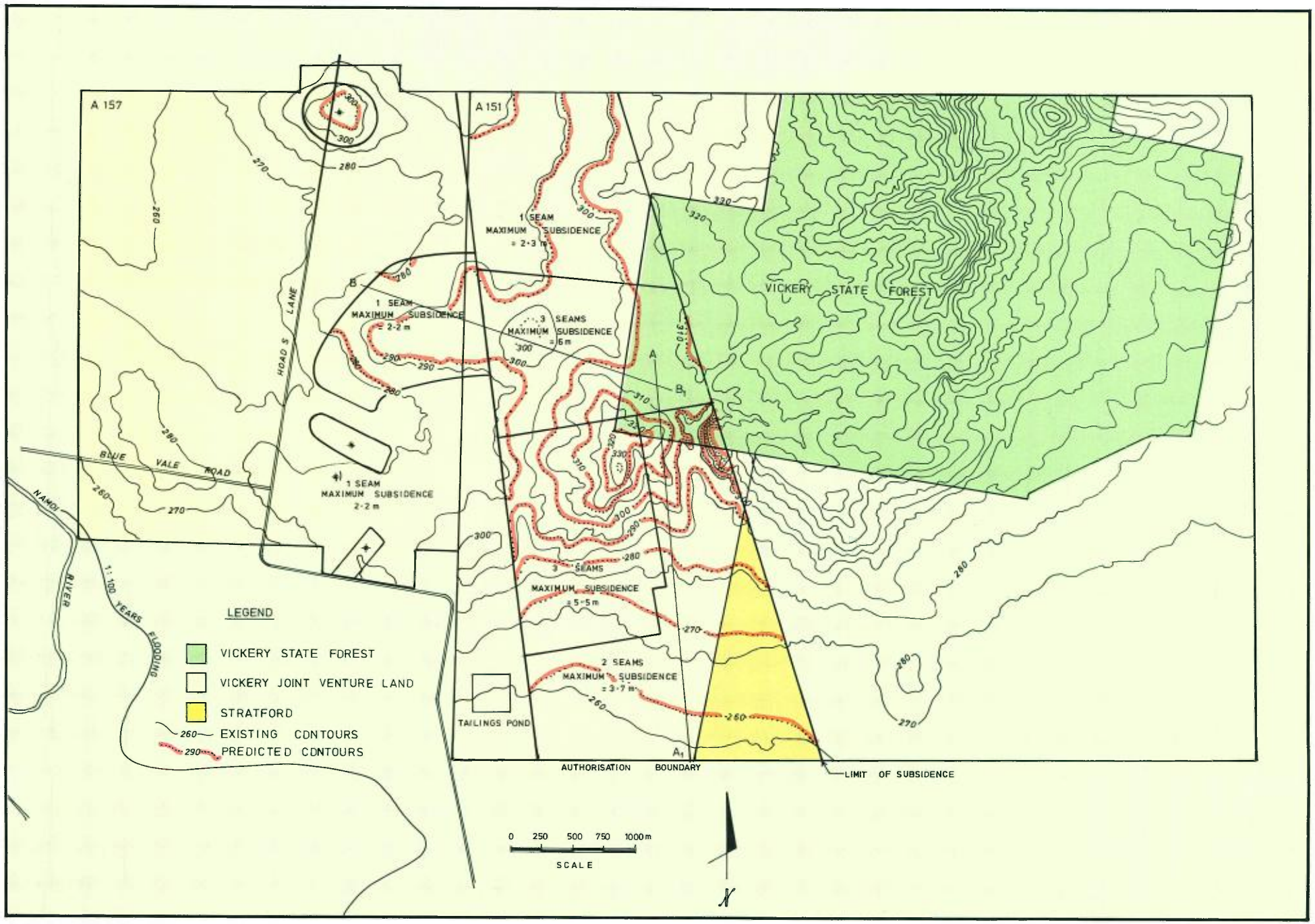
The maximum subsidence above Greenwood Mine will be 2.2 m. Subsidence will be complete approximately 1 year after mining has ceased.

VICKERY JOINT VENTURE

THE COAL CLIFF COLLIERIES PTY LTD PROJECT MANAGERS

MAXIMUM SURFACE SUBSIDENCE
AFTER 21 YEARS

FIGURE 6.1



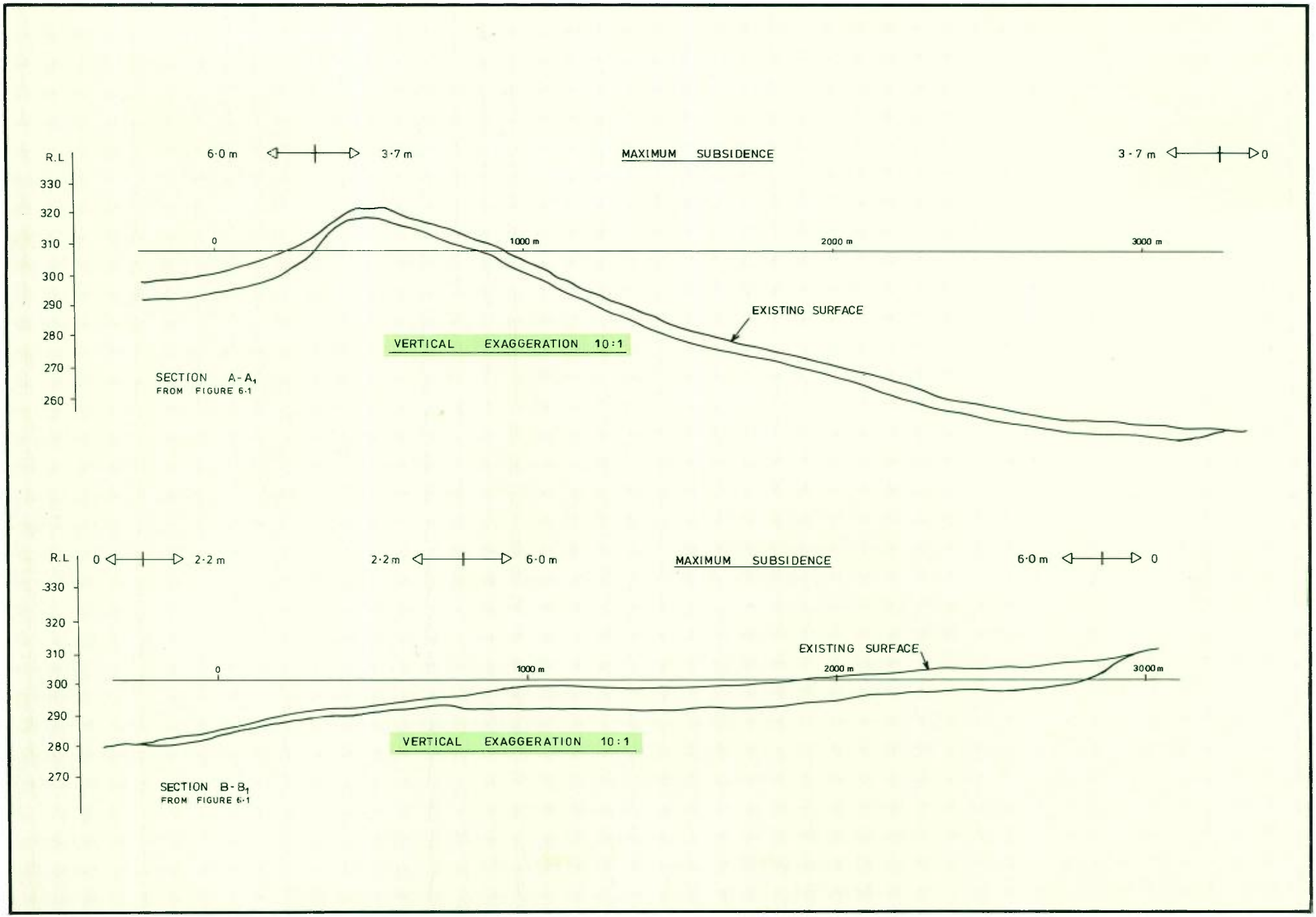


FIGURE 6.2

VICKERY JOINT VENTURE

THE COAL CLIFF COLLIERIES PTY LTD PROJECT MANAGERS

MAXIMUM SUBSIDENCE CROSS SECTION
AFTER 21 YEARS

6.1.1.3 Greenwood (Cont)

The surface above Greenwood Mine after subsidence will be wavy, reflecting the extent of pillar extraction. Cracks to the surface may appear although the depth of mining is generally deeper than at Red Hill. Any cracks will be remedied by cultivation of the surface soil and sowing with pasture.

Groundwater seepage into the Mine will be controlled by a system of low capacity groundwater bores. These bores will extract water from the water table in the general area of the Greenwood underground workings and within the flow line of the small catchment. This water will be pumped to the water supply dam above the Vickery Mine and used in the mining process. This system of water drainage from the Gundawarra seam is presently being used successfully at the Red Hill Sampling Operation.

6.1.1.4 Vickery

This Mine will be responsible for most subsidence. Maximum subsidence will occur only after the four deeper seams have been extracted from the Vickery Mine. This will mean subsidence will be a gradual process over the 21 years and will be complete one or two years after all seams have been extracted.

Vickery Mine operations occur at a much greater depth than those at Red Hill and Greenwood Mines. Consequently, there will be no major cracks appearing on the surface.

The sequential extraction of up to four seams will create gradual subsidence. Vegetation is not expected to be adversely affected.

The land surface above the Vickery Mine is characterised by hilly topography. When subsidence occurs there will be no low lying areas created and consequently drainage will not be affected. Figure 6.2 shows two cross sections of the surface above underground mining areas before and after mining. The sections have a vertical exaggeration of 10:1 to enable visual presentation of the maximum subsidence over the 21 years of the Project. One section runs north / south over the Vickery Mine and the other runs east / west over the Vickery and Greenwood Mines.

Most of the surface above the Vickery Mine is owned by the VJV. A portion of the Vickery State Forest will subside however no drainage or vegetation impacts are expected. The remaining part of the surface overlying the Vickery Mine is part of the Stratford property. The subsidence in this area is expected to reach a maximum of 3.7 m. There are no structural improvements on the affected Stratford property surface except a farm dam.

Coarse washery rejects will be placed in an area subject to subsidence, but tailings dams will be located where subsidence will not occur. Subsidence will not cause stability problems with the coarse rejects area. All major structures will be constructed on areas not subject to subsidence.

6.1.2 Surface Hydrology

6.1.2.1 Mines

The major hydrological effect results from subsidence (See Section 6.1.1). No effect on surface hydrology due to subsidence is expected above Red Hill and Greenwood Mines.

The flatter areas over the southern section of the Vickery Mine will be affected. The original drainage patterns will be re-established by contouring along the edge of the subsidence area.

The small opencut experimental mines do not interfere with surface streams. Measures will be taken to control the surface runoff from the overburden stockpile areas. Drainage banks will be constructed around the toe of the overburden stockpiles to direct water to sedimentation dams. The Greenwood opencut will require one contour bank leading to a sedimentation dam with a capacity of 2,500 m^3. The Blue Vale Opencut will require two sedimentation dams with a total capacity of 5,000 m^3.

The reject disposal area will have a catchment drain around the toe of the area leading to a sedimentation dam of approximately 3,500 m^3. Water from the sedimentation dam will be pumped back to the Preparation Plant for recycling. The sedimentation dam will be cleaned as required and material collected will be disposed of within the reject disposal area.

The tailings disposal dams do not interfere with surface runoff. The tailings dams will have internal drainage only and no runoff water will be produced. Excess water will be pumped back to the Preparation Plant for recycling.

The Red Hill Sampling Operation has surface drains which direct clean water away from, and around the disturbed areas. These will continue to operate when the Sampling Operation becomes a mine. A similar system will be used to control surface runoff water around the surface facilities of the Greenwood and Vickery Mines.

6.1.2.1 Mines (Cont)

The first component of the Vickery Mine surface water control system is the supply dam in the catchment above the Vickery Mine. Water passing through this dam will then enter a smaller dam downstream. Excess water from this smaller dam will be diverted to the west in a contour bank. The water will then flow down a drainage line immediately to the east of the existing Welkeree house. Culverts will drain this water below the Vickery Mine access.

Table 6.1-1 includes data showing the effectiveness of the sedimentation dam at the Red Hill Sampling Operation.

The total filtrable residue and the non-filtrable residue is reduced significantly by this existing sedimentation dam. Proposed sedimentation dams for the Vickery Project are expected to work as effectively.

Table 6.1-1 WATER QUALITY DATA FROM RED HILL SAMPLING OPERATION SEDIMENTATION DAM

Sample Origin	Mine Sump	Catch Dam
Total filtrable residue, 180°C, mg/l (Method 209B*)	1850	937
Non-filtrable residue mg/l (Method 209D*)	157	17

* Standard Methods for the Examination of Water and Waste Water (15th Edition) 1980 - APHA - AWWA - WPCF

6.1.2.2 Coal Haul Road and Access Roads

Vehicle access to the Vickery Project will be obtained via the Blue Vale Road from both Gunnedah and Boggabri. The Blue Vale Road to Gunnedah will be the coal haulage route between the Mine and the Train Loader.

The Blue Vale Road crosses low lying, flood prone land. The areas where water cuts the road will be traversed by low level concrete causeways.

Floods that break the banks of the Namoi River will cause coal haulage to cease. There will be no direct effect on Mine or Loader operation although access to the Mine may be hindered. Structures at the Mine and Loader are above the 1 in 100 year flood level of the Namoi River.

The roads are expected to be untrafficable for at least 1 day per year by minor flooding. Major floods in excess of 1 in 20 year return period will cut the roads for up to 2 weeks. When major flooding occurs the rail between Gunnedah and Werris Creek will also be out of service. The Train Loader stockpile capacity enables continued train haulage when the Blue Vale Road is untrafficable due to flooding.

Piped concrete causeways will traverse larger lagoons along the edge of the Namoi River.

The Namoi River bridge will be built at bank height to avoid bridge abutments diverting flood waters. There is provision for stock access beneath the bridge.

The culvert over a lagoon outflow on the Trunk Road 72 side of the Namoi River bridge will be built to allow water to pass underneath the road.

An overpass bridge for Trunk Road 72 will span the coal haulage route. The approaches to the overpass are aligned with the flood flow direction, minimising the amount of redirected flood waters. The new sections of road built at the intersection will meet Department of Main Roads standards.

The Blue Vale Road between Boggabri and the Mine will maintain its present alignment. The level of the Barber's Lagoon crossing will be raised approximately 1 m and more pipes installed. This will enable improved access to the Mine and to properties in the area during wet weather. The road surface between the Namoi River and Barber's Lagoon on the Blue Vale Road will be regravelled.

The general approach to major floods has been to accept that they do occur and not try to develop a flood free system.

6.1.2.3 Train Loader

Two of the three intermittent surface streams which cross the Train Loader Site will be affected. The streams pass below the North West Rail Line through culverts. The easterly stream passing under the rail loop will be directed into an internal pond. The internal pond will drain into a large agricultural dam in the north west corner of the Site.

The intermittent stream passing below the North Western Rail Line to the west of the existing Gunnedah Coal Loader will be redirected around the western end of the rail loop into the large agricultural storage dam in the north west corner of the property. Water will pass out of this dam into the existing flow line then into the Namoi River. Drainage will need to be provided along the edge of the Site access road.

Drainage water from stockpiles will pass through a settlement pond. The pond will settle out most of the coal within the surface runoff water and will be cleaned periodically and coal returned to the stockpile.

6.1.2.3 Train Loader (Cont)

Water will pass from the pond into a settling dam with 30 Ml capacity where more coal will come out of suspension. The water will pass out of the settling pond into an internal drainage pond within the rail loop. Water passes from the internal drainage pond into the large agricultural dam. Water will pass from the dam into the existing flow line and into the Namoi River.

No deterioration in water quality leaving the Site is expected. An ongoing water quality monitoring programme will be established by the VJV.

6.1.3 Groundwater

6.1.3.1 Mines

Groundwaters at the Mine Site are equivalent to surface waters in quality and in some instances are superior. Groundwater is mostly within the hardrock aquifers away from the alluvials of the Namoi Valley. These aquifers have low flow rates.

The Red Hill Sampling Operation had some initial problems with excess groundwater. This was associated with the entry being at one of the lowest points in the seam. The seam was the aquifer in the area and there was a concentration of water at this low point. A small pump installed in an existing large diameter exploration bore has subsequently maintained dry working conditions. Water obtained from the borehole is used for dust suppression.

The Gundawarra seam being mined at Red Hill is under VJV land. There are no stock water bores within the aquifer affected and no impact on groundwater is expected.

There are no stock water or irrigation bores affected by the operation of the Greenwood Mine, and mining will generally occur within the hardrock aquifers.

The groundwater encountered in the Gundawarra seam is good quality. There is potable water within the coal seam at the north of the Greenwood Mine.

Bores and pumps extracting approximately 1 l/s will be used to lower the water table around the entry and first workings of the Greenwood Mine. This water will be pumped to the water supply dam above the Vickery Mine and used as part of the mine water supply.

The Vickery Mine will operate both within the medium water quality hardrock aquifers to the north of the entry and below the good water quality alluvial aquifers to the south. Gundawarra seam mining will be limited to pillar development in the south of the Vickery Mine to avoid disrupting the aquifers of the Namoi Valley alluvials.

The Karu fault may have higher rates of water flow which will be handled by pumping.

6.1.3.2 Water Supply

The Mine water supply will come from surface catchment water and groundwater pumped from workings. Additional bore water will provide make-up water. Potable quality borewater will be obtained from a bore approximately 2 km south of the Vickery Mine on the Blue Vale Road. This bore has a capacity of 2.4 Ml/day pumping continuously.

The nearest irrigation bore is 1.7 km to the south of the proposed bore. The bore is owned by the VJV and is not operating.

The operation of the new bore will locally lower the water table. Due to the distance of other bores, no impact will occur.

6.1.3.3 Train Loader

The water supply for the Train Loader will come from a bore in the north-west corner of the Site. There will be no effect on other users.

6.1.3.4 Water Balance

The **mine water supply** will consist of Site run-off water and mine inflows made up by water pumped from a bore south of the Vickery Mine.

The sources of water at the Mine will be:

- inflow of groundwater into the workings,
- moisture content in the insitu coal,
- runoff water into water supply ponds and small catchment dams and
- make up water from the bore.

Water will be lost from the system by:

- dust suppression,
- consumption in workshops, bathhouse and office,
- spraying of unsealed Site roads,
- evaporation from the storage ponds and tailings ponds and
- washed coal transferred to the Train Loader.

Table 6.1-2 summarises this water balance.

6.1.3.4 Water Balance (Cont)

Table 6.1-2 ANNUAL WATER BALANCE NORMAL RAINFALL, MAXIMUM PRODUCTION 1.94 Mt SALEABLE COAL (Ml)

SOURCES		USES	
Groundwater Inflow	22	Dust Suppression & Industrial Uses	70
Insitu Coal Moisture	110	Consumption Amenities	12
Rainfall & Runoff Water	142	Evaporation	135
Bore Makeup Water	222	Product Coal Moisture	204
		Refuse Moisture	75
TOTAL	496	TOTAL	496

In an average year, the make up water required for the Mine is 222 Ml or approximately 1.00 Ml/operating day.

The major water requirement at the Train Loader is for dust suppression. This will require approximately 97 Ml/annum. The bulk of this water will be supplied by runoff water collected in the two storage dams and settling pond on Site. These storage dams have a total capacity of 110 Ml. This gives the Train Loader in excess of a 1 year water supply without runoff replenishment.

Makeup water will be drawn from a groundwater bore at the north of the Site. The groundwater bore may be required to supply initial water requirements for the Site should runoff not occur.

Potable water will be supplied from the bore.

In the unlikely event of there being excess water at the Mine or Train Loader during normal operations, irrigation of grazing land will be used to eliminate the need to discharge water.

6.1.4 Aesthetics

6.1.4.1 Mines

The Vickery Project Mines are located in an isolated part of the Gunnedah Region. Very few people other than those employed at the Site or living in the immediate area will see the Mines. Little traffic passes through the area.

Public views to the Red Hill Mine are obtained only from a small section of Hoad's Lane. The distance to the Mine from this Site is approximately 1.4 km. Existing vegetation around the Red Hill Sampling Operation has been protected for aesthetic reasons. No special vegetation screening is necessary.

The Blue Vale Road passes within 300 m of the surface facilities of Greenwood Mine. To mitigate visual effects, a vegetative screen will be planted along the road edge within VJV property. The screen will blend with existing vegetation along the Blue Vale Road and will include similar varieties of trees and shrubs. This will provide an effective screen for the mining operation and will also enhance the value of existing vegetation for wildlife habitat. This planting will occur in 1986.

The Vickery Mine surface facilities can be viewed from the Blue Vale Road from approximately 400 m distance. Large components of the surface facilities are of interest to many people and it is impractical to eliminate them from view. Screening will consist of landscaping the ground facilities to shield views of disturbed areas or components of the surface facilities that have a high visual impact. Colours will be selected to reduce visual impact.

There are a number of large trees remaining in the cultivation paddocks where the Vickery Mine surface facilities will be built. These trees will be retained as part of the landscaping for the surface facilities.

The tailings disposal area is visible from Blue Vale Road. Plantings of trees and shrubs in 1986 will effectively screen the ponds from the Blue Vale Road.

After mining has finished at Red Hill and Greenwood, the entries will be left and they will be mined through during future development. The entries will be fenced and the mine accesses sealed.

6.1.4.2 Access Roads

The Blue Vale Road to both Gunnedah and Boggabri carries low traffic levels. The existing gravel road from the Mine to the Train Loader will be upgraded with a bitumen surface and improved drainage. People travelling on the Trunk Road 72 overpass will catch glimpses of the haulage route passing beneath Trunk Road 72. These glimpses will be screened by the existing vegetation on the travelling stock reserve on either side of the proposed overpass.

The bridge over the Namoi River has a low profile and is visible only by those people travelling along the Blue Vale Road.

6.1.4.3 Train Loader

The Train Loader will be visible from Trunk Road 72 and from trains travelling on the North Western Rail Line. Vegetation screens will be incorporated on the boundary of the Loader to minimise visibility. Buildings and major plant will be painted in an acceptable colour.

6.1.4.3 Train Loader (Cont)

All disturbed areas at the Site will be landscaped. Mounds of earth, located mainly to reduce noise, will be vegetated with trees and grass to reduce visual impact.

6.1.5 Soils and Overburden

6.1.5.1 Mines

There is adequate top soil or top soil forming material at Vickery to rehabilitate overburden stockpile areas, restore reject and tailings disposal areas and to restore any other disturbed area.

Wherever topsoil is to be disturbed, it will be removed in two layers. The first layer represents the top organically rich and biologically active part of the soil. The second layer would be anything up to 1 m of clay material. The top soil would be used to resoil disturbed areas and would be returned in the two layers.

The haul road from Red Hill will be retained as an all weather access through the Project buffer zone farm.

Prior to the construction of Greenwood Mine, all topsoil from areas to be disturbed will be conserved. The topsoil will be used to stabilise the edge of the surface facilities pad.

No deleterious materials will be excavated during the construction of the box cut into the Gundawarra seam at the Greenwood Mine.

The excavated material from Vickery Mine - Stage 1 will be used for construction of the pad for the surface facilities. Excavated drift and shaft material, which is mostly conglomerate, will be placed adjacent to the shaft and drifts for future use in Mine Site construction. Noxious materials will not be encountered in rock excavated during construction. The excavated material will be covered with clay and topsoil from the placement areas and revegetated.

Topsoil from the reject site will be conserved and used to cover the rejects when disposal is complete. This conserving and covering with topsoil is a continuing process and will be done in stages as the reject disposal area grows.

Tailings will dry in the tailings pond. Dry tailings will be covered with a layer of rejects and finally with a layer of topsoil. The tailings pond will be revegetated at the completion of its operating life.

The **overburden** material in the Shannon Hill, Greenwood and Blue Vale opencut mines initially will be placed out of pit with some in-pit storage when room is available. Overburden analysis shows no deleterious materials present in the solid rock. The weathered rock between the soil and the coal has elevated sodium adsorption ratio (SAR) values. To avoid dispersion and soil erosion problems associated with material having elevated SAR values, the material will be covered with stable topsoil. The material will not be placed on outer dump areas.

Overburden stockpiles, after topsoiling, will be stabilised initially with cereal crops undersown with lucerne. Stocking will be controlled while the vegetation stabilises these areas. These cereals and lucerne are grown quite widely within the Vickery area and no problems are envisaged using this technique for vegetation. A similar revegetation technique has been used at Red Hill and has proved successful. Further sowings of other grasses and legumes may be required and this will be done if necessary.

The overburden stockpiles will be planted with indigenous trees and shrubs in addition to the cereals and lucerne.

6.1.5.2 Train Loader

Excavation activities at the Train Loader Site will all be within the soil and subsoil. There will be no excavation of weathered rock or solid rock. The soils are not dispersive and no deleterious materials are expected.

Topsoil from areas to be disturbed will be conserved and used in covering acoustic mounds located adjacent to the rail loop. There is adequate topsoil available at the Train Loader Site for all rehabilitation requirements.

6.1.6 Acoustics

6.1.6.1 Introduction

The bulk (96%) of the Project's mining activity will be underground.

The majority of noise will be generated by the operation of surface facilities associated with coal handling.

Control of noise levels will be regulated by the State Pollution Control Commission (SPCC), who administer the Noise Control Act, 1975. Under this Act a permit to construct and an annual licence to operate will be required. The general SPCC standard requires the existing background L_{90} noise level not be exceeded by more than 5 dB(A) due to the activity of the Project. This standard is used as a criterion for assessing impact.

6.1.6.1 Introduction (Cont)

Noise attenuation aspects of the Vickery Mine Site are discussed in Section 5.1.7. There is rapid noise attenuation to the south of Shannon Hill, Blue Vale and Greenwood Mines. To the north of these Mines, noise attenuation approximates the standard open field condition of 6 dB(A) reduction per doubling of distance.

At the Vickery Mine there is rapid attenuation west, east, and north of the Mine. The attenuation to the south of the Mine approximates a 6 dB(A) per doubling of distance open field attenuation rate.

6.1.6.2 Underground Mining

The **Red Hill Mine** will continue using existing practices. During the operation of the Red Hill Sampling Operation, noise levels have been monitored within the Sampling Operation and at a Site 1.6 km north-north-west of the crusher. The nearest private residence (Merton) is a further 0.9 km from the monitoring Site, giving a total distance of 2.5 km from the Red Hill Mine to the nearest private residence.

The noise levels recorded at the monitoring site show no increase over background levels. The owner of Merton can hear equipment during still periods at night only. Merton homestead is screened from the Red Hill Operation by a ridge.

The existing operation on Red Hill will continue with no modifications. There will be no additional noise impact and no additional ameliorative measures are planned.

The **Greenwood Underground Mine** will have a similar surface facility arrangement as Red Hill except for the generator and major coal handling works. This will reduce the total noise level emanating from the Greenwood surface facilities.

The nearest private residence to Greenwood (Kurrumbede) is 3.1 km distant. This home is screened from the Greenwood surface facilities by a ridge.

The main noise source at Greenwood will be operation of a crusher and noise generated by vehicles delivering Shannon Hill, Greenwood opencut, and Blue Vale coal. Due to experience gained from the Red Hill Sampling Operation and the distance to the nearest private residence, no adverse impact is expected and no special ameliorative measures are planned.

At the **Vickery Mine**, the loudest component will be the rotary breaker and bump noises at material transfer points. The nearest private residences are 3.3 km to the west (Kurrumbede), 3.8 km to the east (Stratford), and 5.1 km to the south-east (Colstoun). The residence west of the Vickery operation is in the direction of the most rapid noise attenuation. No impact is expected at this house. The house 3.8 km to the east is over a ridge. Due to a combination of this ridge and the distance involved, no impact is expected at this house. The house 5.1 km to the south-east is considered to be too distant to be affected.

6.1.6.3 Opencut Mining

The nearest private residence to **Shannon Hill Opencut** (Kurrumbede) is 2.3 km south-west. The Mine and overburden dump are separated from this residence by a ridge. The overburden dump location was selected to effectively utilise the noise attenuating characteristics of the ridge. The combination of distance, topography, and the operation occurring mostly below surface or behind outer overburden dump walls will ensure noise levels are maintained within guidelines.

The nearest private residence to the **Greenwood Opencut** (Kurrumbede) is 3.5 km to the south-west and over a ridge.

During the one year operation of the Greenwood Opencut, most noise will be confined within the pit. The overburden dump will be built up from the outside and infilled. This will have the effect of screening noise from machines operating on the overburden dump.

There will be no adverse impact on neighbours due to the operation of the Greenwood Opencut therefore no special ameliorative measures are planned.

There are private residences 2.0 km west (Mirrabinda Cottage) and 2.4 km south (Kurrumbede) of the **Blue Vale Opencut**. Kurrumbede is in the direction of the most rapid noise attenuation and no noise impact is expected at this residence. Mirrabinda cottage is 2.0 km distant and noise is expected to reduce to within accepted SPCC criteria.

The nearest home to the north (Merton) is 5.0 km away. This is well in excess of the distance necessary to reduce the noise to acceptable levels.

The operation of the opencut will occur mainly within the pit. This will screen the noise of the machinery. The overburden dump will be built in a similar fashion to the Greenwood Opencut and on the northern side of a ridge. The construction of the overburden dumps will occur from the outside batter inwards, providing a buffer for noise.

There will be no regular blasting in the opencut apart from the deeper unweathered strata within the Blue Vale Mine. Blasting will occur during daylight hours at the change in shift. It is expected one blast per week may be required.

6.1.6.3 Opencut Mining (Cont)

The Blue Vale Opencut will operate for three years.

All trucks leaving the operation will travel away from the nearest private residence. They will also be on the far side of a ridge separating them and the private residence. No significant impacts are expected on these neighbouring residences, therefore no special ameliorative measures will be taken.

6.1.6.4 Coal Haulage

Coal will be hauled from the Vickery Mine to the Train Loader along the Blue Vale Road. Coal haulage will be a 24 hour per day operation and will be carried out Monday to Friday with some Saturday operation where necessary. There are 9 houses along the coal haulage route that may be affected by noise from coal transport.

Table 6.1-3 outlines the distances from the road to potentially affected houses.

TABLE 6.1-3 DISTANCE FROM PRIVATE HOMES TO BLUE VALE ROAD

PROPERTY		DISTANCE (m)
Nalya	1	650
	2	450
Weroona	1	300
	2	400
Brooklyn	1	450
	2	70
Leigh Cross		1000
Connandale		1100
Woodend		1300

The acoustical impact of the trucking operation * was assessed, based on:

1. Measurements of existing ambient sound levels of the nearest residences along the proposed route.

2. Measurements of the sound emission levels of a test truck of the proposed type.

3. Predictions of likely future sound levels at the nearest residences for a range of operational options under **worst case night time** conditions.

4. Comparison of predicted levels with acoustical criteria for possible annoyance and sleep disturbance.

* An acoustical study of the haul road proposal was undertaken by Louis Challis and Associates in October, 1985.

Figure 3.18 shows the relationship of the private houses relative to the Blue Vale Road.

The proposed truck route is within a typical, quiet rural area. The daytime noise environment is dominated by local noise sources such as tractors and animals. There is very little existing traffic on the Blue Vale Road. Occasional overflights of small aircraft occur. The night time noise environment is quiet. Temperature inversion conditions prevailed on the evening of the measurements. Table 6.1-4 presents a summary of the ambient noise levels along the haulage route.

TABLE 6.1-4 SUMMARY OF AMBIENT NOISE LEVELS - COAL HAULAGE ROUTE

Position	Time	Percentile Noise Level-dB(A) $L_{A0.1}$	L_{A90}	L_{Aeq}	Remarks
WEROONA North of House	1325	63	32	45	Grader, light plane, birds
	1642	74	31	54	Birds (galahs)
	2107	45	28	29	Cows
WEROONA South of house	2330	56	28	40	Car, domestic equipment
	0210	57	28	36	Domestic equipment, animals
NALYA	1422	58	28	38	Birds, dog, car
	1608	57	29	38	Birds, domestic noise
	2143	33	27	28	Cow
	2256	42	28	28	Cow
BROOKLYN	1521	59	28	39	Motorcycle, car and tractor
	1713	54	28	39	Tractor, bird
	2020	52	28	38	Truck on BVR, dog
	2221	44	28	32	3 cars on BVR

NOTE: $L_{A0.1}$ is the sound level exceeded 0.1% of the time ie: the loud end of the noise range.

L_{A90} is the sound level exceeded 90% of the time and is referred to as the background ambient noise level.

L_{Aeq} is the equivalent continuous sound level or the average sound level. Number subscripted after the L_{Aeq} refers to the time over which the sound level is averaged. L_{Aeq24} and L_{Aeq1} refer to 24 hour and 1 hour averaging time respectively.

6.1.6.4 Coal Haulage (Cont)

To move the maximum throughput of 1.94 Mtpa of saleable coal would require 345 x 25 t payload trucks per day. In the noise analysis, 690 movements per day for 25 t trucks were included to allow for the return truck trips.

The trucks proposed will be new vehicles purchased by a contractor for this Project. Trucks will include the following features designed to minimise noise emissions.

- Exhaust system fitted with additional length muffler.
- Under bonnet acoustical lining.
- Rubber lining on tight fitting tail gates.
- All units will be turbo charged resulting in decreased exhaust noise.
- Fan clutches will be fitted and as the fan will normally be required on uphill grades, it is unlikely that the fan would be required at all on the proposed route.
- Wide single wheels at the rear instead of the current double wheels. This would eliminate some of the bounce of the empty trailer on the return trip.
- A new type of suspension which minimises clatter.

Noise level limits would be imposed on the trucks and regular testing carried out to ensure continued compliance.

A detailed series of sound level measurements were carried out to determine the noise emission levels of an existing truck which is similar to those units proposed for the Project. The test vehicle was considered to be closely representative of the proposed vehicles in terms of noise emission.

The test vehicle was at the quieter end of the scale for these types of vehicles. The maximum level of 83 dB(A) under the ADR 28A test* is well below the 89 dB(A) limit for this class of vehicle.

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* The Australian Design Rule 28A test is the accepted standard for measuring truck noise under operating conditions. Maximum noise levels 7.5 m from the test trucks are recorded during acceleration and breaking operations.

Distance attenuation rates for the $L_{A0.1}$ levels and the L_{Aeq1} levels were determined. The determined relationships were used to predict $L_{A0.1}$ and L_{Aeq1} noise levels at the nearest residences. Adjustments were made to calculated levels for ground absorption, meteorological effects such as wind, temperature inversions, and air absorption.

Trucking during the day causes no acoustic impact. The acoustic effects of trucking at night can be ameliorated by:

- Treatment of houses within 650 m of the road. The treatment considered includes air conditioning, reglazing and partial cladding to overcome possible sleep disturbance. The level of treatment required will be determined by the amount of noise reduction required to meet standards.

- Screening and landscaping of some outside areas to overcome possible outside night-time annoyance.

Table 6.1-5 presents the predicted sound levels for the proposed trucking operations on the Blue Vale Road at night time under temperature inversion conditions and during day time under prevailing wind conditions.

TABLE 6.1-5 PREDICTED SOUND LEVELS FOR PROPOSED TRUCKING OPERATIONS ON BLUE VALE ROAD AT NIGHT TIME UNDER TEMPERATURE INVERSION CONDITIONS AND DURING DAY TIME UNDER PREVAILING WIND CONDITIONS

RESIDENCE		DISTANCE (m)	PREDICTED LEVELS - dB(A) NIGHT $L_{A0.1}$	NIGHT L_{Aeq1}	DAY $L_{A0.1}$	DAY L_{Aeq1}
Nalya	1	650	53	45	45	34
	2	450	56	47	48	37
Weroona	1	300	58	50	50	38
	2	400	57	48	49	36
Brooklyn	1	450	56	47	48	37
	2	70	63	51	62	49
Leigh Cross		1000	50	42	37	24
Connandale		1100	49	41	35	26
Woodend		1300	47	40	32	24

6.1.6.4 Coal Haulage (Cont)

When assessing the impact of the proposed operations over 24 hours in an area where the ambient noise levels are particularly low, it is appropriate to establish criteria for sleep disturbance as well as annoyance. The possibility of sleep disturbance arises as a result of the lack of other ambient sources likely to cause sleep disturbance.

Criteria have been determined by Vallet et. al. 1983 based on physiological assessment of the subject's sleep patterns when exposed to, and removed from traffic noise. Levels measured in the bedroom above which sleep quality starts to become impaired are L_{Aeq} 37 dB(A) and $L_{A\,max}$* 45 dB(A). The equivalent external noise level criteria for sleep disturbance is L_{Aeq} 42 dB(A) and $L_{A\,max}$ 50 dB(A) when bedroom windows are open.

Comparison of the predicted sound levels for night time in Table 6.1-5 indicate that these criteria will be exceeded for all the residences within 650 m of the road.

The criteria would be achieved at Connandale and Woodend and all residences located further away from the route.

To overcome the internal noise levels and to enable compliance with internal noise criteria, residences within 650 m of the route will be provided with acoustical treatment and air conditioning. This would need the agreement of the owners. The internal noise criteria, ie: $L_{A0.1}$ = 45 dB(A) and L_{Aeq1} = 37 dB(A) are considered to be readily achievable since a noise reduction in the order of 25 dB(A) from outside to inside can be obtained with appropriate treatment.

Noise reduction achieved by house treatment resolves all potential annoyance and sleep disturbance problems within the houses.

External criteria for the day time and evening noise levels of trucking operations based on the existing ambient noise levels are the $L_{A0.1}$ and the L_{Aeq1} levels. These should not exceed the existing ambient $L_{A0.1}$ and L_{Aeq1} levels respectively by more than 5 dB(A).

A comparison of the lowest $L_{A0.1}$ and L_{Aeq1} ambient noise levels and the predicted levels can be obtained from Tables 6.1-4 and 6.1-5. In cases where the evening L_{Aeq1} was less than 30 dB(A), the ambient level had been taken to be 30 dB(A) in accordance with standard practice.

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* $L_{A\,max.}$ is the maximum sound level.

Table 6.1-5 indicates the criteria would be achieved on a day time basis at all residences with the exception of the Brooklyn cottage. During the evening however, if temperature inversions occur (which represent the most adverse conditions), it is likely criteria would be exceeded at all of the above residences. Sound levels are likely to be acceptable under these criteria at the other residences which are at a distance of 2 km or greater from the proposed truck route.

The criterion used for annoyance, outside a residence, represents a stringent constraint for any trucking operation, even with reasonably quiet vehicles and a flat road. The number of people likely to be highly annoyed by traffic noise in urban areas can be estimated from a Dose response function determined from Australian studies (Ref: A.J. Hede - 1984). Given that in the proposed trucking situation, the area is a quiet rural location, that the time period under consideration is evening and not the full 24 hours, and that the traffic is predominantly trucks, the data are limited in their application. Hede's data indicate 10% of the population would be highly annoyed by traffic noise at a level of about $L_{Aeq}24$ = 53 dB(A). The Blue Vale Road data indicate predicted $L_{Aeq}1$ levels of 50 dB(A) or less at all but the nearest house. This indicates a small potential for annoyance.

The overall impact on a household would depend on the extent to which residents wish to spend the evening outside their house. To overcome noise impact outside the house, the VJV will provide acoustical screening and landscaping. This will be done in conjunction with the owners of affected residences and in response to a demonstrated requirement.

The following measures will be taken to ensure minimum noise impact from the trucking operation.

- All trucks used on the Project will be required to conform to a noise level of 83 dB(A) when measured according to the ADR 28A test code.

- All trucks will be maintained in good order and be tested at least once every 3 months according to the ADR 28A test code.

- All sound reducing equipment will be checked and refurbished as required and replaced if necessary as indicated in the test in 2 above.

- The road shall be maintained in good condition to minimise any noise from moving vehicles.

- Drivers shall be instructed to drive in a considerate manner at all times.

6.1.6.4 Coal Haulage (Cont)

- Outdoor areas of affected houses will be treated with screening and landscaping.

- Affected houses will be treated for internal noise reduction. This will require the agreement of owners and be performed in accordance with detailed plans. The plans will accompany SPCC operating licence applications.

6.1.6.5 Train Loader

An acoustic study of the Train Loader * determined potential acoustic impact by comparison of existing and predicted noise levels. This enabled recommendations to be formulated for the minimisation of noise impact.

The existing acoustic environment is typical of the fringe of a rural town. The primary industrial noise sources in the existing environment are the abattoirs, the existing coal loader, the tannery, and the stock feed depot.

The primary transportation noise sources are trains on the main North Western Rail Line, coal trucks on Quia Road, and traffic on Trunk Road 72.

Table 6.1-6 presents the existing ambient noise levels at residences in the vicinity of the Train Loader. Data was collected in the form of exceedance levels (percentile levels) in dB(A) over 20 minute sample periods at each of seven locations.

In establishing criteria for acceptable sound levels, two factors require consideration:

- The relative changes in sound levels between the existing situation and the predicted situation, and

- The absolute sound levels which would be regarded as normally acceptable by the community in a rural urban area.

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* The acoustic study was undertaken by Louis A. Challis and Associates Pty. Limited.

In order to assess these two factors, the following criteria were adopted:*

- The increase in $L_{A0.1}$ or $L_{Aeq}24$ resulting from the proposal should not exceed 5 dB(A) and the $L_{A0.1}$ should not exceed 80 dB(A).

- Where the existing $L_{Aeq}24$ level is 55 dB(A) or greater, the component $L_{Aeq}24$ level from the proposal should not increase the existing level by more than 2 dB(A).

Ambient sound level measurements were obtained at 7 residential locations around the Train Loader Site. The $L_{A0.1}$ and $L_{Aeq}24$ levels were computed under normal weather conditions. These levels were adjusted for the effects of prevailing winds and the presence of temperature inversions. The adjusted figures were used to assess impact by comparison with existing noise levels.

Table 6.1-6 shows the existing levels, sound levels created by the Train Loader, and predicted sound levels resulting from the additive effect of existing and Train Loader sound levels. The predicted sound levels include effects of prevailing winds and temperature inversions around the Train Loader.

The acoustic impact was predicted on a day when 4 trains were loaded. This would represent maximum train movements. Vickery requires an average of 2 trains per SRA operating day to move its maximum tonnage. The study indicated the Wilkinson property in the north-western corner of the site would experience noise above acceptable levels. The Torrens property south-east along Torrens Road would also experience elevated levels due to increased train traffic along the main North Western Rail Line.

The primary sources of the noise impact at the Wilkinson house would be the loading bin, the transfer hopper, conveyor drives to the west of the stockpiles, and train loading operations. Discussions have started with the Wilkinson family. Should they indicate a desire to remain in the house, the VJV will undertake acoustic treatment and air conditioning of the house to keep noise impacts within recommended guidelines.

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* To provide an assessment of the likely impact of proposed operations which are transient in nature, it is appropriate to utilise two descriptors capable of quantifying the effects of both the level and duration of the individual events. The descriptors used in the acoustic impact predictions were the typical maximum level $L_{A0.1}$ and the equivalent continuous 24 hour level $L_{Aeq}24$ [dB(A)]. These descriptors have been in common use under ISOR 1996 and have recently been included in the new Australian Standard 1055 - 1984 Noise Assessment in Residential Areas.

6.1.6.5 Train Loader (Cont)

TABLE 6.1-6 TRAIN LOADER - EXISTING AMBIENT SOUND LEVELS AND PREDICTED SOUND LEVELS INCLUDING EFFECTS OF PREVAILING WINDS AND TEMPERATURE INVERSIONS - LOADING FOUR TRAINS PER DAY

POSITION LEVEL	EXISTING LEVEL	SOUND LEVELS PRODUCED BY TRAIN LOADER	PREDICTED SOUND LEVELS
BARRAMALINGA			
$L_{A0.1}$	75	58	75
L_{Aeq24}	45	37	46
L_{A90}(night)	37	30	38
LOT 153, QUIA ROAD			
$L_{A0.1}$	90	73	90
L_{Aeq24}	60	48	60
L_{A90}(night)	36	32	37
ROSLYN			
$L_{A0.1}$	84	81	84
L_{Aeq24}	55	54	57.5
L_{A90}(night)	36	32	37
PORTLAND			
$L_{A0.1}$	68	64	68
L_{Aeq24}	50	41	51
L_{A90}(night)	37	34	39
CEDAR VALE-LOT 445			
$L_{A0.1}$	66	67	67
L_{Aeq24}	50	52	54
L_{A90}(night)	33	37	38
OLIVE VIEW-LOT 446			
$L_{A0.1}$	66	62	66
L_{Aeq24}	50	50	53
L_{A90}(night)	33	37	38
WIRRINGULLA RESIDENCE			
$L_{A0.1}$	66	58	66
L_{Aeq24}	45	46	48.5
L_{A90}(night)	36	34	38
WILKINSON RESIDENCE			
$L_{A0.1}$	76	71	76
L_{Aeq24}	45	52	53
L_{A90}(night)	33	49	49

L_{A90} (night) is the night time sound level exceeded 90% of the time and is referred to as the night time background ambient noise level.

The predicted increases in L_{A90} (night) levels at the Cedar Vale, Olive View, and Portland residences would result primarily from the continuous noise of equipment operating during the loading periods. The major sources of continuous noise would be from the transfer hopper and conveyor drives. The noise from the transfer hopper will be attenuated by provision of appropriate earth mounding on the northern, eastern, and southern sides.

Some of the more distant residences may experience noise effects as a result of recurring peaks of noise from the operation of the coal loading bin. This would occur particularly at night under temperature inversion conditions and the peaks would be in the range 50 - 55 dB(A). The noise of many other sources in the existing environment, would be elevated under temperature inversion conditions resulting in a general increase in noise levels. Notwithstanding the transient nature of this noise source, some annoyance could result at these levels without treatment of the plant.

To overcome this problem, an acoustical absorptive screen will be placed on the south-western side of the bin support structure and also on the north-eastern side extending north of the control room.

The noise of trucking operations is not regarded as significant at Olive View as a result of its location adjacent to Trunk Road 72 and at a distance of 350 m from the proposed trucking route.

The primary noise source at the Torrens residence is trains on the main North Western Rail Line rather than the noise of the Train Loader. The increase in noise will be experienced at the Torrens residence regardless of the source of trains. During heavy seasonal transportation of wheat, the Torrens residence would experience similar elevated levels. The predicted increase in noise is 0.5 dB(A) in excess of the 2.0 dB(A) allowed under the criterion for increasing the $L_{Aeq}24$ level where the existing level is 55 dB(A) or greater.

Based on the average train requirement, no ameliorative action will be taken by the VJV for the Torrens residence.

6.1.7 Air Quality

6.1.7.1 Mines

The ROM coal from Vickery has a low fines content. This reduces potential for dust generation from the ROM coal product. The coal seams are the aquifers in the Maules Creek Formation. This, plus water used for dust control in the mining operation results in ROM coal having a moisture content between 7-9%. The combination of moist coal and absence of fines minimises dust generation potential.

6.1.7.1 Mines (Cont)

ACIRL has tested Vickery coal * to determine the optimum coal moisture content for dust suppression. The results showed Vickery coal does not start to emit significant quantities of dust until it is dried to about 9% moisture. At 9% total moisture, the dustiness index is zero. It is not necessary to add water to the coal for dust suppression when the total moisture level is around 10%.

During production and stockpiling of coal at Red Hill Sampling Operation, moisture levels have rarely dropped below 10%.

The experience at the Red Hill Sampling Operation suggests coal dust is generated either from very exposed conveyor belt transfer points or where fugitive coal is crushed by vehicles. The control of dust from ROM coal is therefore based on eliminating exposure of coal at transfer points and on the minimisation of vehicular traffic over the coal.

Dust control at the Red Hill Sampling Operation is achieved by mobile sprays spraying the coal stockpile when required. There is also addition of moisture to the coal by fine mist sprays before it is crushed. Very little dust is generated from coal stockpiles.

Coal trucks have their loads trimmed and covered prior to leaving the site. This has worked effectively and there are no problems with coal dust from moving coal vehicles. Watering the haul road has also proved to be effective. On site, access roads will be watered as required to control dust.

The dust control measures at the Red Hill Sampling Operation are effective and no adjustment is planned for the Red Hill Mine.

The **Greenwood Underground Mine** will have a similar surface arrangement as Red Hill, except that coal will be transferred directly to the washery at the Vickery Mine instead of being crushed and stockpiled.

As there will be no coal stockpile at Greenwood, coal dust generation from vehicular sources will be eliminated.

There is one conveyor transfer point on the north-eastern side of the surface facility area and a crusher for delivered coal. Due to the temporary nature of the conveyor, its reduced visibility and the cost involved, no screening or enclosing of this transfer point is planned.

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* Optimisation of Dust Suppression using Water on Vickery Joint Venture Shipment Coal. Australian Coal Industry Research Laboratories Ltd - November 1985

The surface facilities pad will consist of weathered conglomerate excavated from the intake and return ramps. This material does not contain excessive fines and is not a source of dust unless traversed by traffic. During dry and windy conditions, areas used by traffic on the pad will be watered from fixed sprays.

The access road to the Greenwood Mine will be watered when necessary to control dust. Experience gained at the Red Hill Sampling Operation indicates this is a most effective means of dust control.

The **Vickery Mine** is the site of the long term surface facilities for mining operations at Vickery. The nearest residences to the Vickery surface facilities are 3.1 km south-west, 3.8 km east and 5.1 km south east. These residences are at a sufficient distance from the surface facilities to be unaffected by any coal dust.

Access road, coal haulage road, and car park areas within the Vickery Mine surface facilities will be bitumen sealed. This will reduce the need to water road surfaces.

There are no exposed conveyor transfer points. The 35,000 tonne ROM coal circular blending bed and stockpiling system features a slewing and luffing stacking boom. This will minimise the coal drop distance, minimising the time coal is exposed to wind and will reduce production of smaller particles of coal.

There are automatically operated mist sprays at all transfer points in the coal handling system. A manually operated high pressure spray system will be installed to service the circular blending bed stockpile.

The circular blending bed stockpiling system will have water sprays on the discharge boom which will be activated during high wind periods. The water spray system will operate when winds exceed 10 m/s or when necessary.

The circular form of the blending bed reduces the surface area of coal exposed to wind.

The operation of the **Preparation Plant** is characterised by a wet process making it unnecessary to include specific design features for dust elimination. Any coal spillage or fugitive coal will be washed from the concrete floor of the Preparation Plant. These washings will pass back into the process and enter the product, reject and tailings streams of the process.

6.1.7.1 Mines (Cont)

Product coal and rejects handling incorporates storage bins at all outlets. There are no product stockpiles other than emergency stockpiles associated with the bin operation. This feature reduces potential for dust generation. Emergency stockpiles will have mobile spray facilities consisting of water sprays activated manually and capable of being transferred from stockpile to stockpile.

Any coal falling from vehicles or conveyor belts onto site roads will be picked up and transferred to emergency stockpiles or to the circular blending bed. This will eliminate dust generation from crushed coal on vehicle access routes.

Coarse rejects will be disposed of as land fill over the surface of underground mine workings. There will be no dust generated from the rejects themselves. Dust will be generated from the clearing of the site prior to placing the rejects. The generation of dust will be minimised by a programme of progressive clearing, stripping, and rehabilitation of areas prior to and after disposal of the rejects.

The reject sites will be rehabilitated by firstly covering with fresh topsoil and then revegetating with pasture, trees and shrubs.

The haul road between the Preparation Plant and the rejects disposal area will be watered as required.

The **tailings** circuit within the wash plant is a wet process. Tailings will be pumped to the tailings dam located south of the washplant. Due to the wet surface of the operating tailings ponds, no dust will be generated from them.

When tailings ponds have reached their capacity and have dried, the surface of the tailings will be covered with reject. The reject will be covered with conserved topsoil and rehabilitated with agricultural species and a diverse planting of trees and shrubs.

The prevailing wind directions at the Mine Site are south-east and north-west. The nearest private residences are 4.1 km to the south-east and 7.1 km to the north-west. At these distances, the residences will not be affected by dust.

6.1.7.2 Transport to Train Loader

Coal will be transported from the Mine Site to the Train Loader by 25 t highway vehicles.

Experience gained at the Red Hill Sampling Operation suggests no dust problem is likely to arise with the transfer of coal in these trucks.

The coal haulage route will be a sealed, high quality road. This will reduce the potential for spillage from vehicles. Any major spillages will be removed to avoid crushing of coal and subsequent dust generation.

6.1.7.3 Train Loader

The coal will be delivered to the Train Loader and tipped into the dump station. Vickery coal does not generate dust unless finely crushed and dried.

There will be a system of water sprays at the Train Loader to control dust. All conveyor transfer points will be serviced by automatic mist sprays. In addition, there will be a manually operated boom spray system capable of wetting the entire surface of the coal stockpile. This system will operate when wind exceeds 10 m/s. The prevailing winds in the area are north-west and south-east. The stockpiles are orientated closely to this prevailing wind direction. The closest private residence to the coal stockpiles is 400 m north-west of the Site.

All disturbed areas on the Site will be rehabilitated and landscaped to eliminate dust generation.

Access roads into the Train Loader Site will be sealed.

The stacker / reclaimer minimises the handling of coal. It eliminates the need for vehicles to enter the coal stockpiling area, except in emergency situations. The elimination of vehicles from the stockpile areas minimises dust generation potential.

A dust monitoring system is presently installed at the proposed Train Loader Site. Prior to and during the operation of the Train Loader it is proposed to increase the dust gauges from 4 to 12. The VJV will respond to any problems detected by the dust monitoring system.

No dust problems are expected from the proposed Loader with the ameliorative measures proposed.

6.1.8 Traffic

Impact on traffic will occur from the following:

- Employee Mine access,
- Train Loader access,
- Coal haulage,
- Supply deliveries,
- Train transport.

6.1.8 Traffic (Cont)

Mine access will be via the Blue Vale Road from both Boggabri and Gunnedah. Approximately 79% of the increased workforce will come from Gunnedah and 21% from Boggabri. This results in 147 people from Gunnedah and 39 people from Boggabri travelling to the Mine daily. These trips will be spread over three shifts. Each shift will average 49 and 13 people travelling from Gunnedah and Boggabri respectively. Mine experience elsewhere indicates there will be approximately 3 people per vehicle, resulting in 16 vehicles from Gunnedah and 4 from Boggabri at shift changes.

The VJV will improve the condition of the Blue Vale Road into Gunnedah and will also re-condition parts of the road into Boggabri and improve an existing low level lagoon crossing.

No major impact is expected from the use of the Blue Vale Road by vehicles travelling to and from the Mine. Approximately 10 vehicles per day will be involved in deliveries. This will add insignificant numbers to the daily usage of the road.

The new Blue Vale Road will reduce the density of traffic around Cohens Bridge and the Gunnedah Airport intersection. This will have a beneficial impact in these areas.

The alternative route provided by the Blue Vale Road is a more direct route to the abattoirs, wheat silos, and sale yards for people living along the road. The standard of the road will be a significant improvement on the condition of the existing road. The construction of the Blue Vale Road and Namoi River crossing provides a facility for the community that is above the standard justifiable by Gunnedah Shire Council.

The raising of the low level crossing across Barbers Lagoon will improve wet weather access into Boggabri. It is also proposed to improve the condition of the road between the Namoi bridge and the Barbers Lagoon crossing near Boggabri. This will further enhance the wet weather access to Boggabri.

Access of employees and deliveries to the Train Loader will not impact greatly on traffic density. Approximately 25 vehicle movements per day will be made to and from the Train Loader.

The major impact on traffic will be associated with coal haulage along the Blue Vale Road. At maximum production, 345 truck trips per day (one way) will be required to move coal from the Vickery Mine. The average number of truck movements per hour in one direction will be 15.

The combination of improved road design and driving in accordance with the changed traffic density will enable coal trucks to mix with present road users without adversely affecting safety and level of service.

6.1.8 Traffic (Cont)

The truck haulage will cause an increase in traffic density. It will require changes in driving experience by people using the road to ensure the safe mixing of trucks and private vehicles.

Parking bays will be provided where school children catch the school bus. This will provide a safer bus operation.

The road will be widened and bitumen sealed. It will be built to a 100 km/hour Department of Main Roads travelling standard (Refer Section 3.6.3.2). Sight distances are much longer than the designed minimum. These features will assist road safety.

Saturday trucking will sometimes be needed to co-ordinate with train and shipping schedules, which are not directly controlled by the VJV. Operational aspects such as flooding, road maintenance, and industrial conditions could also make occasional Saturday trucking necessary.

There will be an increase in the number of trains that use the North Western Rail Line. Assuming 3,200 t nett trains are used, 1.7 trains per day will move 1.94 Mtpa.

The existing rail system is capable of handling the increased traffic, thereby improving utilisation of the facilities. The movement of coal will provide a greater base load for the rail system, generating additional revenue to the community.

6.2 CULTURAL AND SOCIO-ECONOMIC ENVIRONMENT

Discussion with the Premier's Department and affected Councils about the application of the Infrastructure Funding Policy have been held and are progressing satisfactorily.

6.2.1 Urban and Regional Impact

6.2.1.1 Assumptions

The following assumptions have been used for the discussion of the employment, population and housing effects of the Vickery Project.

Construction Workforce

- 33% construction workforce are married.
- Household size for married workforce is 3.0.
- All non-local administration workforce live in permanent housing in Gunnedah.
- Other non-local workforce distributed between Boggabri and Gunnedah on a 25% / 75% basis.
- Due to temporary nature of construction activities, no local employment multiplier effect will occur.

6.2.1.1 Assumptions (Cont)

Construction Workforce (Cont)

- All administration workforce assigned non-local.
- All trades jobs assigned 50% local / 50% non-local.
- All non-trades jobs assigned local.

Operation Workforce

- 70% mining workforce married.
- 70% multiplier workforce married.
- Household size for married workforce is 3.0.
- All non-local administration workforce live in permanent housing in Gunnedah.
- Other non-local workforce distributed 10% Boggabri and 90% Gunnedah, based on the following criteria:
  - Location of Gunnedah relative to non-local employee source,
  - Size of town,
  - Cost of housing,
  - Distance to site,
  - Cost of living.
- Boggabri Employment Multiplier - 0.3
- Gunnedah Employment Multiplier - 0.2
- Spouses assumed to be unemployed.
- Administration workforce - 80% non-local
- Trades jobs assigned 70% local / 30% non-local.
- Non-trades jobs 90% local / 10% non-local.
- All multiplier jobs assigned 80% local / 20% non-local.
- Local employees will be located 25% Boggabri and 75% in Gunnedah.

The local component of trades and non-trade jobs will be highly influenced by Government infrastructure guidelines and mining union membership requirements.

Assumptions on the availability of local labour are discussed in Section 6.2.1.3.

6.2.1.2 Construction Workforce

The major component of Project Construction occurs during Year I (refer Section 3.7.1). The workforce ranges between 50 and 104 people, with an average of 85.

A second construction phase occurs in Year 3 of the Project when 26 people are required for 12 months to complete the entry and surface facilities for the Vickery Mine.

The third stage will be during Year 6 of the Project when 54 people will be required for 12 months to construct the Vickery Mine shaft and drifts.

The peak construction workforce will consist of 104 people of whom 10 will be Administrators, 60 Tradesmen, and 34 labourers.

Using the assumptions listed in Section 6.2.1, the 104 maximum workforce will consist of 64 locals and 40 non-locals.

Local people are those already living in Gunnedah or Boggabri. About half of the non local component of 40 could be expected to commute daily to the Project from Manilla, Tamworth, and Narrabri. To assess maximum impact, it has been assumed that all non locals locate in Gunnedah - Boggabri.

Thirty of the non-local component at peak construction are expected to be located in Gunnedah and 10 in Boggabri. These people can be accommodated in existing facilities.

Due to the temporary nature of construction activities, no local employment multiplier effect will occur.

6.2.1.3 Operation Workforce

The operation workforce and profile of skill type are presented in Table 6.2-1.

TABLE 6.2-1 OPERATION WORKFORCE AND SKILL PROFILE

MINE YEAR	STAFF	TRADES	MINERS	TOTAL
EXISTING	4	5	24	33
Year 1	28	25	81	134
Year 2 - 7	35	48	126	209
Year 7 - 21	35	50	134	219

6.2.1.3 Operation Workforce (Cont)

There is an existing workforce of 33 at the Red Hill Sampling Operation.

The operation workforce will reach a maximum level of 219 in Year 7. This will consist of 35 Administrators, 50 Tradesmen, and 134 miners.

The workforce increase of 186 consists of 110 Miners, 45 Tradesmen, and 31 Staff. Using the assumptions listed in Section 6.2.1.1., the increase of 186 will consists of 137 locals and 49 non-locals. Table 6.2-2 presents total employment increase using operation phase assumptions listed in Section 6.2.1.1.

TABLE 6.2-2 TOTAL EMPLOYMENT INCREASE

	JOBS (A)	EMPLOYMENT MULTIPLIER	SERVICE JOBS CREATED (B)	TOTAL EMPLOYMENT INCREASE (A + B)
Local				
Gunnedah	103	0.2	21	124
Boggabri	34	0.3	10	44
Non-Local				
Gunnedah	45	0.2	9	54
Boggabri	4	0.3	1	5
TOTAL	186		41	227

Total employment will increase by 227. This consists of 186 new jobs on the Project and 41 new service jobs created by the Project.

Of the 41 service jobs, 33 will be filled by locals and 8 by non-locals. This allocation gives 170 local jobs and 57 non-local jobs in the total employment increase of 227.

The 170 local jobs will be filled by people already living in Gunnedah and Boggabri. Tamworth, Narrabri, Manilla, Coonabarabran, Mullaley, Curlewis, and a number of small villages are within commuting distance of the Project and will absorb some of the local jobs.

The VJV predicts 170 local people will be readily available for employment based on:

- Existing unemployment (Refer Section 5.3.2.3 and 6.2.1.4),
- Underemployment particularly on farms,
- The move away from farming employment,
- The number of young people who presently leave the district to gain employment, due to lack of local opportunity,
- The number of unsolicited applications for employment with VJV (in excess of 250) that have already been received at the Gunnedah office,
- The potential for local employees to commute up to 1.5 hours travelling distance.

Coal transport will be undertaken by contract. The workforce required for this trucking operation will be 30, of which 2 would be non-local supervisory staff.

The location of the non-local workforce based on the assumptions in Section 6.2.1.1 is given in Table 6.2-3.

TABLE 6.2-3 PREDICTED RESIDENTIAL LOCATION OF IMMIGRANT WORKFORCE

		Gunnedah	Boggabri
Trucking	2	1	1
Mining	49	44	5
Service	8	7	1
TOTAL	59	52	7

The total population increase using the assumptions listed in Section 6.2.1.1 is given in Table 6.2-4.

TABLE 6.2-4 TOTAL POPULATION INCREASE

	WORKFORCE	SPOUSE	CHILDREN	TOTAL
Gunnedah	52	36	36	124
Boggabri	7	5	5	17
TOTAL	59	41	41	141

6.2.1.3 Operation Workforce (Cont)

This assessment has not included the potential for commuters from Manilla, Tamworth, Narrabri, Baan Baa, Curlewis, and surrounding districts whose likely contribution to the workforce will reduce the "worst-case" impact as documented in this EIS.

6.2.1.4 Unemployment

The construction and operation of the Vickery Project should have a significant beneficial impact on unemployment in the region. There is a pool of approximately 650 unemployed people in the Gunnedah Shire and approximately 1600 in the Narrabri Shire. It appears there is a considerable section of the community underemployed and willing to take on further work. In addition, the current practice of young people leaving the region for employment may be modified as a wider range of options for local employment are created.

Over 250 unsolicited applications for employment have already been lodged at the VJV Development Office in Gunnedah.

6.2.1.5 Population

The **construction workforce** will only have a temporary effect on population growth. A maximum of 40 non-local people and a very limited number of family members would locate in Gunnedah and Boggabri.

The community infrastructure in Boggabri and Gunnedah would be capable of coping with such a population increase.

The operational workforce will include 186 new jobs of which 49 will be filled by non-local people. It is predicted that this will increase the population in the area by approximately 141 of which 124 would live in Gunnedah and 17 in Boggabri.

The effect of this increase on Boggabri's population will not be significant.

Most of the 124 people moving into Gunnedah will arrive in the first two years of the Project. This represents an average total population growth rate of 62 people per year during the first two years of the Project. This is above recent Gunnedah population growth rates (Refer Table 6.2-5).

TABLE 6.2-5 GUNNEDAH POPULATION ANNUAL GROWTH RATE

YEAR	ANNUAL RATE
1966	193
1971	145
1976	91
1981	44
1984	33 *(estimated)

6.2.1.6 Residential Land and Housing Availability

There is adequate semi-permanent accommodation in both Gunnedah and Boggabri to satisfactorily house the immigrant component of the **construction workforce.** Due to the short term nature of the construction phase, it is not anticipated that families will move to the region. Accommodation for construction personnel will be semi-permanent accommodation in both towns. Should temporary accommodation for construction workers prove to be inadequate, the Gunnedah Shire Council has a 33 site caravan park which is presently not operating. The Shire is willing to open this park either under a lease arrangement or Council administration. This provides a more than adequate buffer for temporary accommodation during the construction phase.

Gunnedah has adequate supplies of residential land available for development. In addition, there were about 90 developed and serviced residential blocks available in 1985. The Vickery Project should have no adverse impact on the availability of developed land in Gunnedah, but rather a desirable impact by increasing the sales of developed land.

There is a pool of approximately 130 houses continuously available for sale in Gunnedah. The introduction of 52 new residents into Gunnedah over a two year period would have the impact of reducing this pool and could encourage an increase in the price of housing in Gunnedah. Countering this effect, not all the houses in the 130 would be of suitable size or standard for the incoming population. Some new residents will buy land and construct homes. The VJV will provide some rental accommodation to be used as transient housing by migrant staff to supplement the home ownership scheme.

Mining staff movements into other established towns, has shown that some people purchase small to medium rural holdings. This will occur with Vickery employees and will further decrease the impact on the town's residential housing supply.

The VJV proposes to ameliorate any negative impact due to this imbalance by making a home ownership / home loan scheme available to immigrant staff employees (the bulk of the immigrant workforce). This scheme would have the objective of encouraging home ownership rather than renting. The scheme would be based on a response to need rather than an attempt to provide housing on a predicted needs basis.

The small number of people who will move to Boggabri, and the ready availability of housing and community infrastructure in the town, suggest no negative socioeconomic impacts are likely to arise.

6.2.1.7 Education

Schools are presently underutilised. There is a surplus capacity of 308 primary and 134 high school places in Gunnedah.

The proposed maximum increase in school children (36) will be easily accommodated in Gunnedah schools.

The increase of up to five children in Boggabri will also be readily accommodated as the primary school has 160 spare positions and secondary students travel to Gunnedah.

The immigration of 41 children to the region will slow the trend to lower student numbers.

The increased requirement for TAFE education in skills and trades applicable to the Vickery Project will continue to be met by KCC's Vale Training Centre.

6.2.1.8 Health Services and Facilities

A standard bed to population ratio suitable for country areas is between 3 and 5 beds per 1,000 people.

Gunnedah and Boggabri have 92 hospital beds or 9.14 beds per 1,000 population.

Both Boggabri and Gunnedah have adequate hospital beds to service the immigration of a population associated with 59 new jobs.

The hospital bed availability is more than adequate for both the construction phase and the operation phase of the Vickery Project. With the workforce involved in the trucking operation included, the maximum increase in population is 141 people. This increase in population will reduce the ratio by 0.1 beds per 1,000 people.

The population increase would enable more efficient utilisation of hospital beds in the region and make the area less vulnerable to closure of existing services.

The ratio of physicians to population is 0.89 positions per 1,000 head of population. This is considered adequate for a country area, particularly one so close to the Tamworth Regional Hospital. Physician services can be obtained at the Tamworth Hospital as well as from visiting physicians at Gunnedah and Boggabri Hospitals.

With the forecast population increase attributable to the Vickery Project, the physician to population ratio would decrease marginally from 0.89 to 0.88 physicians per 1,000 head of population.

6.2.1.9 Community Integration

No significant impact on the existing community or existing infrastructure is anticipated with the accommodation of the construction workforce.

There will be beneficial social effects resulting from the construction. These will include increased local employment and town revenue, skills training and opportunities to meet new people.

The operational phase of the Project will create different effects to the construction phase. The differences will derive from the permanent settlement of the incoming workforce and their families.

The social adjustments required have been experienced in other towns associated with mining or industrial development. Particularly at the low level of population increase projected for the Vickery Project, it is not expected that these adjustments will be noticeable.

Concerns experienced by existing residents will relate to an overestimation of the potential impact from the influx of Vickery Project employees. There has been much discussion concerning a population boom associated with mining projects in the Region. The population increase associated with the Vickery Project is well within the variations of normal population increase normally experienced in Gunnedah.

The extent and timing of the integration of the immigrant population is dependent on the attitudes of the existing residents to the changes taking place. The relatively small immigrant population increase will facilitate the integration occuring harmoniously.

The benefits from an increased population include increased local employment and town revenues. The influx of new people enables the provision of a wider range of community facilities. Opportunities will be available for meeting and establishing new friends and hence support for community services and recreation clubs and the development of new fields of interest.

6.2.2 Land Use

The objective of the **rehabilitation** programme is to revegetate disturbed areas with timber, shrubs and agricultural plantings.

The recent agricultural use of the area has substantially reduced the amount of timber. The rehabilitation of part of the disturbed area to timber will help to rectify this position. The timber will provide a future source of wood, wildlife habitat, and protection for farm animals. The planting of disturbed areas with timber does not preclude the future use of the area for agriculture once the soils have reformed and adequate biological activity has returned.

6.2.2 Land Use (Cont)

Adequate topsoil is available from disturbed areas for rehabilitation requirements. No area will be specifically cleared to obtain topsoil.

The Red Hill and Greenwood Mines will be rehabilitated upon completion. The overburden disposal areas for the Shannon Hill, Greenwood, and the Blue Vale Opencuts will be similarly rehabilitated. Temporary final voids will remain at each site. These voids will serve as preliminary works for:

- access for future underground mines,
- future opencut operations when the presently sub-economic opencut reserves are developed.

The landscape screening of the Greenwood Mine and the tailings disposal area below the Vickery Mine will be planted with indigenous species.

In the short term, land involved in mining will be removed from agricultural production. The revegetation of areas with agricultural species and timber will return them to productive use over the longer term.

Industrial use of the Train Loader Site will reduce its capabilities for agricultural production. Recent owners have not fully utilised the Area for agricultural purposes and conversion to a Train Loader will not markedly decrease its productivity. Land not needed for coal handling purposes will be used for grazing or cropping.

Land use for industrial purposes is consistent with recent trends within the area.

The 3,600 hectares of land around the mines will not be removed from agricultural production. Management of these areas will be consistent with the objectives of buffer zone management and economic agricultural production.

6.2.3 Archaeology

There will be no impact on archaeological sites at the Mines or the Train Loader.

The haul road may traverse the edge of a surface scatter of artefacts on the Four Mile Stock Reserve. Preliminary discussions with the Red Chief Local Land Council have been held. Excavations will be made to determine the exact extent of the artefacts and the potential of the deposit for scientific and archaeological value. The surface of the area where the road is proposed is disturbed already by traffic.

If any artefacts are to be disturbed, application will be made to the National Parks and Wildlife Service for a permit to destroy or interfere. The application will be made in conjunction with discussions with the Red Chief Local Land Council. A number of scarred trees occur on the Stock Reserve but the cause of the scarring is not known. Every attempt will be made to avoid damaging trees, however some trees will need to be removed due to the confined space at the Trunk Road 72 crossing and along the Crown Road access on the eastern side of the Namoi River.

6.2.4 Existing and Crown Roads

The only existing road required to be moved on the Project Site is Hoad's Lane over Red Hill Mine. This road will be temporarily relocated while coal is extracted from the area. When subsidence is complete after about 1 year, the road will be returned to its original position.

Blue Vale Road will be upgraded. The surface will be widened and bitumen sealed between Vickery Mine and Trunk Road 72. The standard of the road upgrade will be far above the standard that could be justified by the Council for local use. An upgraded Blue Vale Road, with a new bridge over the Namoi River, shall provide better access into town. The new road and bridge across the Namoi River provides faster access for residents on the Blue Vale Road to the saleyards, wheat silos, and abattoirs. This removes the need for most agricultural products from this area to be trucked through Gunnedah. An upgraded Blue Vale Road will be of long term benefit to local residents and the community.

The new Namoi River bridge will reduce the amount of traffic using that section of the Blue Vale Road closest to Gunnedah and will reduce the amount of traffic using the 100 year old Cohen's Bridge adjacent to Gunnedah. This should result in reduced traffic flows and road maintenance costs in the area between Gunnedah and the Airport.

A Crown Road runs across the Vickery Mine. This will be relocated to the south of its present position. The Crown Road through Brooklyn property will be available for public use.

6.2.5 Regional Economic Stimulus

The Vickery Project will provide a major stimulus to the Region's economy. The majority of positions will be filled by local people and a substantial percentage of wages will be spent in the area.

It is anticipated the Project will directly or indirectly employ significant numbers of people who would either have been unemployed or underemployed.

There are a number of economic benefits which will result from the Project's construction and operation.

6.2.5.1 Employment Effects

The effects of the operation phase on employment will be long term. When the operation workforce stabilises there will be 186 new employees at the site. Of these, 137 will be recruited locally as will a further 33 employed in multiplier jobs. Approximately 49 mining jobs and 8 multiplier jobs will be filled by non-local employees.

6.2.5.2 Retail Expenditure

An important stimulus to the local economy is the increase in retail expenditure of the mining and multiplier workforce. Assuming all the workers spend 40% of their income on retail expenditure per year, an estimated increase in retail sales of $3.1m would result.* This figure takes into account the increased incomes of mining employees drawn from the local area (Refer Table 6.2-6).

The effect of increased retail expenditure will be significant for Gunnedah. Historically Gunnedah has shown a higher relative share of wholesale retail trade employment than other towns within the Northern Statistical Division.

TABLE 6.2-6 ESTIMATED RETAIL EXPENDITURE VICKERY MINE EMPLOYEES - January 1985 ($M/annum)

DESCRIPTION	NUMBER	EARNINGS $	AMOUNT AVAILABLE FOR RETAIL EXP.
Immigrant Mine Workers	49	$1.8m	$0.7m
Mine Workers employed locally	137	$5.2m	$2.1m
Induced/Indirect employment generation	41	$0.9m[1]	$0.3m
TOTAL			$3.1m

1 Based on Average adult male wage NSW Q1 1985 ABS

* "The Lower Hunter Sub Region Commercial Study. Working Paper: NSW Planning and Environment Commission Newcastle Office 1980).

6.2.5.3 Fiscal Effects

The main source of Local Government Revenue is rate income for ordinary services, water and sewerage. The estimated annual increase to Narrabri Shire will be approximately $5,000 based on the 1985 average assessment. In Gunnedah Shire the annual increase will be approximately $45,000.

The costs of growth are more difficult to quantify. Where there is sufficient capacity, cost to the Local Government will be the cost of connection and supplementary service delivery. It is normal practice for Local Government to recoup costs in charges for such services.

Local government services provided at Gunnedah and Boggabri are underutilised. The immigration of 59 people and families will not exhaust existing capacity of water and sewerage systems. The rating of these families will reduce the fixed cost per user of Local Government Services.

If 50% of the immigrant families built, then the connection of 30 new residences to the services will not increase repair and maintenance costs significantly. If the charges per user are maintained at pre-connection levels, a greater component of the total user fee can be used for major replacement and extension.

If extensions are required to accommodate new users, these should be funded from borrowings with user fees structured to cover capital plus interest costs. This is the normal method of funding public infrastructure and should be used for providing Local Government Services for immigrant workers for the Vickery Project.

State Government revenue will be generated from:

- Up-front charges
- Rail freight charges
- Coal royalties
- Port charges
- Payroll tax
- Indirectly from Commonwealth Government taxes
- Workers Compensation premiums
- Operating Licence fees

Commonwealth Government Revenue will be generated from:

- Company Tax
- Employee Tax
- Excise

During the construction phase, the major stimulus to the local economy results from employment.

6.3 IMPLICATIONS FOR REGIONAL DEVELOPMENT

The Vickery Project will assist the Northwest Coalfield to reach its full potential as a diversified coal resource of national significance. There are currently two underground coal mines operating near Gunnedah. Their combined production rate is approximately 1.25 Mtpa of coal. The Vickery coal reserves will attract a diversified market and produce a more stable local coal industry.

The Regional agricultural and livestock industries are subject to international competition. The Regional income varies according to international levels of supply and demand for agricultural commodities. The introduction to the Region of an expanded coal industry, has the potential to help diversify and stabilise the Region's income. Development of the industry will discourage the migration of some young people from the Region to metropolitan areas.

6.4 ENVIRONMENTAL MONITORING

The VJV have been operating an environmental assessment programme under the control of an Environmental Officer. The programme will continue during the approval process and throughout the mining operations.

The VJV will monitor various elements of the environment in a comprehensive programme that will incorporate:

- Rehabilitation
- Climatic Data
- Dust
- Water
- Noise
- Fauna and Flora
- Graphic record of the mining operations
- Socio-economics

Rehabilitation

Studies of historical climatology information and analyses of soil, overburden, and interburden material will enable site specific plans to be formulated. These plans will provide the basis for rehabilitation of the overburden and interburden from Shannon Hill, Greenwood, and Blue Vale Opencuts, and the washery rejects and tailings disposal areas.

Soil and vegetation studies on the rehabilitated areas will provide a basis for verifying the success of the programme.

Any developments in soil formation and revegetation production contrary to plan, will be detected at an early stage and corrected.

Meteorology

An automatic meteorological station is established in the Project Area. This station monitors and records windspeed and direction, maximum and minimum temperature, precipitation, and relative humidity.

The station will provide a meteorological data bank for the Project Area.

A wind speed and direction recorder is established on the Train Loader Site.

Air Quality

The design of the Project has incorporated dust amelioration measures. Generation of dust is not considered a problem at the Mine, particularly as the Site is isolated from any population centre. The generation of dust will be avoided by implementing appropriate measures at the Train Loader.

Dust levels will be controlled for safety, amenity, and aesthetic purposes. The State Pollution Control Commission (SPCC) will set allowable dust levels for the Project and will also review the performance of the VJV in achieving dust control.

Dust levels will be monitored using regional dust gauges.

Water

Impact on water quality and quantity will be monitored.

Water samples are already being collected from the Namoi River, local permanent and intermittent streams, and from monitoring bores throughout the Area.

The Water Resources Commission (WRC), Narrabri and Gunnedah Shires also monitor water use and quality use in the Namoi Valley near the Project.

During the construction and operation of the Project, water use will be supervised through WRC licencing procedures.

Activities with potential for water pollution will be controlled by the VJV and regulated by the SPCC licencing procedures.

The effects of the mining operation on water were considered during the early planning stages of the Project and appropriate measures incorporated in the overall design. No problems are anticipated from excessive water use or pollution.

6.4 ENVIRONMENTAL MONITORING (Cont)

Water (Cont)

The use of water on site will be monitored to provide information on consumption and indicate areas where water conservation measures could be implemented.

Noise

Design of the mine layout, operation, and equipment selection have included noise reduction considerations. Maximum noise levels will be defined by the SPCC. Noise levels will be regularly monitored to ensure compliance with SPCC requirements.

Fauna and Flora

The distribution of fauna and flora in the Project Area reflects massive disturbance from previous land use.

Studies of fauna and flora on mined and non-mined areas will provide useful comparisons when assessing the success of rehabilitation. Potential problems in rehabilitated areas can be detected at an early stage by monitoring fauna and flora.

Aesthetics

A graphic record of mine development will be maintained through the life of the Project.

Socioeconomics

The employees of the Project will mostly live in Gunnedah and Boggabri.

The VJV will monitor relevant aspects of the socioeconomic environment in the region. This monitoring will develop a data base essential for meaningful discussion concerning socioeconomic impacts.

Data collected will indicate trends in:

- Regional population,
- Employment, and
- Real Estate price movement in mining and non-mining towns.

SECTION 7

REFERENCES

7.0 REFERENCES

Australian Coal Association, May 1985
Industry Overview

Beeston, GR., Walker, PJ., Purdie, R., and Pickard, J. 1980
Plant Communities of the Poplar Box (Eucalyptus populnea) lands of Eastern Australia
Australian Rangelands J. 2, 1-16

Louis A. Challis and Associates Pty. Ltd. August 1985
Acoustic Assessment of Proposed Coal Loading Facility for Vickery Joint Venture at Gunnedah NSW

Louis A. Challis and Associates Pty. Ltd. October 1985
Acoustical Assessment of Proposed Coal Trucking Operations Between Vickery Mine and Coal Loading Facility at Gunnedah, NSW

Coffey & Partners, 1982
Hydrological & Hydrogeological Studies

Dames & Moore, 1981 / 82
Acoustics and Vibration

Dames and Moore, September, 1981
EIS Northern Opencut Extensions to the CSR Lemington Mine

Dyson and Marston, June 1976
The Soil Conservation Service of NSW Gunnedah District Technical Manual

Gutteridge Haskins & Davey, 1983
Vickery Mine Project - Haul Road Proposal - Blue Vale Road - Gunnedah

Haglund,L., 1985
Archaeological Investigations of Areas That May be Affected by Proposed Mining for Coal in the Gunnedah Area, NSW

Hede, A.J., December, 1984
Factors Determining Traffic Noise Annoyance
Australian Acoustical Bulletin, Vol. 12, No. 3

Miller, S., 1982
Soil, Overburden and Interburden - Vickery Joint Venture

NSW Planning and Environment Commission, 1980
The Lower Hunter Sub Region Commercial Study

Sinclair Knight and Partners, 1981
Sewerage Development Strategy for Gunnedah Shire Council

Sinclair Knight and Partners, 1981
Water Supply Strategy for Gunnedah Shire Council

Snowy Mountains Engineering Corporation, January 1983
Namoi River Flood Plain Model Investigation
Report prepared for Kembla Coal & Coke Pty. Limited

7.0 REFERENCES (Cont)

Soil Conservation Service of NSW, June 1976
Gunnedah District Technical Manual and updates to 1983

State Pollution Control Commission, 1980
Namoi Environmental Study

Transmark Report, February 1974
Long Term Strategy for the Rail Movement of NSW Coal Export. Report prepared for the Public Transport Commission.

Vallet, M, Gagneux, JM, Blanchet, V, Favre B, & Labiale G
Long Term Sleep Disturbance Due to Traffic Noise
Journal of Sound & Vibration (1983) 90(2), 173-191

Vickery Joint Venture, September 1983
Environmental Impact Statement for Red Hill Sampling Operation

Vickery Joint Venture, February 1984
Supplementary Document to Environmental Impact Statement for Red Hill Sampling Operation.

Vickery Joint Venture, March 1984
Residential Land, Houses and Semi-Permanent Accommodation - Gunnedah, NSW.

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Naomi Valley coal project

Borrower's name	Date	Ext

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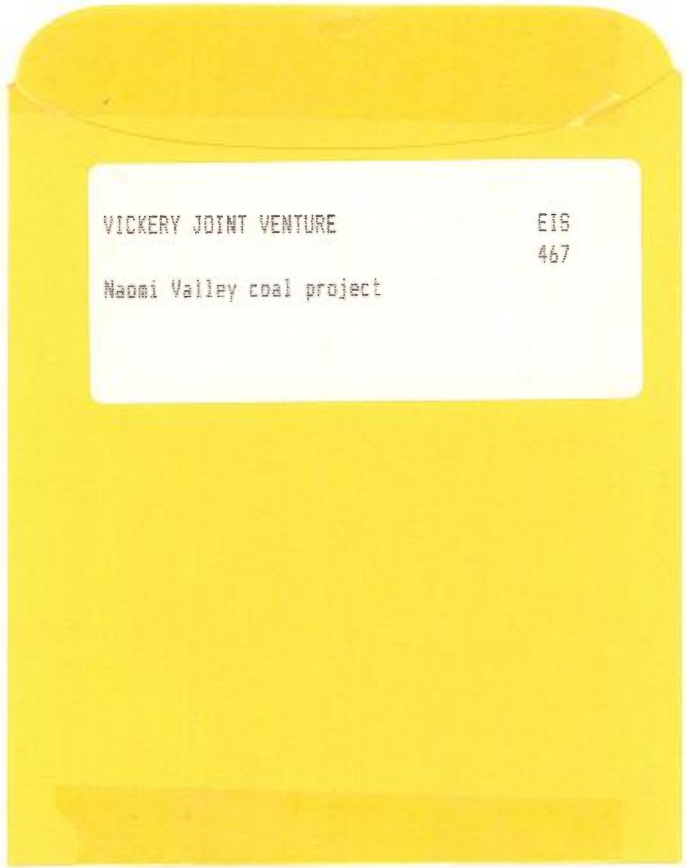
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