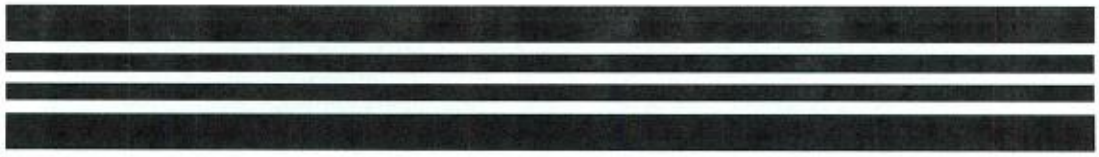

EIS 156

AA055954

Ulan to Gulgong railway line extension : environmental impact statement October 1981

ULAN to GULGONG Railway Line Extension

Environmental Impact Statement

ULAN COAL MINES LIMITED

ULAN TO GULGONG
Railway Line Extension

Environmental Impact Statement

Prepared for:

ULAN COAL MINES LIMITED

by:

KINHILL PTY LTD
55 Clarence Street
SYDNEY 2000

OCTOBER 1981

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

ENVIRONMENTAL IMPACT STATEMENT

This statement has been prepared by or on behalf of **Ulan Coal Mines Limited** 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:-**The construction of the Ulan to Gulgong railway line extension including balloon loop and related facilities, a quarry and borrow pits as set out in the accompanying EIS.**

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

No. **Not Applicable** Street **Not Applicable**

Locality/suburb: **Railway line extension - Land lying both in the Shire of Merriwa and Shire of Mudgee extending from Gulgong to approximately 4 km east of Ulan along the east of MR 214 diversion.**

Quarry - Land lying west of Main Road 214 and approximately 13 km north of Ulan being in the Shire of Merriwa.

Borrow pits - Land lying approximately 1000 m either side of the railway easement between Moolarben Creek and 3 km west of Round Top Mountain Road.

Real property description: Railway line extension - Dedicated railway line easement and Land situated in the Parish of Lennox, County of Phillip being land district of Mudgee Portions 6,7,11,12,13,14 and 25.

Quarry - Land situated in the Parish of Bobadeen, County of Bligh being land district of Mudgee, Portions 9,10,12,15,16,17.

Borrow pits - Various parcels of land situated in the Parish of Moolarben, and Parish of Wialdra, County of Phillip and Parish of Cope and Parish of Ulan, County of Bligh and along and adjacent to the railway easement.

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

Garth McKenzie
B.T.P.(Hons),M.B.A.,M.R.P.,M.R.A.P.I.
Kinhill Pty Ltd
55 Clarence Street
SYDNEY NSW 2000

Certificate

I, **Garth McKenzie** of **Kinhill Pty Ltd** hereby certify that I have prepared the contents of this Statement in accordance with clauses 34 and 35 of the Environmental Planning and Assessment Regulation, 1980.

Garth McKenzie
.....
Signature

26 Oct. 1981
.....
Date

CHAPTER 1

INTRODUCTION

Ulan Coal Mines Limited is proposing to construct a 24.8 km single track extension of the Muswellbrook to Ulan railway line, from Ulan to Gulgong at an estimated cost to the company of $11.2m. This proposal is the result of a basic agreement between Ulan Coal Mines Limited and Government instrumentalities and is the result of a requirement of the State Government for Ulan Coal Mines Limited to investigate the feasibility of extending the railway line to Gulgong.

The railway line extension will provide an alternative outlet for export steaming coal from Ulan in the event of the railway line to Newcastle from Ulan via Muswellbrook being inoperative. It will also provide rail transportation of coal to domestic markets and will provide a more direct rail route to Newcastle for rural produce, especially grains, from the central western districts.

In conjunction with the proposal to build the Ulan to Gulgong railway line extension, and once the railway line between Muswellbrook and Gulgong becomes operative, road haulage of coal to the coal loading facility at Gulgong will cease and the coal loading facility will be removed and the area rehabilitated.

1.1 BACKGROUND: SANDY HOLLOW TO MARYVALE RAILWAY LINE

The Ulan to Gulgong railway line extension forms part of the Sandy Hollow to Maryvale railway line, which was first considered in 1911. A New South Wales Royal Commission on Decentralisation of Rail Transit (PP 1911) recommended that the line be built to increase the decentralising effect of a proposed port that was under consideration at Port Stephens.

Construction of the railway line began in 1936. However, resource shortages during the 1939-45 war and finance shortages in the immediate post-war period saw construction cease in 1951. The railway formation, drainage facilities, bridge works and most tunnel works had been completed at that stage. No ballast or track had been laid.

Completion of the works could not be economically justified during the 1950s, 1960s and the early 1970s. In 1970, a study (NSW DC 1970) by the NSW Development Corporation recommended against completion at that time, and investigations by the Bureau of Transport Economics in 1973 also concluded that completion of the proposed railway line was uneconomical. Subsequent proving of the significant coal deposit at Ulan in 1976, however, provided economic justification for construction of the railway line.

A benefit - cost study, conducted by the Commonwealth Bureau of Transport Economics in 1979,(BTE 1979) recommended completion of the railway line to allow development of the Ulan coal deposit and also to provide economic benefit to the transportation of grain, metalliferous concentrates and general freight between the central-west and Newcastle.

1.2 STUDY AREA LOCATION

The study area is located almost on the north-western boundary of the Central Tablelands, being just a few kilometres from the Central Western Slopes, and is within the south eastern corner of the Orana Region of New South Wales. Ulan and Gulgong are located, approximately 320 km by road from both Sydney and Newcastle.

The study area is partly within Merriwa Shire and partly within Mudgee Shire, and extends from Ulan in the east to Gulgong in the west over a rail distance of 24.8 km.

1.3 EIS STUDY OBJECTIVES, SCOPE AND PLANNING CONTEXT

This Environmental Impact Statement (EIS) is prepared in accordance with the requirements of Section 77(3)(d) under Part IV of the Environmental Planning and Assessment Act, 1979, and accompanies a development application for the extension of the Muswellbrook to Ulan railway line from Ulan to Gulgong. The railway line extension is designated development as per Schedule 3 item (i) of the Environmental Planning and Assessment Regulation, 1980 and is subject to a Direction dated 23 July 1981, pursuant to Section 101 of the Environmental Planning Assessment Act, 1979.

This EIS describes the environmental effects of the construction activity associated with completion of the railway line extension from Ulan to Gulgong. The EIS provides details about the construction of the railway line, its importance to the community and the Government as well as the environmental safeguards that will be adopted to alleviate any environmental effects resulting from the construction of the railway line.

The EIS consists of a further six chapters. Chapter 2 summarises the main features of the railway line extension from Ulan to Gulgong, the benefits of the railway line extension, the environmental effects of constructing the railway line and measures that will be adopted to overcome these effects.

Chapter 3 describes the Ulan Gulgong railway line extension in detail and the building programme for its construction, while Chapter 4 describes possible alternatives to extending the railway line to Gulgong and the energy implications of not extending the line.

The biophysical environment of the study area is described in Chapter 5 and particular emphasis has been given to those features of main concern to the extension of the railway line.

Chapter 6 describes the socio-cultural environment of the study area and examines the proposal in terms of its environmental effects, and in Chapter 7 the economic environment and effects of the proposal are described together with an assessment of the local, state and national economic benefits of the proposal.

Mudgee Shire Council and Merriwa Shire Council are the relevant consent authorities however, in accordance with the Direction issued under Section 101 of the Environmental Planning and Assessment Act, 1979, the Minister for Planning and Environment will determine the application for development consent.

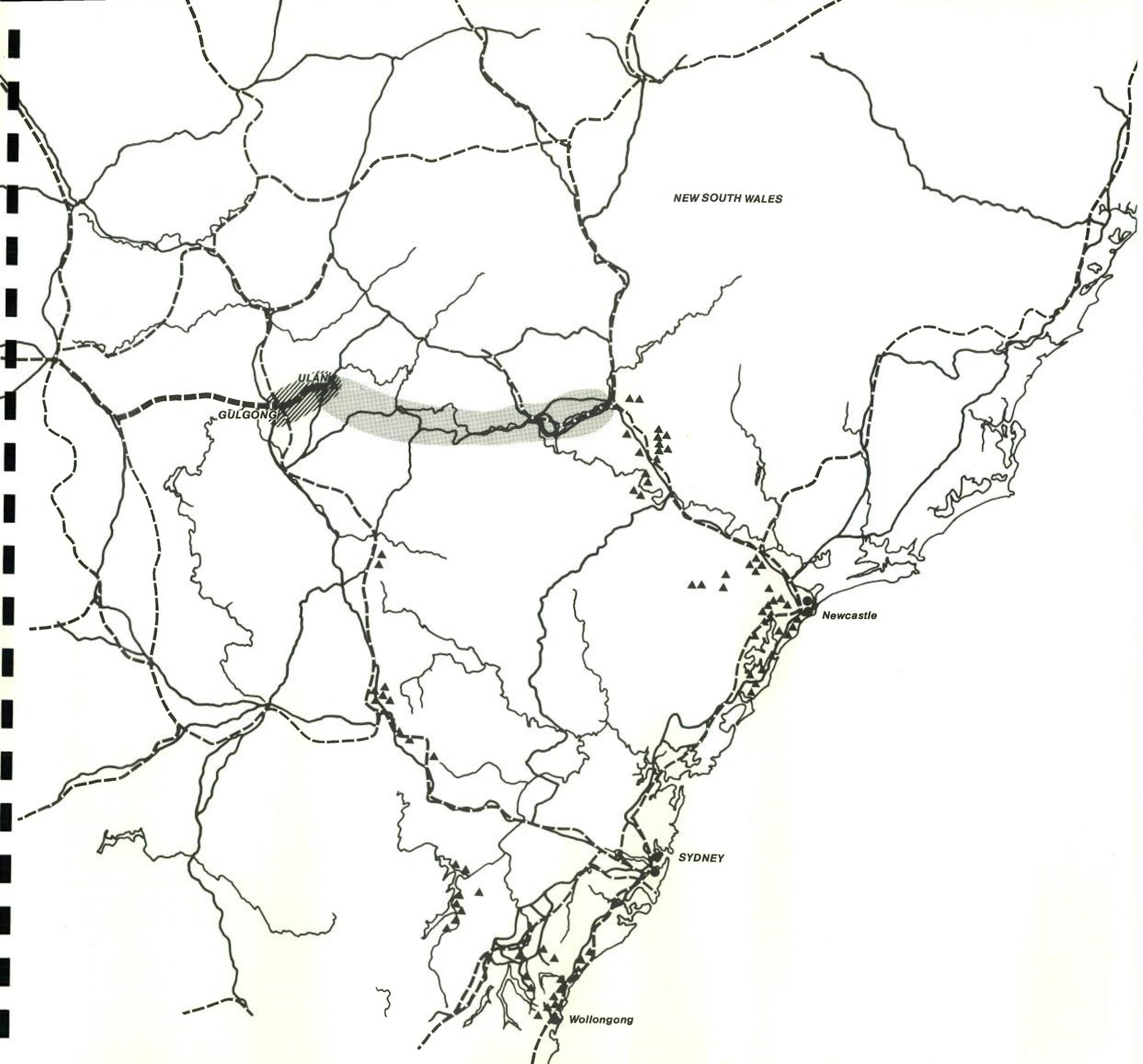


Figure 1.1
STUDY AREA:
REGIONAL LOCATION

- Study Area
- Muswellbrook to Ulan Railway Line (Under Construction)
- Future Extension of Railway Line to Maryvale
- New Railway Line
- Coal Mine
- Coal Loader

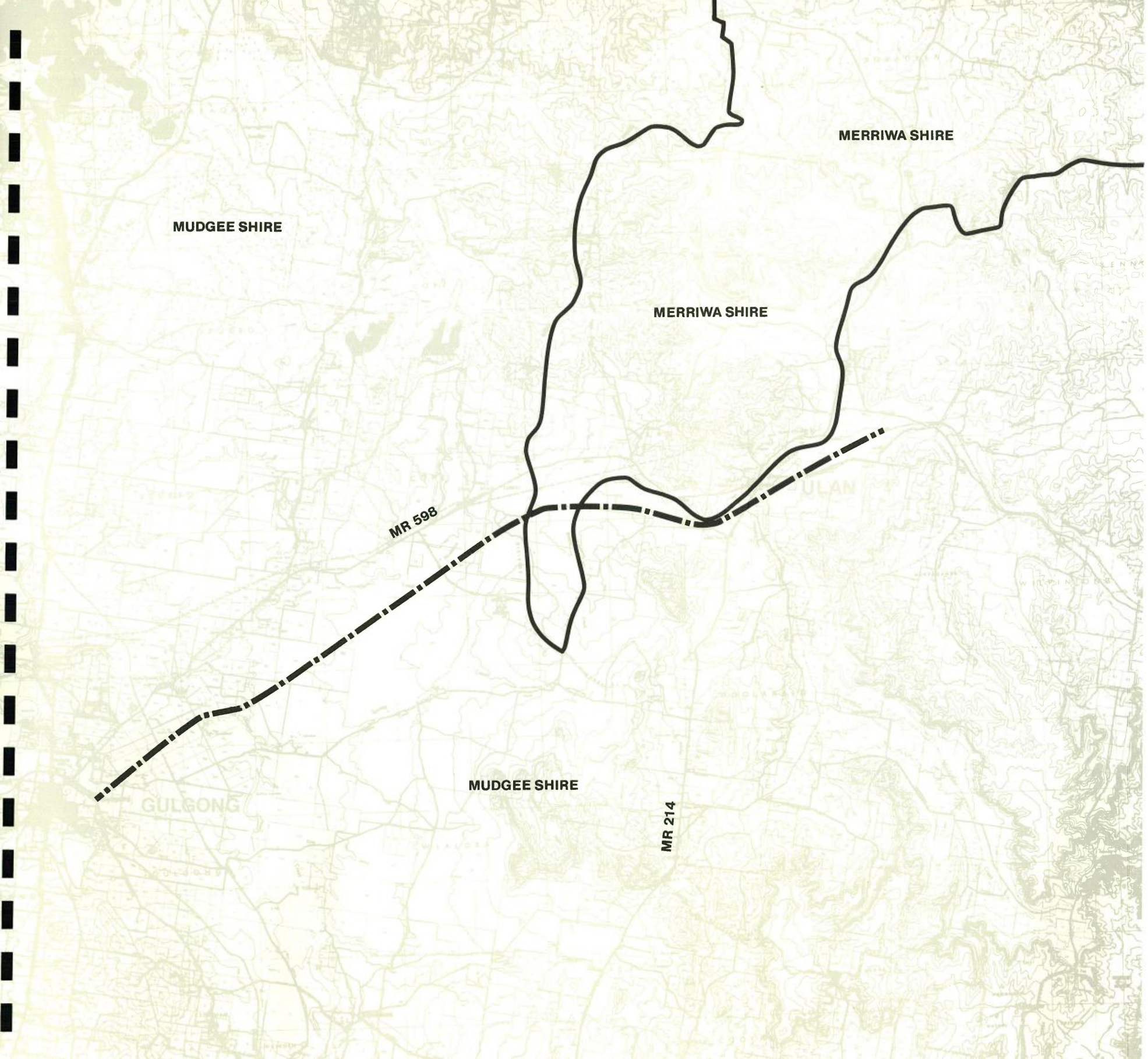


Figure 1.2
STUDY AREA:
LOCAL

Ulan – Gulgong Railway Extension

Shire Boundary

Ulan Coal Mines Limited will be the applicant. Ownership of the easement has been vested in that company for the purposes of constructing the railway line and on completion the railway will revert back to the ownership and control of the State Rail Authority (SRA).

1.4 EXISTING DEVELOPMENT AND PREVIOUS PROPOSALS

Coal mining started at Ulan in 1924, with intermittent small output. Regular output began in 1957 with the completion of a small coal fired power station at Ulan. Despite closure of the power station in 1970, coal production was continued to supply local consumers. In 1975 the coal mine was purchased by White Industries Limited.

In 1976 exploration by White Industries Limited proved that there were sufficient reserves to warrant expansion of mine operations. In 1978 Mitsubishi Development Corporation purchased a 40 per cent equity in the Ulan coal mine and the operating name of the Company was changed to Ulan Coal Mines Limited.

The coal resources at Ulan are remote from the sea coast, and development is therefore dependent on the construction of a direct rail link to Newcastle. Accordingly the Company submitted an Environmental Impact Statement, dated April 1980 (Longworth and McKenzie Pty Ltd 1980), for the construction of the railway line from Sandy Hollow to Ulan and reconstruction of the line from Muswellbrook to Sandy Hollow.

Construction of the railway line and the associated reconstruction of the Sandy Hollow to Muswellbrook section of existing line was recommended for approval, with conditions, as described in the Department of Environment and Planning's Environmental Impact Assessment Report, September 1980 (DEP 1980). This work is currently underway and it is expected that the railway line to Ulan will be completed by October 1982.

Development applications and the EIS (Longworth and McKenzie Pty Ltd 1980) were submitted in October 1980 for the expansion of the Ulan coal mining operation from a production of O.6 million tonnes per year (or megatonnes per year Mtpy), with 0.5 Mtpy for export, up to 4.2 Mtpy with 4.1 Mtpy for export.

In the environmental assessment of the proposed expansion of Ulan colliery (DEP March 81), the Department of Environment and Planning concluded:

> 'The proposed increase in the use of road transport for coal to Gulgong and the increase in throughput of coal at the Gulgong rail loading facility would be unacceptable on a long term basis. However by mid 1982 when the Ulan to Sandy Hollow railway is scheduled for completion the Gulgong facility would be required for handling only 0.1 million tonnes of coal per year compared to .6 million tonnes at present. This would be a significant improvement. Nevertheless, in the interests of environmental protection and social well-being it is considered that the Gulgong facility should cease operations as soon as possible. In this regard the ideal solution would be to extend the Sandy Hollow railway to Gulgong.'

Accordingly the DEP recommended that the expansion of the Ulan Colliery be approved provided the company (Ulan Coal Mines Limited) among other things

> 'Undertakes, in consultation with the State Rail Authority and Mudgee Shire Council, as soon as practicable, a study of the feasibility of extending the Sandy Hollow railway from Ulan to Gulgong, with the main objective being to remove the rail loading facility at Gulgong and road transport of thereto'

The Inquiry (CI 1981) found that the Gulgong coal loading facility has an adverse impact on the environment and that the facility should cease to operate by 31 December 1982, or in the event of the need for an extension of operation there should be substantial improvements and/or relocation of the facility. The closure or relocation of the facility was preferred and the Commission of Inquiry endorsed the Department's recommendation that the company investigate the feasibility of extending the railway line to Gulgong.

The Inquiry (CI 1981) recommended to the Minister for Planning and Environment that approval, subject to conditions be granted for the expansion of Ulan coal mines. Approval was granted and Ulan Coal Mines Limited subsequently investigated the feasibility of extending the railway line from Ulan to Gulgong.

At a Civic Reception at Mudgee on 4 August 1981 the Premier of New South Wales, Mr Neville Wran, announced that the previously approved Muswellbrook to Ulan railway line would be extended to Gulgong. The Premier also stated that:

> 'surely as night follows day then the line will be connected to Maryvale'*

The Premier pointed out that the railway line was necessary for the development of Ulan coal for export and that benefits will include the elimination of large coal trucks from the local roads and the removal of the coal loading facility at Gulgong. It will provide alternate rail links from Ulan to Newcastle and other ports as well as a link with the northern line to western NSW, and will provide a direct rail link for rural produce from the central west to Newcastle.

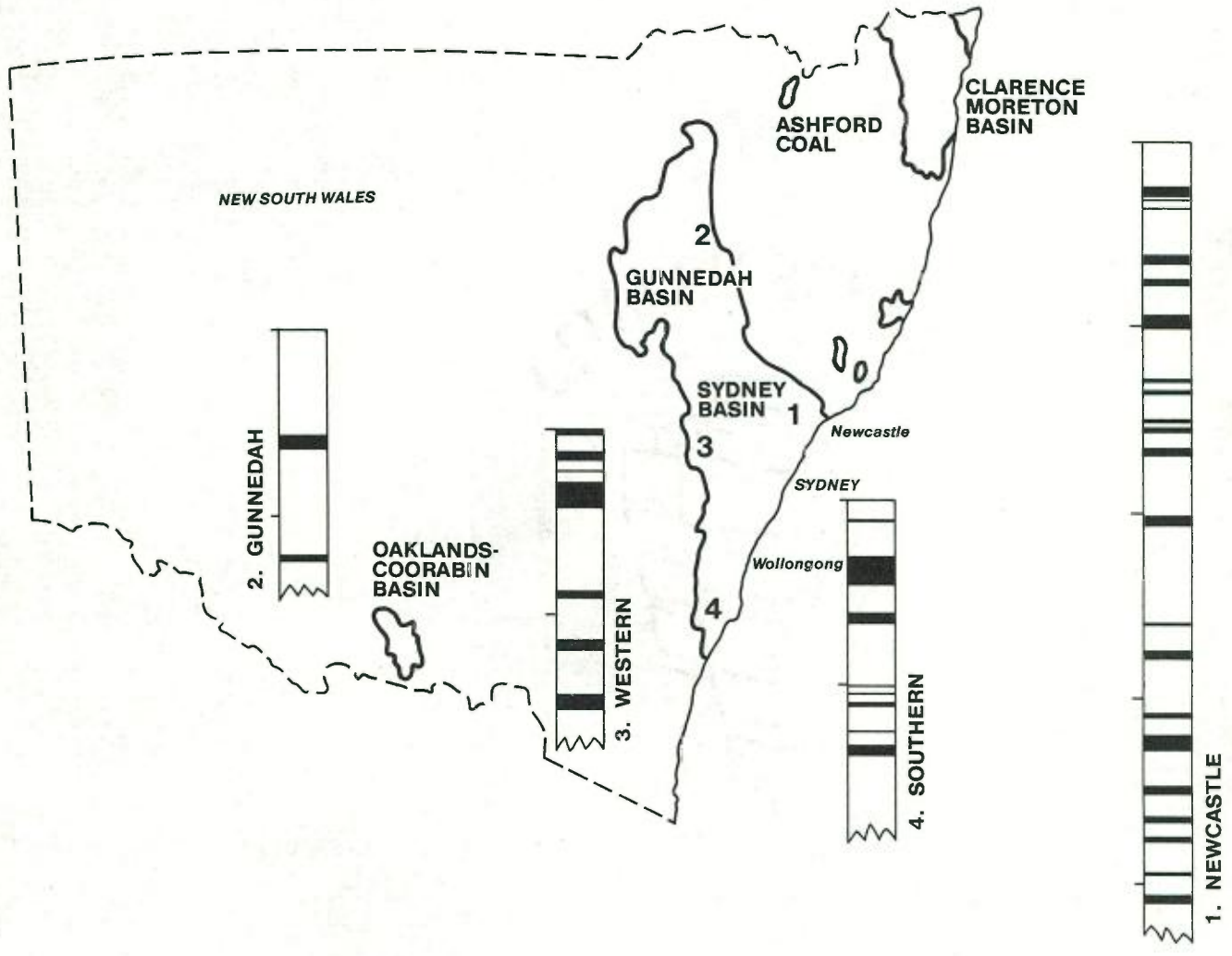
1.5 STATE AND REGIONAL CONTEXT

New South Wales has a large black coal resource occurring as seams within sedimentary rock basins. The major coal bearing basin is the Sydney Basin although some coal is also mined from the Gunnedah Basin. Coal seams are deeply buried under younger rock strata in the central parts of the basins but are mined at the edges of the basins where they occur closest to the surface as for example at the South Coast, Lithgow, the Hunter Valley and Ulan areas of the Sydney Basin. The Ulan deposit occurs at the north western edge of the Sydney Basin.

In 1979 the Joint Coal Board estimated that the in-situ black coal resources of the state were 22,700 Mt of measured and indicated reserves with a further total of 490,000 Mt of inferred resource.

* (Mudgee Guardian 4th Aug. 1981).

Figure 1.3
MAJOR COAL BEARING BASINS OF NEW SOUTH WALES



Only 12000 Mt of the measured and indicated reserves are considered to be recoverable under present economic and mining criteria. (CRDC 1981)

The Ulan area contains approximately 2.0 per cent of the State's inferred resources although this figure could increase with further exploration.

Recovery of the resource depends on mining techniques with an average 90% of the resource being capable of recovery using open cut mining and up to 85% recovery using advanced underground mining techniques. Surface land use and depth of coal offer the main constraints to mining coal. Figure 1.4.

Production of NSW coal has expanded from less than 12 Mtpy raw coal in the late 1940s to 50.9 Mtpy in 1979.

Prospective NSW raw coal production is shown below in Table 1.1.

Table 1.1 NSW raw coal production 1979 to 1990 (Mt)

	Actual	Prospective			
Raw coal production	1979	1981	1983	1985	1990
Underground	38.0	50.1	61.2	73.9	90-
Open cut	12.9	17.6	33.3	56.1	75
Total	50.9	67.6	94.5	130.0	165

Source: NSW Coal Strategy 1981. Coal Resources Development Committee, April 1981 p38

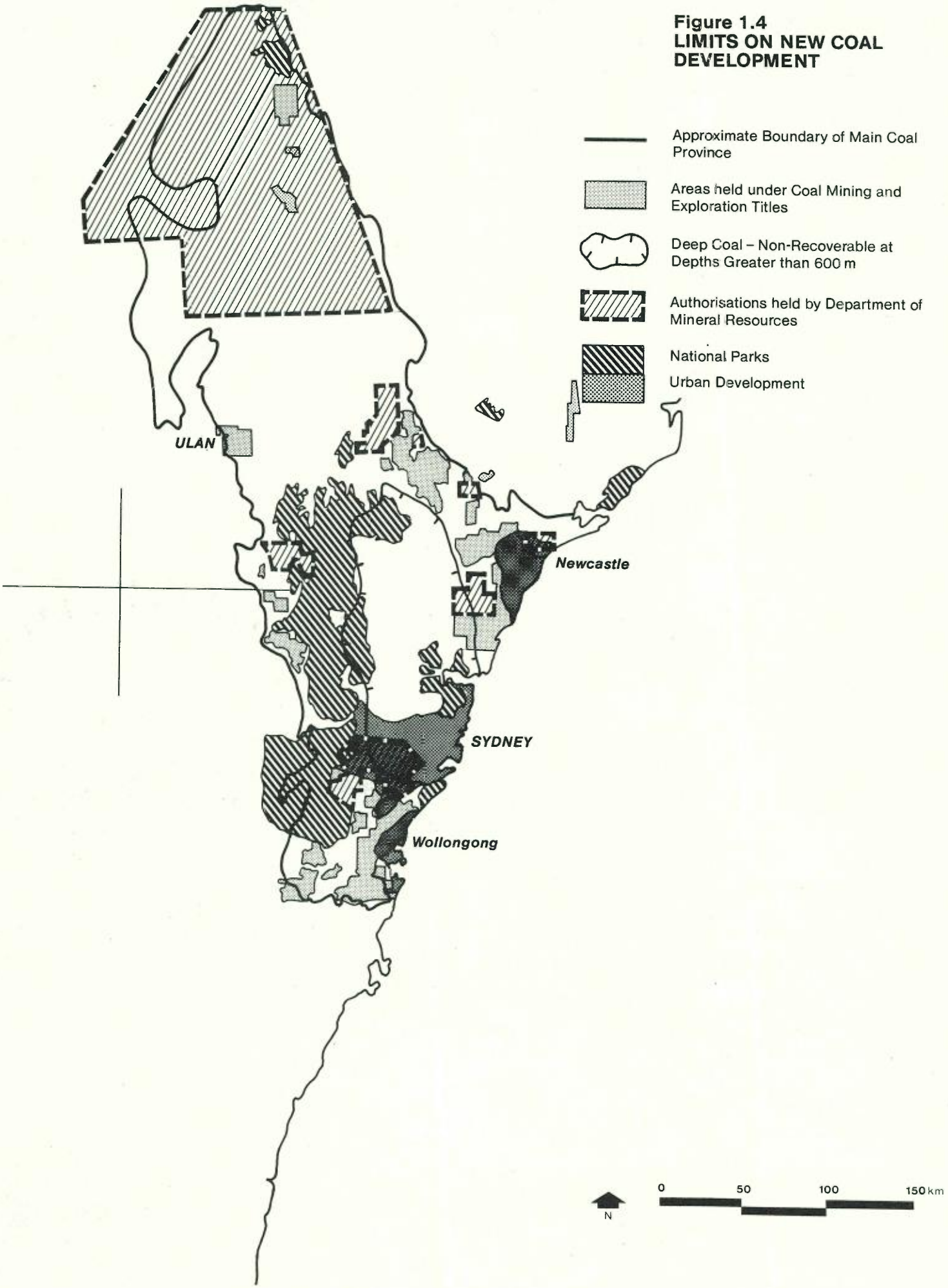
The prospective increase shown is very large: open cut production could increase by in excess of 60Mt over 10 years, equivalent to an average annual rate of increase of 17 per cent with underground production potentially increasing by more than 50Mt or 8 per cent per year.

The implications for NSW is that the State's coal production could be increased four or five fold over the next 20 years.

In the 5 years from 1975/76 to 1979/80 Australian coal exports have grown by about 42 per cent. NSW exports represent approximately 50 per cent of the Australian coal exports and have increased over the 5 year period by 55 per cent to almost 22 Mtpy.

In developing the coal resources of the State, it is the New South Wales Government's policy to use rail transportation in preference to road haulage for coal wherever practicable, with particular importance and priority placed on the implementation of this policy in relation to export coal. The construction of the railway line from Muswellbrook to Ulan and its extension to Gulgong is seen as a major step in the implementation of the Government's policy in this regard. The construction of the Ulan to Gulgong railway line is clearly advantageous in that it will lessen the need for road haulage of coal. In addition it will mean that the use of the coal loading facility at Gulgong can be discontinued and the adverse environmental effects of this facility will cease.

Figure 1.4
LIMITS ON NEW COAL DEVELOPMENT



CHAPTER 2

SUMMARY

2.1 ULAN-GULGONG RAILWAY LINE EXTENSION

In the assessment report on the expansion of Ulan coal mines (DEP 1981) the Department of Environment and Planning recommended that a feasbility study be undertaken by the applicant to extend the railway line from Ulan to Gulgong. This recommendation arose from concern expressed in public submissions relating to safety aspects along the main road being used for road haulage of coal to Gulgong road maintenance costs and concern expressed by residents in respect of the visual noise and dust effects of the coal loading facility at Gulgong.

A Commission of Inquiry (CI 1981) recommended that approval be granted and endorsed the Department's recommendation that Ulan Coal Mines Limited undertake investigations with the feasibility of extending the railway line from Ulan to Gulgong.

Approval was granted and in consultation with the SRA, Mudgee Shire Council and Merriwa Shire Council, the Company now proposes to construct the railway line from Ulan to Gulgong.

This proposal conforms to State Government policy in relation to the use of rail transportation in preference to road haulage whenever practicable.

2.2 COMPANY OBJECTIVES

In undertaking this proposal, in the interests of environmental protection and social well-being the Company seeks to remove the adverse impacts of the coal loading facility at Gulgong and road transport of coal to that facility.

The company also seeks to secure an alternative means of rail transport of export coal should the railway line between Muswellbrook and Ulan become inoperative for any reason. Coal could then be railed from Ulan through Gulgong to Newcastle in trains similar to those currently being used.

The majority of domestic market coal will be transported by rail from Ulan through Gulgong.

2.3 BENEFITS OF THE RAILWAY LINE EXTENSION

The most immediate benefits of extending the railway line to Gulgong relating to concerns previously expressed, will be the removal of the coal loading facility at Gulgong and the elimination of road haulage of coal to that facility.

Additional benefits include significant saving in energy consumption and the provision of a more direct rail link for rural and other produce from the central west to Newcastle. It is also possible that export coal could be railed to Sydney or Port Kembla.

2.4 SUMMARY OF ENVIRONMENTAL EFFECTS AND AMELIORATIVE MEASURES

2.4.1 SHORT TERM EFFECTS

Short term effects relate to those matters associated with the construction of the railway line. They will be temporary and will last for varying periods during the 10 months estimated time to construct the railway.

Air quality: Activities associated with earthworks, including vehicles leaving and arriving at the construction site on unsealed roads,will be the main source of dust emission. Should dust prove to be a major problem during construction, water tankers will be used to dampen road surfaces.

Soil erosion and stream siltation: In the process of construction, the track formation will be restored. This will involve clearing the formation of existing vegetation thereby causing possible soil erosion and stream siltation. Advice regarding possible means of minimising soil erosion has been sought from the Soil Conservation Service. This advice will be complied with as has been done during the construction of the longer Muswellbrook to Ulan section of the railway line.

Ecological protection: Construction workers will be instructed by the Company in conservative attitudes towards plants and wildlife in the region. Restrictions will be placed on the use of firearms, trailbikes, four wheel drive vehicles, pets and animal trapping.

There may be some short term disturbance to wildlife population during the construction phase, but in the long term these populations will re adjust. These effects will not be signficant.

Access and construction traffic: Access to the railway easement is non-disturbing because of the relatively short length of line and numerous public crossing points. Where access through private property is necessary it will be undertaken in accordance with the requirements of the land owner. The majority of construction traffic and heavy equipment will use the railway easement, thereby minimising the use of public and private roads.

Employment: Railway line construction will provide a total of approximately 3000 man weeks of work creating temporary employment for approximately 95 people during the 10 months construction period. Construction camps are already established at Ulan and Bylong and will serve the needs of the railway line construction workforce. Senior staff and inevitable visitors will be temporarily housed in motel/hotels at Gulgong and Mudgee.

Construction materials

Earthworks: Material for earthworks will be extracted from borrow pits adjacent to the railway formation. The Soil Conservation Service has indicated suitable areas for this material and provided advice on rehabilitation.

Ballast: Material for ballast will be extracted from a quarry north of Ulan along MR 214. Blasting operations will be necessary to extract the material which, will then be transported by road to a temporary stockpile on property owned by Ulan Coal Mines Limited. The total operation will last for a period of approximately 15 weeks.

Sleepers: These will be manufactured at Denman and transported direct by rail to Ulan. The manufacturing plant at Denman is currently producing sleepers for the Muswellbrook to Ulan section of the railway line.

Rail: Steel for the rail will be from BHP-AIS, Port Kembla. It will be transported by rail to Sydney for joining, thence to an existing temporary stockpile along the Muswellbrook to Ulan railway line. It will then be transported by rail for use along the Ulan to Gulgong section.

2.4.2 LONG TERM EFFECTS

Coal Sterilisation*: Ulan is on the western most edge of the Sydney Coal Basin and as the railway line extends towards Gulgong beyond the coal measures it is not likely to sterilise significant quantities of recoverable coal.

Flooding implications: If the railway line between Ulan and Muswellbrook becomes inoperative due to flooding the implications will be less important with an extension of the railway line to Gulgong as this will provide an alternative emergency rail route to transport export coal. There is negligible risk of flooding on this alternative route and the completion of the railway line to Gulgong is not likely to increase the existing flooding regime along adjacent creeks.

Noise: The noise effects of the proposal will be experienced in both short and long terms. Disturbance due to construction noise will be temporary and will not be continuous in any one location during the 10 month construction period.

The long term effect of the proposal is that some residents in close proximity to the railway will be affected by noise from passing trains but the passbys will be of short duration.

Level crossing safety: Concern has been expressed in relation to the potential problems of safety at the public level crossing just south of Ulan village on the 'old' alignment of MR 214. The type of level crossing provided will be determined by the Inter-Departmental Level Crossing Committee who will consider a number of safety factors when assessing the means of level crossing protection. The provision of other public level crossings will be similarly determined.

Serverence: Public level crossings will be provided where the railway easement crosses public roads. Private and accommodation crossings to give access across the railway line for private land owners will be provided after consultation with individual land owners and the SRA.

* Coal sterilisation: inability to extract coal because of surface land development.

CHAPTER 3

DESCRIPTION OF PROPOSAL: ULAN-GULGONG RAILWAY LINE EXTENSION

3.1 COMPANY OBJECTIVES

Ulan Coal Mines Limited will transport the bulk of its coal east by rail to Newcastle. The proposed westerly extension to Gulgong will be used to provide the mine with a rail route for domestic coal and an alternative route for export coal if the main line between Ulan and Newcastle becomes inoperative for any reason. Coal could then be railed via Gulgong, through Werris Creek to Newcastle or through Mudgee to Balmain, Port Kembla, or via Sydney to Newcastle. The extension to Gulgong will also mean that road haulage of coal to the coal loading facility will cease and that the coal loading facility at Gulgong will be removed and the area rehabilitated.

3.2 NEED FOR RAILWAY LINE EXTENSION

The extension of the railway line to Gulgong will provide a more direct connection for rail traffic using the Wallerawang to Gwabegar Branch of the main western railway to travel to Newcastle. This, coupled with the possible future extension of the railway line to Maryvale, will enable freight from western New South Wales to be transported more economically to the port of Newcastle. Principal commodities that could benefit include:

a) wheat and other grains (0.3 to 1.0 Mpty)
b) concentrates (0.4 Mtpy)
c) wool
d) meat and livestock (to a lesser extent).

3.3 RAILWAY LINE DETAILS

3.3.1 EXISTING EASEMENT AND FORMATION

Construction of 24.8 km of railway line between Ulan and Gulgong will follow the existing easement which is approximately 20 m wide either side of the track centre line. The existing railway formation is 6.1 m wide. Clearing and reforming will be needed.

The SRA requires that construction of the railway line be compatible with the reconstruction and construction work currently underway on the Muswellbrook to Ulan railway line. The SRA also requires that the alignment standard to impose fewer operating constraints than do sections of existing main lines.

3.3.2 RAILWAY LINE DESIGN STANDARDS

The following alignment and construction standards will be used.

Easement: The easement width will vary between 15 m and 20 m (either side of the track centre line) and will be cleared and maintained as a firebreak and maintenance access road.

Formation: The formation width will be at least 6.1 m to suit the heavy duty concrete sleepers.

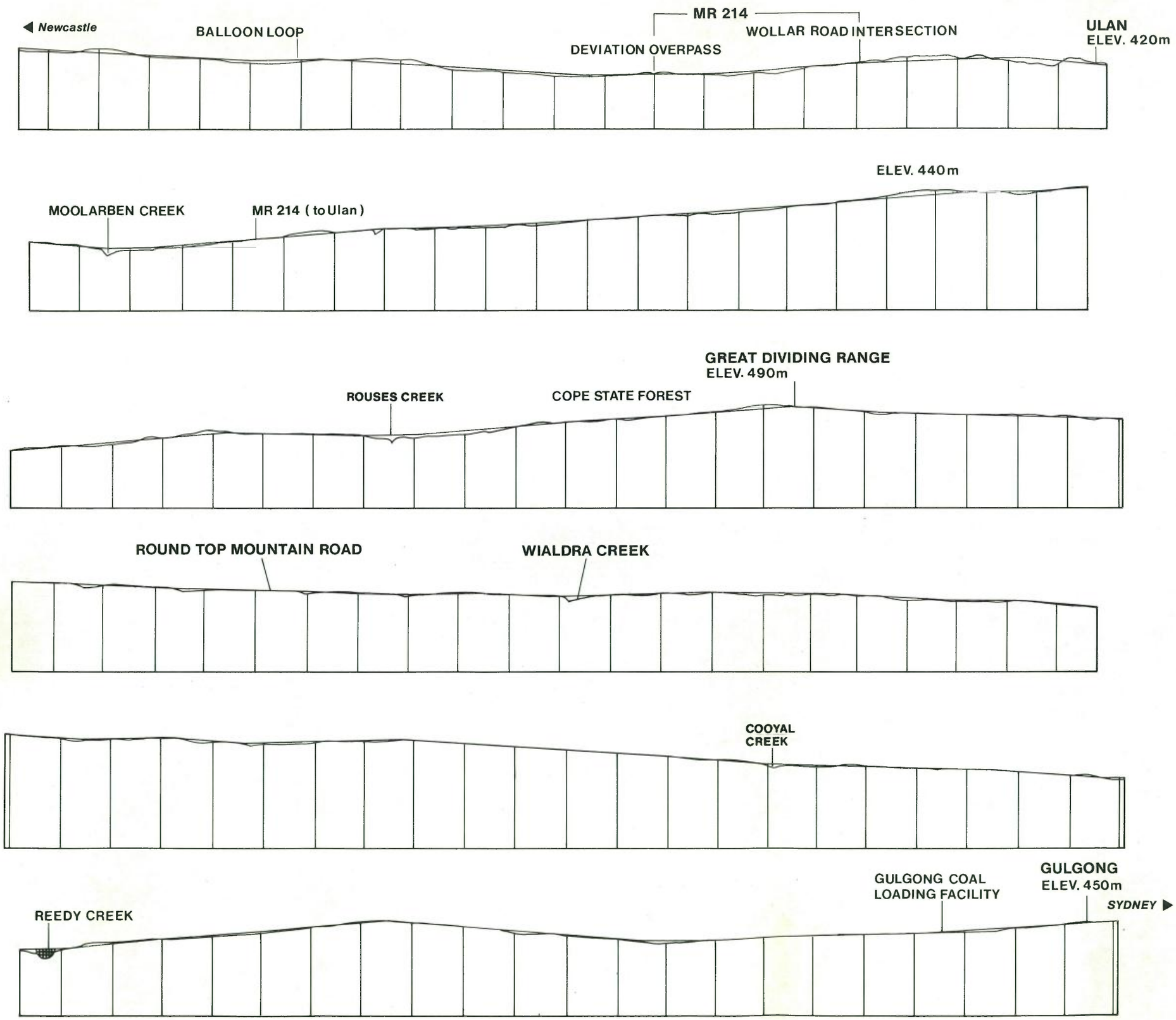


Figure 3.1
ULAN TO GULGONG RAILWAY LINE: LONGITUDINAL SECTION

Grades: Ruling grades will not exceed 1:80 against loaded trains and 1:50 against empty trains.

Curves: The minimum radius of curvature will be 300 m except at junctions and within station limits, where speed limitations automatically apply.

Ballast: The depth of ballast from the under side of the sleepers will be 300 mm and shall be in accordance with current SRA class 1 main line standard.

Rail: 53 kg/m of continuously welded rail will be laid on prestressed mono-bloc concrete sleepers. This conforms to the current SRA class 1 main line standard for 25 t axle loading.

Track fastenings: The fastenings are to be 'Pandrol' E type rail clips together with rail foot pads and shoulder insulators suitable for any signalling requirements.

Bridges: There will be three steel bridges. Steel work is required for one bridge which will be constructed to SRA standard specifications.

3.3.4 TRACK FACILITIES DESIGN STANDARDS

Signals: Signalling will conform to SRA minimum safe working requirements, that is an "Electric Train Staff system" (a manual block token system). Fixed signals and interlocked points will be provided at all crossing stations, and telephone train control will be installed.

Sidings: No sidings or passing loops are necessary in the section of railway line between Ulan and Gulgong.

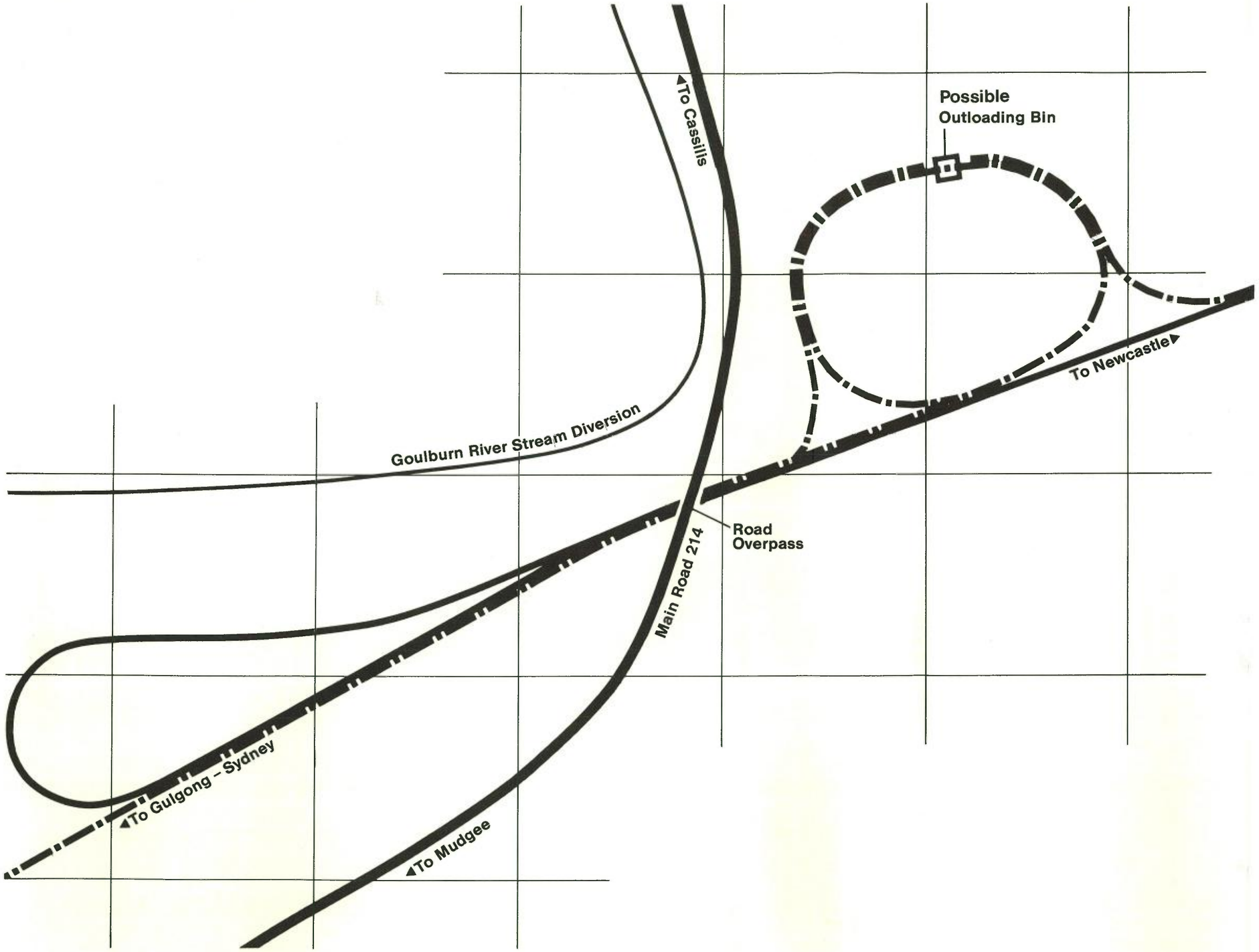
Balloon loop: A balloon loop and provision for a loading facility similar to the one currently under construction at Ulan will be built to provide a turnaround for trains travelling to and from Gulgong or Newcastle.

Turnouts: The 1:15 turnout for the balloon loop will be constructed to conform to current SRA Ulan 1 main line standard.

Level crossings: Construction details from the original survey of the railway line between Ulan and Gulgong indicated seven public level crossings, sixteen private and accommodation crossings.

Depending on the present land ownership and land management situation, individual requirements for private and accommodation crossings will be re-assessed. The requirements of all land holders have been sought by personal visits by officials of Ulan Coal Mines Limited and by advertisements in the local press. All private and accommodation crossings are subject to SRA approval and where provided will have winged fenced approaches closed by swing gates on either side of the railway.

Figure 3.2
BALLOON LOOP



Approved Railway and Balloon Loop

Proposed Balloon Loop and Railway Line Extension

N

0 1 2 3 5km

Public level crossings will be provided where public roads cross the railway line easement. The particular means of protection of each public level crossing will be determined by the Inter-Departmental Level Crossing Committee, whose membership is drawn from the SRA, the Departmental Main Roads (DMR), the Traffic Authority of NSW, the Police Department, the Department of Local Government and the NSW Treasury. This Committee assesses the means of control of level crossings by taking into account such factors as the alignments of the road and rail approaches, road and rail average speeds, road and rail sighting distances, the nature of the road surface and typical prevailing weather conditions. The level of protection will vary up to train controlled flashing lights, bells and boom barriers.

Fencing and stock control: Fencing will be in accordance with SRA standard SG423A and ST53A for gates. Both sides of the easement will be fenced. Allowance will be made for private and public crossing requirements, for privately owned water reticulation sleeves under the formation, returns for stock underpasses, major water ways and cattle stops.

3.4 RAILWAY LINE CONSTRUCTION PROGRAMME

3.4.1 DESCRIPTION OF CONSTRUCTION TASKS

Clearing: Trees and shrubs will be cleared from the easement by chain saw and dozer and then pushed into heaps prior to burning. Burning will take place only with the approval of the local bush-fire brigade.
Scheduled timing: Start 2.12.81 - finish 15.1.82.

Fencing: The railway easement will be fenced both sides to provide security for stock. Temporary fencing will be erected to ensure adequate stock control during railway line construction.
Scheduled timing: Start 1.2.82 - finish 23.4.82.

Formation earthworks: Restoration of the previously constructed formation will be undertaken. The top 300 mm of earth will be removed and used to construct a maintenance road alongside the track. 300 mm of underfill will then be applied and consolidated by a vibration roller to 90 per cent standard.
Scheduled timing: Start 16.1.82 - finish 7.5.82.

Capping layer: A select high standard earth capping layer will be placed on top of the formation before the placement of ballast. This capping layer will be consolidated to 95 per cent modified standard.
Scheduled timing: Start 1.2.82 - finish 21.5.82.

Final trim: Precise trimming will be carried out by an auto guide machine imported from U.S.A.
Scheduled timing: Start 11.2.82 - finish 30.5.82.

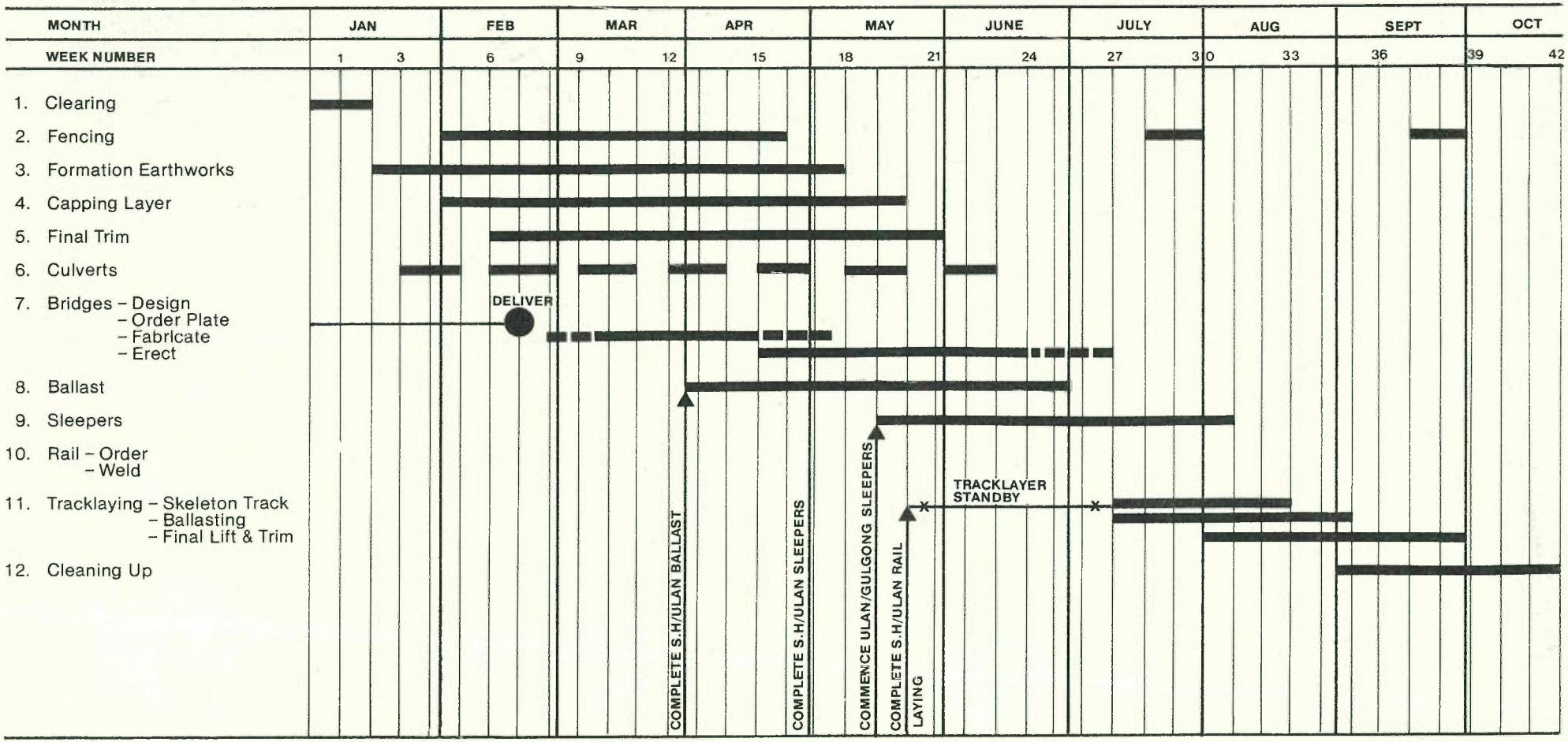


Figure 3.3
ULAN TO GULGONG PROPOSED RAILWAY LINE EXTENSION CONSTRUCTION PROGRAMME

Culverts and drainage: Side drains will be provided at formation level in all cuttings. Cut off drains and training banks will be provided at the top of batters. Culverts were provided as part of the original construction work and new work will be limited to cleaning out blockages and opening waterways.
Scheduled timing: Start 25.1.82 - finish 18.6.82.

Bridge construction: Only five spans of bridge steelwork are needed.One small mobile crane will be used for the erection of bridge spans. All steel work on bridges will be cleaned and painted with one coat of inorganic zinc paint and two coats of vinyl paint.
Schedule Timing: Start 15.2.82 - finish 9.7.82.

Ballast: Ballast will be transferred by rail wagons for plug dumping on laid rails.
Scheduled timing: Start 1.4.82 - finish 30.6.82.

Sleepers: Concrete sleepers will be progressively transported by rail to the end of the rail line for track laying.
Scheduled timing Start 14.5..82 - finish 6.9.82.

Track Laying
Track laying will proceed from Ulan to Gulgong using a Plasser SUM1000 machine.
Scheduled timing Start 9.7.82 - finish 30.9.82.

Signalling and communication: All signalling and communications on this section of the railway line will be consistent with the system installed along the Muswellbrook to Ulan railway line. The system will be to a standard specified by the S.R.A. and suitable for conversion to C.T.C. Signalling will be approved after the railway line becomes semi operational.
Scheduled timing: Start 14.6.82 - finish 15.10.82

Cleaning up: All redundant materials will be removed from the formation.
Scheduled timing: Start 1.9.82 - finish 30.10.82

3.4.2 CONSTRUCTION MATERIALS

Earthworks and capping material: Fill for formation reconstruction and capping material will be obtained from borrow pits on private property adjacent to the railway easement. The location of these borrow pits is dependent on the quality of the natural material and once established as suitable the manner of winning (dozer,front end loader or scraper) will be negotiated with landowners. The material will then be trucked in 20-35 t capacity trucks or scrapers directly to the formation. Approximately 160,000 t of material will be required, 100,000 t for formation works and 60,000 t of the selected material for the capping layer.

Borrow pits will be reformed and rehabilitated to the requirements of land holders. Rehabilitation is usually in the form of dams or to requirements set down by the Soil Conservation Service (see Section 5.5.).

Ballast: Ballast for the railway will be obtained from a quarry near Ulan. Approximately 100,000 tonnes of sized ballast will be required.

Ulan Coal Mines Limited have the approval of the owner to operate the proposed quarry. Operation of the quarry will be conducted on a, 10 hour basis for a 6 day week to provide an estimated 200 tonnes of ballast per hour. Some blasting will be necessary to extract the material. Ballast material will be transported by 20-35 t capacity road trucks to a temporary stockpile adjacent to the railway on land owned by Ulan Coal Mines Limited (see Section 5.3). Alternatively the ballast material may possibly be obtained from the quarry currently operating at Bylong and transported by rail to Ulan.

Sleepers: Sleepers for the railway line will be supplied by Monier from their concrete manufacturing plant at Denman. 41,000 pre stressed concrete sleepers will be used and transported direct to Ulan by rail.

Rails: Steel for the rails will be produced and rolled by BHP-AIS at Port Kembla in 13 m lengths and supplied to the Chullora Works for joining. Rail will be of 53 kg/m weight and will be flash-butt welded in 110 m lengths. The rails will be transported by rail transport from Chullora via Newcastle and Muswellbrook to a stockpile along the Muswellbrook-Ulan line.

Bridge steel: Five steel girders, each 7 m long and weighing 4 t are required to complete the construction of the unfinished bridge. The steel girders will be transported by road transport to the bridge site.

Culverts and drains: Any new drainage structures will be in concrete (class 2) or corrugated steel pipes to AS 2041 and 2042, 1977. Where existing rabbit and cattle stops are used for drainage they will be replaced as above with approval from the land owner. Major land holders have agreed in principle to this process.

3.4.3 WORKFORCE

Camp and site accommodation: The existing construction camp at Ulan and Bylong will be used to provide housing for construction employees and employees operating the proposed quarry north of Ulan. The main camp will be located at Ulan.

Workshops and plant pool: Existing construction workshops at Ulan and the existing temporary workshop for heavy equipment on land owned by Ulan Coal Mines Limited at Ulan will be used.

Construction workforce: A total workforce of approximately 95 people will be employed on the construction of the railway line. Table 3.1 shows the manhours needed for the main construction tasks.

Table 3.1 Manhour requirements for main construction tasks.

Task	Manhours	Period (Months)
Earthworks	44,800	4
Track	24,000	3
Bridges	3,200	2
Ballast	8,400	3.5
Train crews	20,160	3
Miscellaneous	14,400	3
Total	114,960	

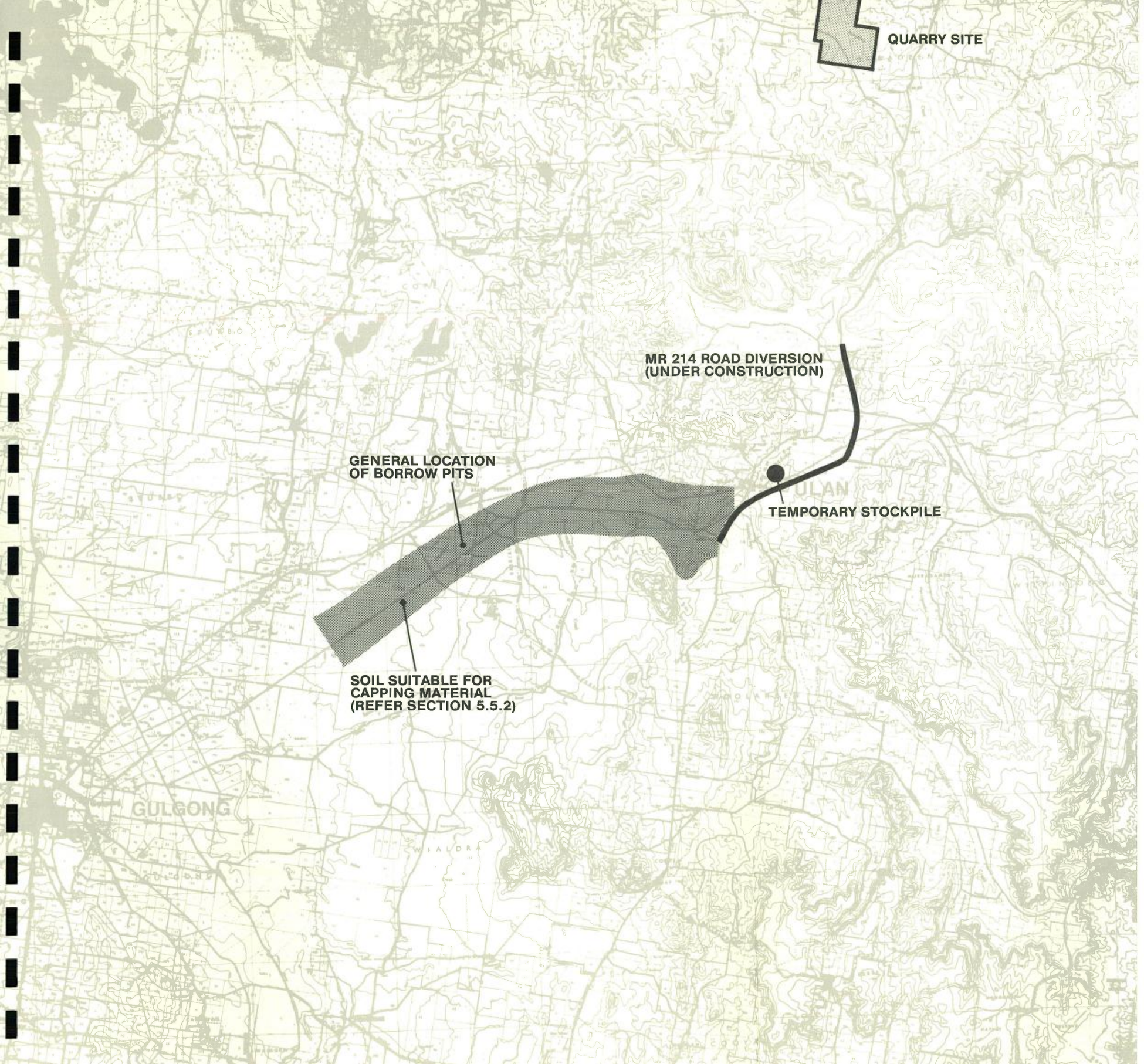


Figure 3.4
QUARRY AND BORROW PITS

Access: Various access points will be located along the railway easement during the construction of the line. Where access points are required through private property they will be located by agreement with property owners.

On completion, the only access will be the maintenance road adjacent to the line however line access may be necessary at one or more places to satisfy SRA requirements.

3.5 RAILWAY OPERATIONS

3.5.1 OPERATIONAL CONDITIONS

Railway operating practice in NSW is moving towards a greater reliance on unit train operation and higher average trailing loads and lengths. To some degree this would affect potential trains travelling between Ulan and Gulgong. Trains of bulk commodities such as coal, wheat, other grains and possibly concentrates could be comprised of standard wagon consists*. However, the size and type of such consists would be determined by constraints caused by sidings, tracks and bridges away from the section of railway in question.

The haulage of coal from Ulan via Gulgong, either in emergencies to Newcastle (or any other loading port) or to elsewhere in NSW for domestic use, will be in train consists compatible with the Wallerawang-Mudgee-Gulgong-Merrygoen line.

Currently such trains travelling via Merrygoen are limited to 24 NHTF (CTS) wagons plus a brake van with a gross weight of 1824 t. Such trains are hauled by three branch line locomotives (of classes 47, 48 or 49) and would have a combined length of approximately 430 m.

The prevailing track and siding constraints on the Wallerawang to Gwabegar Branch are:

- Wallerawang to Kandos, class 1 track, 115 km/h maximum speed, crossing loop lengths 288-540 m and no restrictions on the use of main line or branch line locomotives;
- Kandos to Mudgee and Cudgegong Abattoir, class 3 track 100 km/h maximum speed for 421, 422, 44 and 45 class main line locomotives and all branch line locomotives, 80 km/h maximum speed for 42, 442 and 80 class main line locomotives, crossing loop lengths 206-364 m.
- Cudgegong Abattoir to Gulgong, 364 m crossing loop at Gulgong, 100 km/h maximum speed, main line locomotives to be restricted to class 44 only but no restrictions on the use of branch line locomotives; and
- Gulgong to Merrygoen, 70 km/h maximum speed, crossing loop lengths 364-531 m and only branch line locomotives permitted.

* Standard wagon consists are trains consisting of the same type of wagons carrying a single commodity and generally work the same rail route all the time.

On the cross-country railway lines from Dubbo through Merrygoen and Binnaway to Werris Creek, the operating constraints are less severe.

It is desirable that future wheat and other grain movements should be handled by unit trains in a manner similar to that of present unit coal trains. In this case, for example, trains comprised of 39 NGTY (WTY) wagons plus a brake van, with a gross weight of 3159 t may traverse the Ulan to Gulgong section from north or west of Gulgong. However, the operation of such trains will be dependent upon the provision of suitably long crossing loops (of at least 650 m in length) and some easing of the restrictions in the use of main line locomotives.

3.5.2 RAILWAY LINE CAPACITY

The construction of the Muswellbrook to Ulan railway line has made available three crossing loops for coal train use, namely, Sandy Hollow, Kerrabee, and Coggan's Creek. These will permit an approximate limiting sectional running time of 60 minutes for laden coal trains and 35 minutes plus a safeworking allowance of 5 minutes for empty coal trains.

Assuming a practical limit of 70 per cent of the theoretical number of train paths possible under this arrangement, this will allow for nine coal train movements/day in each direction. These running times, and hence total movements, will be relatively unaffected by the choice of diesel or electric traction. The SRA intend to retain the Denman facility to service the concrete sleeper factory, thus it would not be available for unit coal trains.

When the railway line is constructed from Ulan to Gulgong, Ulan Coal Mines Limited will ship the majority of their production, irrespective of destination, by rail. Domestic production will need approximately 1-2 train movements per week along the Ulan to Gulgong section of the railway line. If the export market coal has to travel via Gulgong because of failure of the railway line between Muswellbrook and Ulan, a more frequent service using trains similar to the type currently operating will be needed.

The current intention is that trains of 42 NHGF (CHS) wagons plus a brake van will carry coal to Newcastle. Ulan Coal Mines Limited intends to commence production at a rate of 3.3 Mtpy upon the opening of the Muswellbrook to Ulan railway. They will increase production to 8.0 Mpty within three years, thereafter production would rise to 10.0 Mpty. In the short to medium term, such levels of production will require a steady flow of four trains per day increasing to eight trains per day in each direction (assuming 300 shipping days per year) along the Sandy Hollow railway. This will rise to 10 trains per day in each direction in the long term.

The practical line capacity could be lifted to sixteen trains per day in each direction by laying in three additional crossing loops (suitable for unit coal trains) and lengthening the existing loop at Denman. These additional crossing loops would have to lie between Sandy Hollow and Kerrabee, Kerrabee and Coggan's Creek and between Coggan's Creek and Ulan. The "Electric Train Staff" safe working system could still be retained. This capacity should be sufficient for all currently projected rail traffic.

Laden coal train speeds would be limited to 50 km/h and empty coal trains would travel at 80 km/h.

3.6 RAILWAY LINE MAINTENANCE

The SRA will ensure that proper inspections and maintenance of the railway line extension from Ulan to Gulgong are carried out in accordance with class 1 main line standards. The SRA will also ensure that adequate safeguards are adopted to prevent contamination of water by chemicals used for weed control along the railway easement. These safeguards will need to satisfy the requirements of the Water Resources and State Pollution Control Commissions. The SRA will maintain firebreaks and will burn off in accordance with the current Bushfire Act.

3.7 POSSIBLE ELECTRIFICATION

The railway line has been constructed to allow for its future electrification. If electrification were to take place, it would most likely be at 25 KV AC. It is not proposed to electrify the railway at this stage.

CHAPTER 4

ALTERNATIVES TO THE ULAN TO GULGONG RAILWAY LINE EXTENSION

4.1 EXISTING SITUATION

Coal produced at Ulan is currently distributed by:

- direct road transport to consumers, or
- road transport via Main Road No 598 to a rail siding and loading facility at Gulgong whence supplies are railed to domestic users or to Newcastle for export.

Ulan Coal Mines Limited is currently constructing the railway line between Muswellbrook and Ulan. When this and the coal loading facility at Ulan are completed, export market coal will be transported directly from Ulan by rail to Newcastle via Muswellbrook.

Domestic market coal and coal being transported to other parts still will need to be transported by road to consumers, or to Gulgong and thence via rail to domestic users.

4.2 ALTERNATIVE MEANS OF TRANSPORT

The Environmental Impact Statement (Longworth and McKenzie Pty Ltd 1980) for the Sandy Hollow to Ulan section of the rail line reviewed the following alternatives to rail transport. These were:

- road transport to Gulgong and thence by rail
- road transport via Merriwa to Newcastle.
- slurry pipeline from Ulan to Newcastle

In addition, alternative routes for rail transport were also examined.

The Department of Environment and Planning in its environmental assessment (DEP 1980) for the Sandy Hollow to Ulan railway in relation to the three alternatives above, concluded that:

> 'any transport option involving road transport would be undesirable from environmental, safety and energy utilization viewpoints. Road transport to Newcastle via Merriwa would involve between 400 and 500 trucks per day, in each direction.'

> 'A slurry pipeline would involve greater capital expenditure and water source and disposal problems at the Ulan and Newcastle ends respectively. The ability to operate a slurry pipeline of such length on a commercial scale at this time in Australia is questionable'

In relation to rail transport alternatives, the Department also concluded (p5),

> 'Reconstruction of the Maryvale to Sandy Hollow railway between Ulan and Sandy Hollow provides the most practical transport option'.

It is now proposed that the railway line be extended to Gulgong. This will enable virtually all domestic and all export coal to be transported by rail. It also means that the coal loading facility at Gulgong will be demolished on completion of the railway line to Gulgong.

Further alternatives to the continuation of the Muswellbrook to Ulan line through to Gulgong are not considered in this report. However, an assessment has been made of the relative energy consumption of the road versus rail alternatives.

4.3 ENERGY EFFICIENCY OF ALTERNATIVES

Ulan Coal Mines Limited current arrangement for both domestic and export coal (all of steaming grade only) requires the road haulage of coal to Gulgong for loading into rail wagons. Large coal trucks of 38 t gross laden weight carrying a 23 t payload are currently used. The average fuel economy of such vehicles lies in the range 50-55 litres per 100 kilometres. Such vehicles can haul coal for a specific fuel consumption in the range 43-48 litres per 1000 net tonne kilometre.

Based on a fuel consumption of 8.8 litres per 1000 trailing tonne kilometre for a diesel hauled train the specific fuel consumption for this type of train would be in the range 12-16 litres per 1000 net tonne kilometre, or roughly one third that of the road transport alternative.

Electrification of the railway would improve energy efficiency to a specific energy consumption in the range 40-60 kilowatt hours per 1000 net tonne kilometre. However the capital costs of electrification do not warrant such an undertaking at this stage.

Table 4 below shows comparative energy consumption in MJ per nett tonne kilometre for the alternatives discussed above.

Table 4.1: Comparative energy consumptions

Coal transport Mode(1)	Actual fuel/electricity Consumption(2) per 1,000 net tonne kilometres (l/kWh)	Comparative energy Consumption(3). (MJ per net tonne kilometre(4).)
Truck	43 - 48	1.65 - 1.84
Diesel train	12 - 16	0.46 - 0.61
Electric train	40 - 60	0.18 - 0.27 (DC) 0.15 - 0.23 (AC)

Source: R Travers Morgan Pty Ltd

NOTES:

1 Coal transport modes as discussed previously in this report

2 Actual fuel/electricity consumption at the vehicle or train for the previously discussed movement task, which includes empty return

3 Comparative energy consumption based on fuel as delivered or electricity as supplied to the SRA (as distinct from the train). AC electricity reticulation has been taken as 95 per cent efficient. DC electricity reticulation has been taken as 81 per cent efficient

4 The conversion factors used are:

- 1 litre of distillate has the energy equivalent of 38.4 MJ from the Australian Institute of Petroleum,
- 1 kWh = 3.6 MJ.

CHAPTER 5

THE EXISTING BIOPHYSICAL ENVIRONMENT AND EFFECTS OF THE PROPOSAL

5.1 SUMMARY

The extension of the railway line will generate a number of biophysical effects upon the environment. These include effects relating to air quality, coal reserves, quarrying, soil erosion, flooding and ecological protection. With the exception of flooding these effects will be of a short term nature and will only occur at various stages during the construction period.

As a result of the proposal air quality will improve. The proposal will not sterilize any known significant quantities of coal, however it will require the operation of a quarry to obtain ballast and earth excavation to obtain material for the reconstruction of the railway formation.

In order to avoid adverse effects of soil erosion advice was sought from the soil conservation service. Continued liaison with officers of the Soil Conservation Service will be maintained for the duration of the railway line construction.

In relation to flooding the proposal will not significantly alter existing flood levels along and adjacent to the railway easement. The proposal provides a positive benefit in that it will ensure an alternative rail route exists for coal transport should the main route from Ulan to Newcastle via Sandy Hollow becomes inoperative.

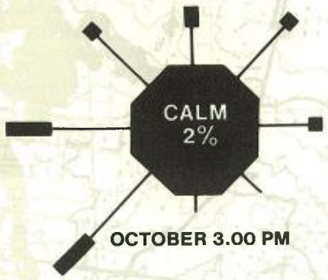
The construction of the railway line will directly affect the vegetation and wildlife within the easement. However as the land within the easement is already modified by previous construction, the effects will not be significant. Also, the loss of this natural resource is relatively small when judged on a regional basis.

Because of the already fragmented nature of the woodland, the railway line will not significantly affect the movement of animals along ecological corridors.

5.2 CLIMATE AND AIR QUALITY

Topography and location have a marked influence in determining the climate of the Ulan-Gulgong region. Ulan is located in the western most corner of the Hunter Valley and is enclosed on the south-western boundary by the Great Dividing Range which forms a physical barrier sheltering the Ulan area from strong winds. Gulgong by comparison is located on the open flat plains to the west and is poorly protected from strong winds. Winds are predominantly from a south-westerly direction and although these winds occur throughout the year, they are more intense during the spring months.

Ulan and Gulgong's location inland produces extremes in temperatures, giving rise to hot summers and cold winters with frequent frosts. Climatic data for the Ulan-Gulgong area were obtained from the Gulgong recording station on Flirtation Hill and data recorded at Ulan. See Figure 5.1



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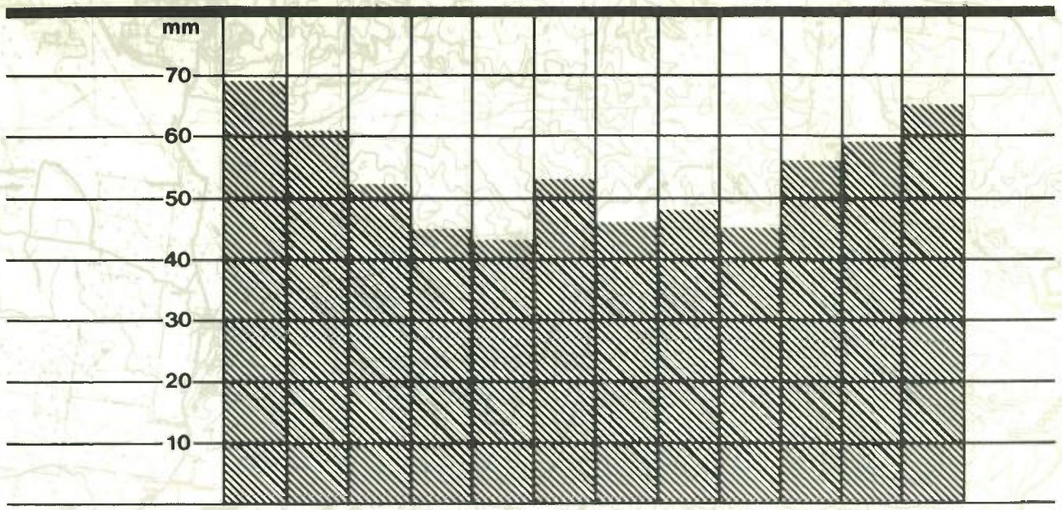
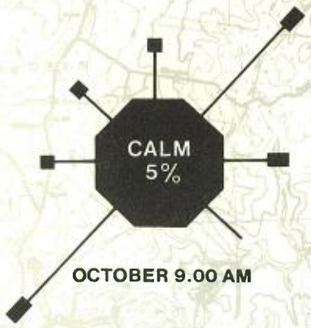


	JAN	FEB	MAR	APR	MAY	JUNE	JULY	AUG	SEPT	OCT	NOV	DEC	
Av Rainfall	69	61	52	45	43	53	46	48	45	56	59	65	64·2
Av Raindays	6	7	5	5	6	7	7	8	6	7	6	6	76
% Chance of Receiving Effective Rain	44	36	13	56	62	87	85	80	60	55	48	46	
Highest 24hr Rainfall	101	134	122	57·1	76·2	58	55·8	44·5	60·7	57·4	83·8	100·3	134



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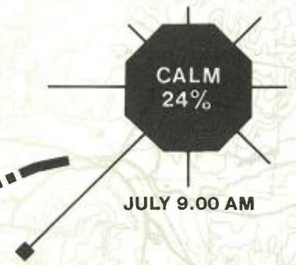

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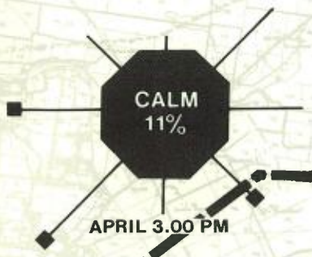


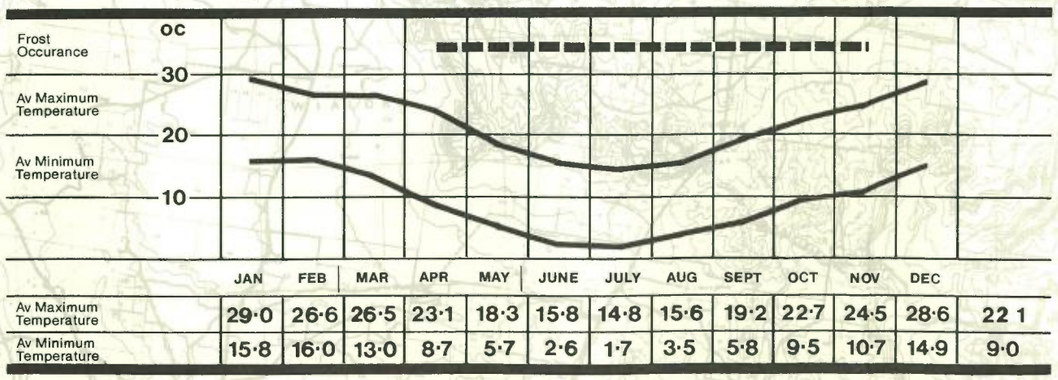
APRIL 3.00 PM

WINTER SUNSET

SUMMER SUNSET

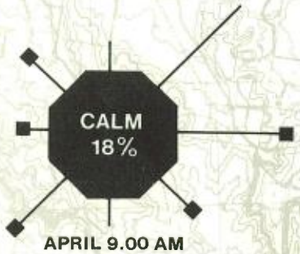
WINTER SUNRISE

SUMMER SUNRISE



	JAN	FEB	MAR	APR	MAY	JUNE	JULY	AUG	SEPT	OCT	NOV	DEC	
Av Maximum Temperature	29·0	26·6	26·5	23·1	18·3	15·8	14·8	15·6	19·2	22·7	24·5	28·6	22 1
Av Minimum Temperature	15·8	16·0	13·0	8·7	5·7	2·6	1·7	3·5	5·8	9·5	10·7	14·9	9·0

JANUARY 3.00 PM



APRIL 9.00 AM

JANUARY 9.00 AM

Figure 5.1
CLIMATIC FEATURES

Winds

Winds up to 10 Knots

Winds over 10 Knots (strong winds)

0 10% Percentage Occurance of Winds

Proposed Railway Line

5.2.1 TEMPERATURE

Hot weather is experienced in the region from October to April with average maxima ranging from the high twenties to the low thirties. During the summer months conditions are very hot when westerly winds bring hot dry air from Central Australia. Temperatures ranging from 32°C to over 38°C are not uncommon.

During the other months of the year temperatures are mild with average winter maxima about 10°C cooler than summer temperatures. Occasionally overnight temperatures can drop below freezing point.

5.2.2 PRECIPITATION

Rainfall in the area is variable with an average of 642 mm per annum at Gulgong and 608 mm at Ulan. The highest recorded annual rainfall at Gulgong was 1411 mm in 1950 and the lowest was 298 mm in 1918.

Rainfall is evenly spread throughout the year with the following seasonal distribution for Gulgong and Ulan as follows:

	Gulgong (mm)	**Ulan** (mm)
Summer	195	200
Autumn	140	120
Winter	147	140
Spring	160	150

Much of the rainfall occurs as intense showers, particularly in summer, with falls up to 130 mm in 24 hours.

Dry spells lasting 6 months or longer occur on occasions. Rainfall during the mid-autumn to mid spring months tends not to be lost through evaporation.

The average annual evaporation measured at Ulan Power Station for the period 1960-74 was 1625 mm.

5.2.3 WINDS

Strong prevailing winds occur in spring, from the south-west to north-west. These winds can be unpleasant in areas with a western exposure. Winter winds are generally calmer but strong winds can develop in the late afternoon.

5.2.4 CLIMATIC EVENTS

Frosts: Frosts may occur from mid April through to September and as late as mid November. For the Gulgong-Ulan area the average frequency of frosts is about 45 days per annum.

Sunshine: The average number of hours of bright sunshine per day in the summer months is 9 hours and in the winter months 6 hours.

Humidity: The average relative humidity varies little throughout the year; however, it varies significantly during the daytime between 72 per cent in the mornings and 49 per cent in the afternoons.

5.2.5 POTENTIAL SOURCES OF AIR EMISSIONS

Generally, the air quality is excellent and consistent with a rural area, except in the immediate vicinity of the Ulan colliery and the coal stockpiles and loading facility at Gulgong. The location of the industry and coal stockpile to the east of Gulgong minimises deposition of particulate matter on the township of Gulgong. Similarly, Ulan colliery and the current construction associated with development of the mines and the Goulburn River relocation are east and south-east of Ulan, again minimising particulate deposition on the township.

Several industrial activities are carried out in the area and are potential sources of air emissions.

Existing air emissions at Gulgong

At Gulgong, the potential sources of air emissions include the flour mill, cement works, wheat silo, coal stockpile and loading facility, and the existing railway line.

During an inspection on Friday 21 August 1981 no particulate matter was seen to emanate from either the flour mill or the wheat silo. Steam could be seen emanating from the cement works. Train traffic on the existing railway line through Gulgong was not observed during the inspection, but air emission from this source would be negligible.

Friday 21 August was a particularly windy day, with winds reaching up to 55 km/h. The coal stockpile was approximately 20 m high and coal dust could be seen being blown from the top of the pile whenever it was disturbed by the front-end loaders. This dust fell to the stockpile again within about 3 m from the point of disturbance. The sprinkler system for dust suppression was not operating, but the coal surface was damp as a result of the showery weather at the time.

A truck washing facility at the stockpile is used to wash all trucks after dumping the coal, thus minimising coal dust entrainment on the return trip to Ulan.

Existing air emissions at Ulan

At Ulan, the potential dust producing sources include the Ulan colliery, coal trucks and truck loading facility, the current construction activity connected with the new rail loop and the coal preparation and storage facilities, and the relocation of the Goulburn River and Main Road 214.

Coal dust was evident on the ground in significant quantities in the immediate vicinity of the colliery and truck loading facility. This was not widespread and there was no evidence to indicate that any detrimental effect on the general air quality occurred outside the immediate area of the colliery and truck loading facility.

A significant area of land has been cleared and levelled in preparation for construction of the coal loading rail loop and relocation of the Goulburn River and MR 214. There was little evidence of dust, although some would be expected in the immediate vicinity from trucks hauling coal over unsealed roads.

The trucks are maintained in good condition, thus minimising exhaust emissions.

Existing air emissions along the railway

The area between Gulgong and Ulan is essentially rural, with arable land predominating west of the Forestry Commission land and rougher grazing land to the east. Dust would be expected at the time of ploughing of the land before sowing, and also during high winds.

On the day of inspection it was noted that several paddocks had been ploughed recently. No dust entrainment as a result of the high winds that occurred during the survey period was evident; however, more would have been expected had the ground not been damp. Very little dust entrainment associated with the grazing ground to the east of the Forestry Commission land would be expected.

Unsealed roads are a source of some dust entrainment. The main roads are all sealed and the only evidence of dust noticed during the survey period was from trucks running off the sealed road on to the soft verges. This was exacerbated due to recent grading of the verges, which had spread a thin layer of soil over the sealed road surface.

Quarrying activities immediately west of Ulan have left exposed rock and soil, which could potentially generate dust in high wind conditions when the ground is dry.

Creek erosion was evident in several places, giving rise to potential dust entrainment in dry, windy conditions.

5.2.6 EFFECTS OF THE PROPOSAL ON AIR QUALITY

The dominant effect on air quality will be that associated with dust during construction activities on the railway line. Little other forms of air pollution are expected, with the only other possible source being that associated with the diesel locomotives.

Construction activity

The construction activities associated with the railway line will involve earthworks and track laying as detailed in Section 3.4.1.

Earthworks associated with these activities will be the main source of dust emissions. Vehicles leaving and arriving at the construction site, using unsealed roads for a part of their journeys, will also be a source of dust emission; however, these journeys will be short, as the railway line is close to the sealed main road.

Construction activities are temporary, and their effect on air quality will also be temporary and localised to the area of construction. Should dust prove to be a major problem during construction, then water tankers will be used to dampen the road surfaces.

Rail operations

The State Rail Authority conducts regular maintenance on their locomotives in the interests of fuel economy and environmental protection. As a result, exhaust emissions generated by the locomotives are minimised.

The railway wagons used for the transportation of coal to Nowra will be high sided and the coal will be loaded at a minimum of 8 per cent moisture content, thus minimising the potential for entrainment of coal dust along the railway line from Ulan.

Any other trains likely to utilise this line will probably carry freight and wheat in covered wagons, minimising the possibility of entrainment of particulates.

Improved air quality

Once the railway line is completed and operating, the air quality of the environment will improve due to the elimination of nearly all coal trucking and the elimination of the coal stockpile and loading facility at Gulgong.

5.3 GEOLOGY

5.3.1 GEOLOGIC UNITS

Ulan is located approximately 5 km east of the Great Dividing Range, which runs generally in a north to south direction. The Divide follows the ridge line of the Gulgong granite of Carboniferous age, which separates the older Devonian and Silurian age rocks in the west from the younger strata of the Sydney sedimentary basin to the east.

Immediately to the east, and to the west of the Divide, the Devonian and Silurian sedimentary rocks have been metamorphosed by a series of earth folding movements and have been subject to intrusions of volcanic rocks. The area is highly mineralised. Areas of low relief, such as just north and east of Gulgong extending to the Gulgong granite, have been covered by younger deposits of cainozoic era clays, sands, silts and gravels.

East of the Divide sedimentary strata were deposited in Permian times beginning with marine environment sandstones, siltstones and conglomerates, the upper part of which is known as the Shoalhaven group. These pass into the non-marine Illawarra Coal Measures (or Upper Coal Measures of the Sydney Basin), which contain the Ulan seam now mined at Ulan. Overlying the coal measures are the Triassic age Narrabeen Group sandstones and to the north-east the Jurassic age shales and sandstones.

5.3.2 SYDNEY BASIN

The Sydney Basin is divided into the Gunnedah and Sydney sub-basins. Generally, areas where economic coal recovery is possible occur where coal measures are close to the surface around the edge of the basin. From the western edge of the basin the strata dips to the east and north-east towards the centre. Thus, at some 30-40 km from the western edge of the basin towards the north east of Ulan, the coal measures are deeply buried under Triassic and Jurassic sediments and tertiary volcanics.

Ulan is located on the south-west margin of the northern or Gunnedah sub-basin, and the railway line extension from Ulan to Gulgong extends westward beyond the edge of the basin.

5.3.3 EFFECTS OF THE PROPOSAL ON COAL AND OTHER RESERVES

Coal reserves: The railway line will not affect any proposals for the extraction of coal, nor will it sterilise any known significant quantities of coal.

Quarrying: It is proposed to operate a small quarry which is located approximately 13 km north of Ulan and 3 km west of MR 214 to supply crushed rock to be used as ballast for the construction of the railway line extension. Approximately 100,000 t of suitably sized ballast will be required.

The site of the proposed quarry is on the 'Bobadeen' property and an agreement has been entered into between the land holder Mr. G.O.Heywood and White Industries Limited (Ulan Coal Mines Limited) relating to the proposed quarry operations.

A contractor will be appointed by White Industries Limited to operate the quarry. The operation of the quarry will be similar to the quarry that is presently operated at 'Wyndham' near Merriwa. The operation of that quarry has been fully described in an EIS prepared by Longworth and McKenzie Pty Limited (LM Pty Ltd 1981).

The proposed quarry site covers a gently sloping hill which has been cleared of trees and is at present used for grazing. The site is adjacent to Bobadeen creek and approximately 1 km from the property homestead.

Material from the quarry site will be transported along 3 km of private road then along MR 214 to a temporary stockpile (figure 3.4) adjacent to the railway easement. The contractor will be responsible for maintaining the roads in good repair and should dust prove to be a problem water tankers will be used to dampen the road surface.

A creek crossing will have to be provided to obtain vehicular access to the proposed quarry site. Cut off drains will be excavated around the quarry and plant site to intercept runoff and prevent direct flow into the creek. A siltation dam will be constructed and all water from the quarry site will be directed toward the dam for storage.

The quarry site will be fenced and on completion of the quarrying operation the site will be rehabilitated (using overburden and top soil material) to the satisfaction of the land holder and Merriwa Shire Council. Advice on the best method of rehabilitation and prevention of soil erosion will also be sought from the Soil Conservation Service.

The quarrying operation will generate substantial noise as a result of blasting, drilling and crushing activities. Truck movements will also contribute to a general increase in noise levels around the quarry site and along the private access road. Blasting operations will be pre arranged with the land holder.

Current investigations by Ulan Coal Mines Limited have identified the proposed quarry as being the preferred source of ballast for the railway line extension. However an alternate source exists in that ballast could be transported from the Bylong quarry. This quarry is currently operating and the feasability of obtaining ballast from this quarry and transporting it to Ulan is being investigated as an alternative to the above.

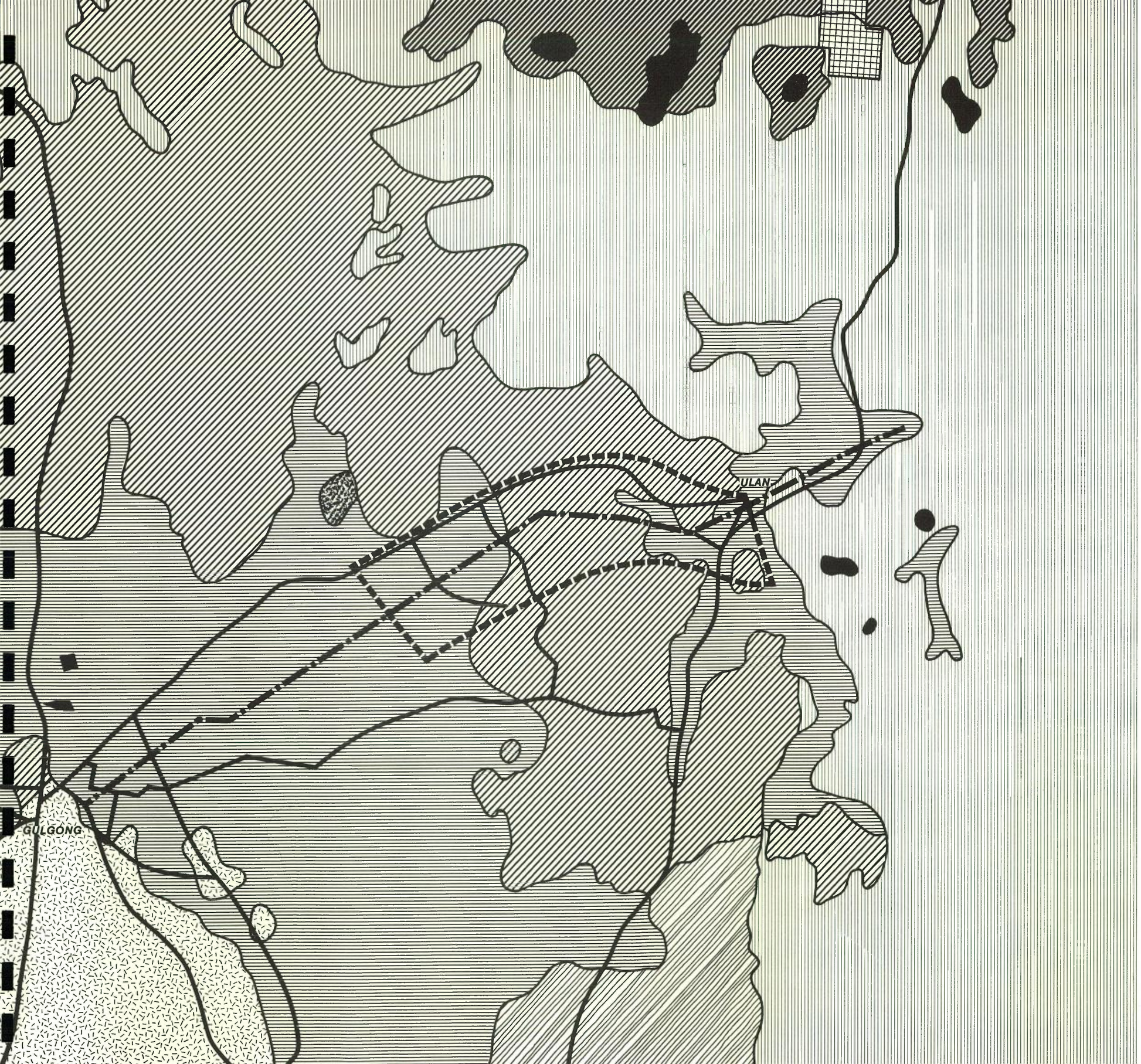


Figure 5.2
GEOLOGY: SUB REGIONAL

- Olivine Basalt and Dolerite
- Undifferentiated Soil Clay Sand Silt Gravel and Eluvial Soil Cover
- Illawarra Coal Measures overlaid by Narrabean Sandstone
- Gulgong Granite
- Undifferentiated Hornfels
- Sandstone, Phyllite, Slate Limestone
- Shale Overlaid by Sandstone
- Shale Siltstone Sandstone Limestone
- Location of Borrow Pits (Generalized)
- Proposed Ballast Quarry Site
- Railway Line and Balloon Loop

Sequence of Rock Types in the Gulgong-Ulan Area

Soil		
Clays, sand, silts, gravel and eluvial soil cover		Cainozoic
Sandstone, conglomerate, red-brown and green mudstone	Narrabean Group	Triassic
Shale, sandstone, conglomerate, chert, coal & torbanite seams	Illawarra Coal Measures	Permian
Shale, siltstone, sandstone, conglomerate	Shoal-haven Group	
Granite, adamellite, granodiorite	Gulgong Granite	Carboniferous
Various metamorphosed sedimentary rocks and volcanics		Devonian Silurian

Note: Generalized from Dubbo 1:250,000 Metallogenic Map

N

0 1 2 3 5km

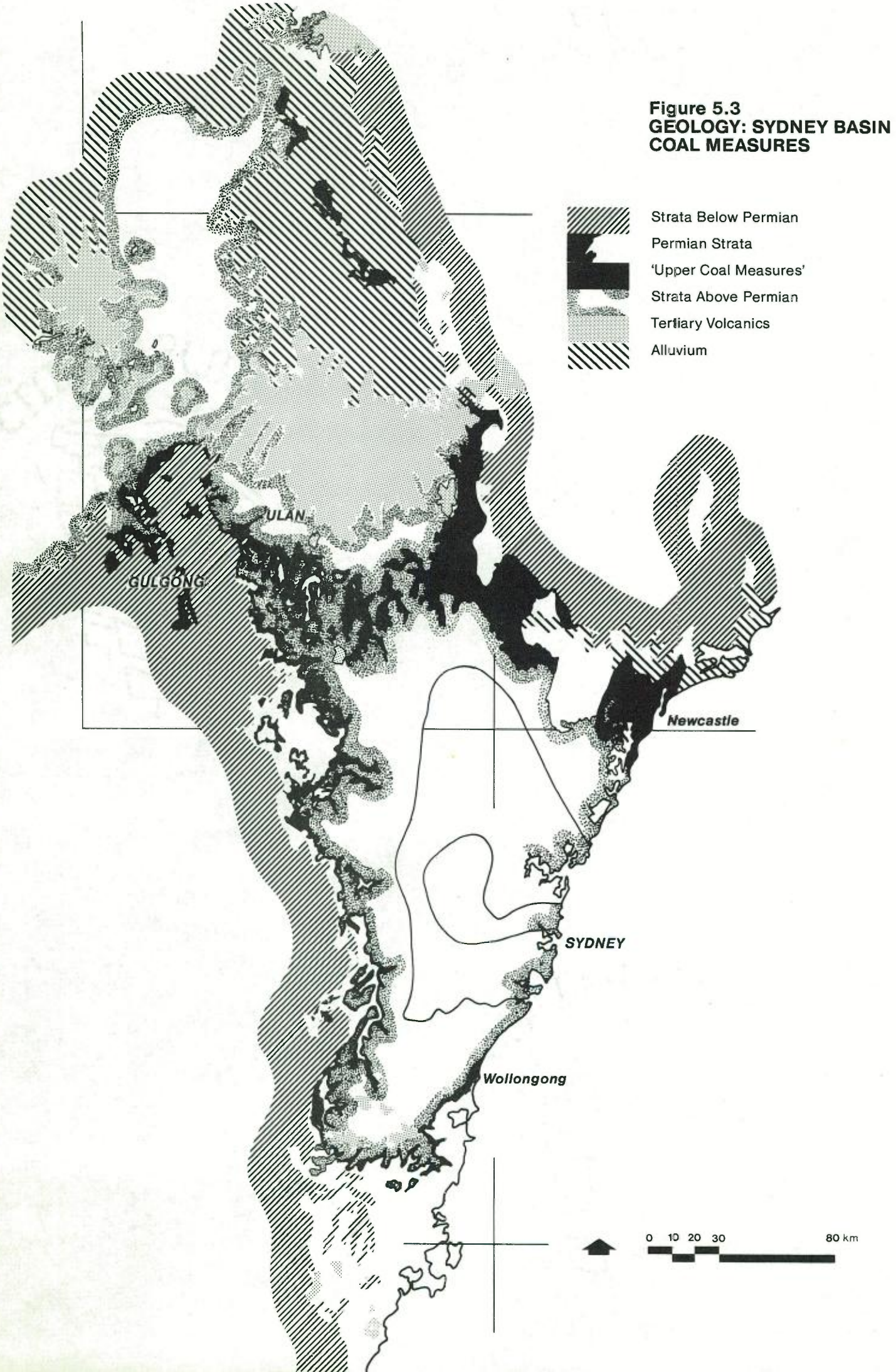


Figure 5.3
GEOLOGY: SYDNEY BASIN
COAL MEASURES

5.4 PHYSIOGRAPHY

The railway line between Ulan and Gulgong traverses gently undulating country with fairly flat gradients. At Ulan the railway line is at an elevation of 420 m and reaches a maximum elevation of about 490 m as it crosses the Great Divide 7.5 km from Ulan. The line then gradually descends to about 450 m at Gulgong. The average gradient between Ulan and the Great Divide is slightly less than 1:100 and between Gulgong and the Great Divide it is slightly less than 1:200. However, there are small sections of the line that reach the maximum ruling grades of 1:80 and 1:50.

5.5 SOILS

There are three distinct soil types associated with the route of the Ulan to Gulgong railway. These soil types have distinctly related geology and vegetation.

5.5.1 SOIL TYPES

Gradational soils: This soil extends east of Moolarben Creek and dominates the general area. The parent material consists of deeply weathered sandstones and shales associated with coal bearing strata.

The soil typically has a clayey sand topsoil, which gradually changes to a light, wattled coloured, clay subsoil. There is some degree of variability of soil characteristics due to the residual effects of the sedimentary horizons, which vary from gravel to sands, loams and clays.

These soils are generally acid throughout, infertile and highly erodible once disturbed. Some profiles show signs of high salinity.

Duplex yellow soils: This soil type extends from Moolarben Creek to 2.5 km west of Round Top Mountain Road and is formed from a granite parent material. The topsoil is sandy loam and commonly includes a cemented silica horizon. The soil surface is hard setting. Subsoils include a deep infertile and highly erodible A2 horizon. The soil is acid throughout and some profiles will show salinity problems.

Duplex red soils: These soils extend from about 2.5 km west of Round Top Mountain Road towards Gulgong. Parent material consists of meta sediments as well as alluvial deposits from Wialdra Creek.

The topsoil is typically sandy loam to clay loam. A2 horizons are generally absent, or if present are not bleached. Subsoil B horizons are sandy clays to light clays.

5.5.2 LOCATION OF BORROW PITS

Capping materials should be available on residual ridges on the duplex yellow soils. Agreement with land holders will be obtained before any work is undertaken. The suitability of the soil for capping material will be field tested at selected locations before excavations.

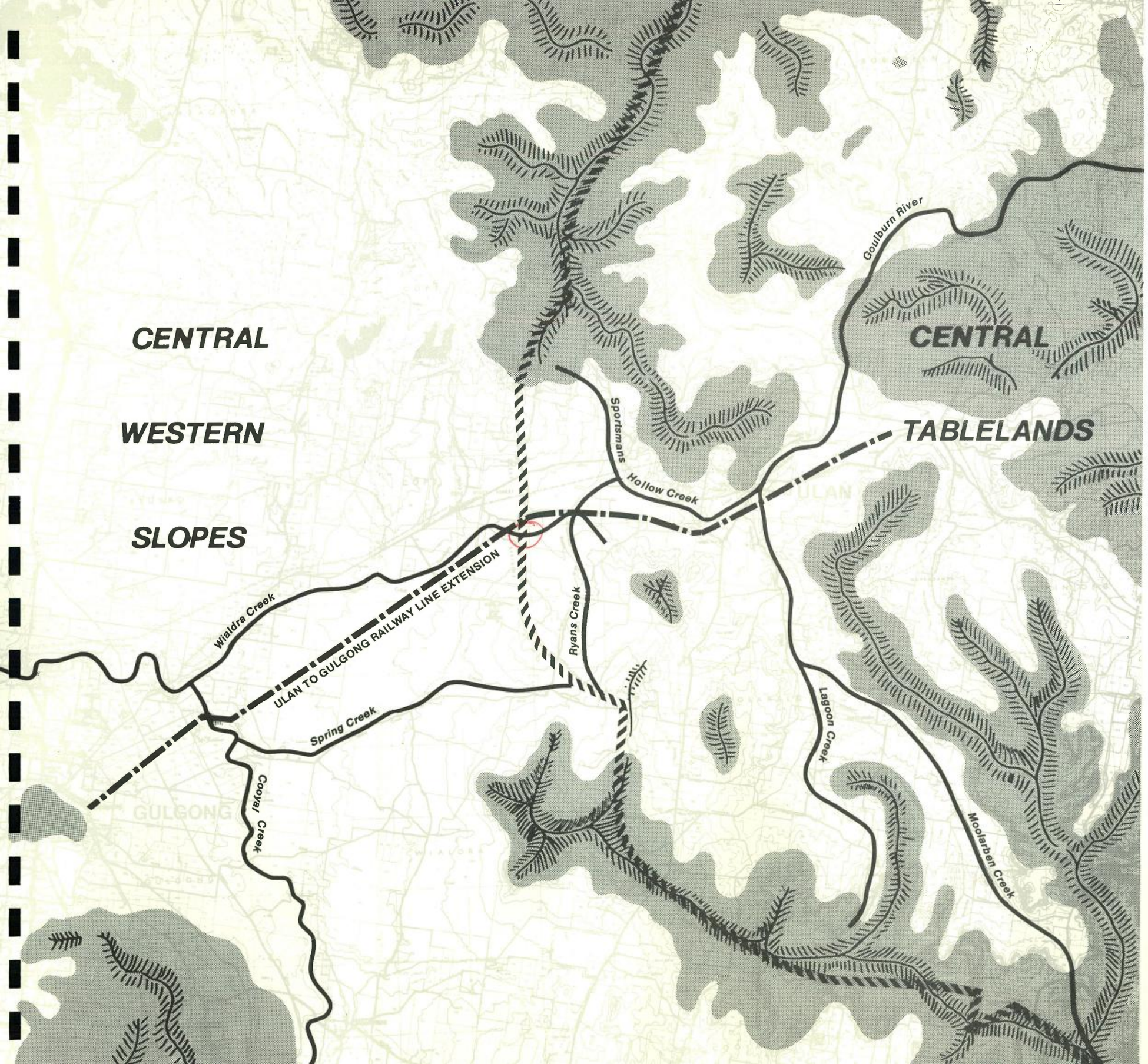


Figure 5.4
PHYSIOGRAPHY

Ulan to Gulgong Railway Line Extension
Great Dividing Range
High Land
Rivers and Creeks

N
0 1 2 3 5km

5.5.3 SOIL FEATURES

Physical constraints

Erosion control of Duplex yellow and graditional soils will be difficult due to:

.surface sealing topsoils
.low chemical fertility
.low water holding capacity
.low pH
.erodable subsoils.

Duplex red soils are of moderate fertility, and although tending to be acid are only moderately erodible. Revegetation is generally fairly successful given stable batter grades, and control of run-off.

Existing formation condition

Erosion of the existing formation has removed material from the batters by minor rilling, to reduce the batter to about 1:3 (V:H).

The table drain adjacent to Rouses Creek has been eroded on the southern side of the formation.

Table drains are fairly stable except where they enter deeply incised creeks. At these deep creeks, erosion removes the sandy loam topsoil exposing the erosion resistant cemented sands.

5.5.4 EFFECTS OF THE PROPOSAL ON SOILS

As a result of consultation with the Soil Conservation Service the following erosion control measures were identified. Continued liason with officers of the Service will be undertaken to ensure adequate erosion control measures are implemented.

Designed erosion control: Batter grades are to be:

- east of Round Top Mountain Road 1:3 (V:H)
- west of Round Top Mountain Road 1:2.5 (V:H)

Culverts: Existing culverts will be designed to discharge without causing soil erosion.

Drainage: Vegetative stabilisation will not be effective where water is concentrated in drains of gradient greater than 3 per cent.
Adeqately designed drop down structures of sand/cement bags, rock rip rap, concrete chutes or half round pipes will be required. Natural water courses or stable depressions will remain undisturbed.

Figure 5.5
SOIL TYPES

Gradational Soils

Duplex Yellow Soils: Soils Suitable for Capping Material

Duplex Red Soils

(Map indicates general location of soil types in proximity to railway line.)

N

0 1 2 3 5km

Topsoils: Topsoil will be separately removed and stored for use in the eventual rehabilitation of disturbed areas.

Reshaping borrow pits: Following extraction, disturbed areas (where required by the land owner) will be reshaped with maximum batters of 1:3 (V:H) Topsoil will be spread over the worked areas to a minimum depth of 15 cm. The area will then be contour ripped. Alternatively, areas could be reconstructed for agricultural water storage purposes.

Top catchment: Run-off from areas above the borrow pits will be controlled by the construction of contour diversion drains.

Revegetation: All disturbed areas, including embankment batters, disposal sites, borrow pits and drainage channels other than artifical chutes will be revegetated by establishing protective ground cover.

Topsoil material will be re-spread to at least 15 cm. Material will not be excessively compacted but lightly ripped or scarified to encourage binding with underlying material where possible.

Sowing will be carried out immediately in freshly spread topsoil material before surface sealing and rilling occurs. Sowing will take place from March to October, as Summer sewing is likely to fail due to low soil moisture.

Revegetated areas will be treated with lime at the rate of 2 t/ha to neutralise the soil acidity.

Initial fertiliser will be applied within 2 months of sowing, with a subsequent application within 12 months. Initial applications will be with Molybdenised starter 15 or equivalent at 200 kg/ha. Subsequent applications will be with starter 12 or equivalent at 200 kg/ha.

Sowing species will include:

	kg/ha
Seaton Park Subclover 5	
Nungarin Subclover	5
Perennial ryegrass	5
Currie Cocksfoot	5
Rhodes grass	3
Kikuyu	3
Paspalum	3

Legumes will be inoculated and lime pelleted within 24 hours of sowing.

The introduced species recommended above are unlikely to persist in forest areas due to grazing pressure from kangaroos and rabbits, and low soil fertility, dependent on the chemical and physical nature of the soils.

Additional species recommended for forest areas include:

	kg/ha
Eucalyptus fibrosa	0.5
Acacia longifolia	0.5
A. decora	0.5
A. dealbata	0.5
Hardenbergia voilacea	0.5
Casuarina nana	0.5

Seeds of the above mentioned species will be incorporated following sowing, or a hay or hydro mulch provided.

Acacia seeds should be heat treated on the day they are to be sown. This involves immersion in water at boiling point (but not boiling water) for a period of 90 seconds.

5.6 HYDROLOGY

The Ulan area lies to the east of the Great Dividing Range within the upper reaches of the Goulburn River watershed, which joins the Hunter River near Denman before entering the Pacific Ocean at Newcastle.

Gulgong is to the west of the Great Dividing Range and is within the Wialdra Creek catchment. Wialdra Creek joins the Cudgegong River before flowing into the Burrendong Dam

5.6.1 CATCHMENTS AND STREAM FLOODING

The Water Resources Commission maintains two stream gauging stations in the Ulan-Gulgong area. One is located on the Goulburn River approximately 100 m along the Wollar Road east of Ulan township. The other gauge is located on the Wialdra Creek to the north west of Gulgong near Dunedoo Road.

The catchment of Wialdra Creek above the stream gauge is 854 square kilometres and the highest flood level recorded (since 1956) was on January 31 1971, when the water level rose 5.05 m above the creek bed. The catchment of the Goulburn River above the stream gauge is 159 square kilometres. The highest flood level recorded since 1956 was also in the January 1971, flood when the water rose 2.24 m above the stream bed.

Other stream catchments are shown in Table 5.1, and October 1940 flodd heights at Cooyal and Moolarben Creeks are shown in Table 5.2.

Table 5.1 Catchment areas above points where streams cross the railway easement.

Stream	Catchment area (sq.km)
Cooyal Creek	5.2
Rouses Creek (1)	13.0
Moolarben Creek (1,2)	106.0
Sportsmans Hollow Creek (above its junction with Moolarben Creek) (3)	460
Ulan Creek (above its junction with the Goulburn River) (3)	51

Notes:

1 Source: SRA railway line construction drawings
2 Moolarben Creek will be dammed to supply water to Ulan Coal Mines Limited
3 Source: Longworth and McKenzie EIS August 1980.

Table 5.2 Flood heights at Cooyal and Moolarben Creeks: October 1940.

	Stream Bed (M) above sea level	Flood height (M)	Track height (M)
Moolarben Creek	443.0	445.7	447.3
Cooyal Creek	457.3	460	463.1

5.6.2 RAILWAY LINE CLOSURES DUE TO FLOODING

Available data on the closure of railway lines linking the Ulan-Gulgong area as a result of flooding are sketchy, but the following information was obtained from the State Rail Authority flood records.

Main North Line - Newcastle to Muswellbrook, track length 122 km:
Line closed in one or more locations on:
Feb 1955, March 1955 (twice), 19/2/62, 13/5/62, 5/3/77.

Muswellbrook to Sandy Hollow, track length - 23 km
Line closed in one or more locations on:
Feb 1955, 23/11/61, 1/2/62, 25/2/76, 6/3/77.

Main West Line - Sydney to Wallerawang, track length 150 km
Line closed in one or more locations on:
Dec 1958, Nov 1959, 31/1/71, 29/10/72, Feb 76, 6/2/81.

Wallerawang to Gulgong, track length 140 km
Line closed in one or more locations in:
Feb 1955, 16/2/56, 13/5/69, 6/11/69, 1/2/71, 11/2/71,6/2/81.

The information recorded above relates to actual extensive train interruptions, since 1955, often in more than one location on the same day of flooding.

Table 5.3 Goulburn River: between Kerrabee and Sandy Hollow - Hydrologic estimates at specified locations

Flood levels **(RL)** are in metres to **AHD;** velocities **(V)** are in m/sec and discharges **(Q)** in m^3/sec

RL: Reduced level, **AHD:** Australian height datum

Location number (see figure 5.6)	1			2			3			4			5			6		
Return Period	RL	V	Q	RL	V	Q	RL	V	Q	RL	V	Q	RL	V	Q	RL	V	Q
1:2	119.1	1.70	129.3	121.0	1.22	128.6	127.5	0.96	125.9	134.9	0.90	123.2	135.8	0.76	222.4	139.5	0.74	120.9
1:3	121.9	2.30	744.3	123.5	1.48	731.9	130.0	1.19	686.4	136.4	1.80	642.2	138.0	1.65	629.2	141.6	1.81	603.2
1:10	123.3	3.25	1604.5	125.1	1.52	1579.8	131.9	1.63	1488.9	138.0	2.21	2400.5	139.9	2.28	1374.5	143.7	2.33	1322.4
1:20	125.1	3.48	2604.0	127.0	1.63	2584.6	133.8	1.91	1513.2	140.0	2.55	2443.8	142.0	2.76	2423.4	145.9	2.81	2382.6
1:50	128.0	3.38	4735.2	129.9	1.62	4732.4	136.8	2.22	4721.9	143.3	3.04	4711.7	145.2	3.56	4708.7	149.3	3.48	4702.8
1955 Flood	128.7	3.32	5172.2	130.5	1.57	5238.7	138.0	2.00	5571.1	145.0	3.10	5886.4	147.0	3.67	5977.4	151.3	3.59	6159.4
1:100	131.0	2.38	7555.7	132.9	1.32	7559.5	140.0	1.96	7573.4	146.8	2.94	7586.9	148.8	3.86	7590.8	132.8	3.77	7593.7
Approximate distance from Sydney (km)	333.800			335.750			340.370			345.340			347.940			351.200		
Railway formation RL (AHD)	131.4			140.9			136.9			142.5			145.5			147.9		
Railway top of rail RL (AHD)	132.1			141.6			137.6			143.2			146.2			148.6		

Source: adapted from State Rail Authority.

5.6.3 ENVIRONMENTAL EFFECTS OF FLOODING ON THE PROPOSED RAILWAY LINE

Major flooding of track-sections servicing the Ulan area generally results in numerous washaways and embankment failures within a short section of track. Little work is done on raising the formation levels in these locations, but extensive drainage management is undertaken to improve floodway openings under the track, in problem areas.

The figures shown in the previous section indicate that similar flooding occurs on both rail routes out of the district, whether it be Gulgong to Sydney or Ulan to Newcastle. Some of the dates correlate on both routes, and this could indicate the local effects of the rainfalls within the region.

Data from SRA indicate that the line from Muswellbrook to Newcastle is likely to present more flood problems than the section presently under construction from Muswellbrook to Ulan. This is also indicated by the fact that the upstream catchments of the Goulburn River are considerably less than those further downstream, particularly when the Hunter River catchment at Singleton and Maitland is considered.

Muswellbrook to Ulan section

The SRA has indicated that the new line could be flooded at some locations by a 1 in 50 year flood.

The alignment and level of the 'as constructed' railway will be almost the same as those of the original line, because many structures were already completed during initial construction some 45 years ago.

The value of flood heights shown in table 5.3 indicate that the track level is topped (over the top of the rail) in four locations for the 1 in 50 year flood of the Goulburn River at the sections shown in Figure 5.6.

The 1955 flood, which was unrecorded at the upper reaches of the Goulburn and Wialdra Creeks, interpolates as approximately a 1 in 65 year flood.

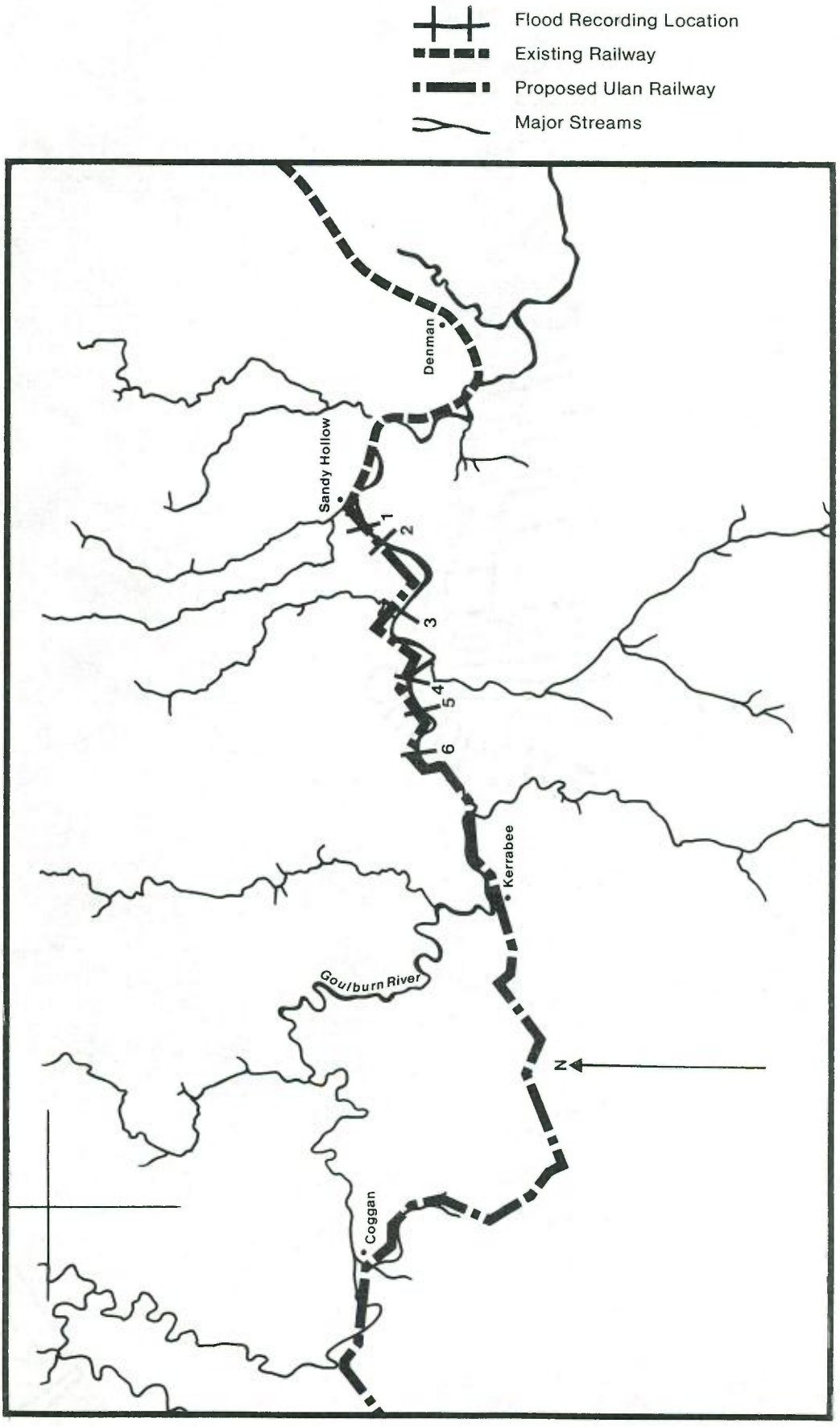
Ulan to Gulgong railway

It is likely that initial formation levels will be sufficient to ensure that the 1 in 50 year flood height does not overtop the track.

5.7 VEGETATION AND WILDLIFE

The proposed route of the railway was surveyed in August 1981 for existing flora and fauna, and its readily accessible nature made it possible to survey most of the route. The area to be directly affected by the development of the railway was considered to be a strip of approximately 100 m on each side of the route. In addition to a general survey, eight sites were chosen, representing various land types along the railway. These are shown in Figure 5.7. At each site, dominant plant species within each vegetation strata were noted and the general condition of each plant community observed.

Figure 5.6
LOCATION OF FLOOD DATA



Identification of animal species within the survey area was limited. However, it was possible to observe many species directly, either during the daytime or at night with a spot-light (either on foot or in a vehicle). Indirect evidence of the presence of other species came from animal droppings and remains, diggings, tracks and from interviews with land holders. Elliott box traps were laid for two nights at selected sites along the railway.

5.7.1 GENERAL DESCRIPTION OF EXISTING VEGETATION

The land to be affected by the Ulan to Gulgong railway was modified by clearing and construction of embankments and culverts when construction of the line was begun 45 years ago. However, during the past few decades the modified land has been left undisturbed and, along parts of the route, mature vegetation has regenerated.

Approximately 57 per cent of the railway passes through land that has been cleared, while the remainder still supports natural vegetation (mainly in Cope State Forest).

Within the cleared areas there has been little regrowth of timber along the railway. Where the railway passes through the State forest, there is a relatively heavy growth of trees and shrubs as a consequence of invasion from surrounding vegetation. Much of the forested area was burnt by a fire approximately 1 year ago, and the vegetation, particularly the lower and middle storey vegetation, is not as dense as that found in unburnt areas. A relatively small area of woodland lying south-west of the road to Round Top Mountain was not affected.

The major vegetation community within the proposed railway is savannah woodland. Where the land has been cleared, the term 'savannah' (meaning open grassland) is appropriate. However, within the forested areas, the relatively dense middle storey of shrub makes the term heathland-woodland more appropriate; this type of community is classified by Specht as open forest with heathy understorey. (Specht 1979) The occurrence of a heath type vegetation appears to be related to the poorer types of soils, which, in the case of the Ulan region, are granitic and sandy.

The densely timbered area within Cope State Forest provides the best example of natural vegetation along the railway and most of the mid- and upper-storey vegetation found elsewhere along the railway is related to this plant community type. The timbered area is an open woodland with ironbarks, such as the Narrow-leaved Ironbark (Eucalyptus crebra), and Caley's Ironbark (E caleyi), boxes such as Yellow Box (E melliodora), White Box (E. albens) and Grey Box (E moulcanna), and smooth barked gums such as Blakely's Red Gum (E blakelyi), Candlebark Gum (E rubida) and Scribbly Gum (E rossii). Non-eucalypt trees include the Rough-barked Apple (Angophora floribundi), Black She Oak (Casuarina littoralis) and the Black Pine (Callitris endlicheri). The latter trees are not as common along the railway as the eucalypts. The Rough-barked Apple is found mainly towards Gulgong, while the Black Pine grows along the entire route of the railway.

The examples of pine on the flatter sections of the railway are small, only reaching their full size in the hilly sections near Ulan. Several examples of the River Oak (Casuarina cunninghamiana) are growing where the railway crosses Wialdra Creek.

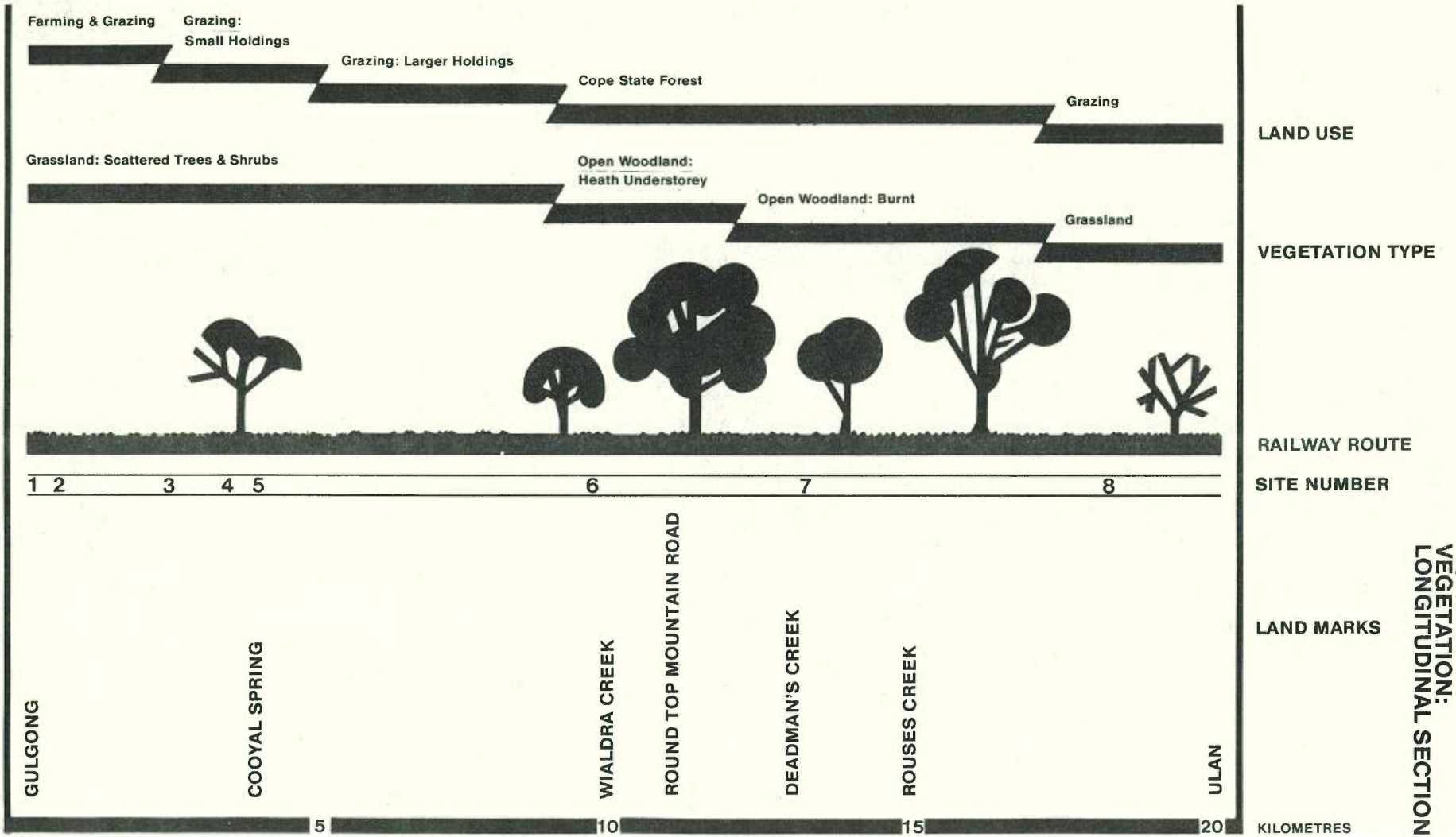


Figure 5.7
VEGETATION:
LONGITUDINAL SECTION

The plants of the middle storey vegetation layer are mainly representative of heathland vegetation although, at the time of the survey, plants were not flowering and identification was difficult. However, the following plants are represented amongst the middle storey vegetation: Burrawang (Macrozamia secunda), Black boy (Xanthorrhoea sp.) Tea Trees (Leptospermun sp.), Bottle Brush (Melaleuca, Kunzea, Callistemon spp.), Wattles such as Small Cooba (Acacia ligulata) and Mudgee Wattle (Acacia spectabilis), Boronias and, associated with water, Cumbungi (Typha sp.).

The lower (ground) layer consists mainly of grasses, particularly within those areas cleared for farming. Dominant grasses include Spear (Stipa spp.), Windmill (Chloris spp.), Cutting (Gahnia sp.), Wallaby (Danthornia spp.) and Kangaroo Grass (Themeda spp.). The ground cover of these grasses is sparser amongst the woodland, and less dense where the land has been affected by fire. At the time of sampling the ground was covered by Native Bluebell (Wahlenbergia sp.).

5.7.2 EXISTING FAUNA

The field survey identified 33 bird, 17 mammal and 2 frog species from direct sightings or from indirect evidence. The species recorded at the site are listed in Appendix II. There was a gradation in animal density along the railway line, the lowest numbers were in the cleared areas, the burnt woodland area having the next highest density whilst the unburnt woodland supported the highest animal density.

The range of fauna was typical of the Western Slopes of NSW and the survey did not record any unusual or rare species along the railway line. Because of cold conditions during the survey, no reptiles were encountered. However, given the diversity of vegetation cover and density of ground cover within the woodland, a wide range of reptiles could be expected to be represented. These reptiles would be typical of the fauna of the Western Slopes and would contain representatives of both inland and coastal species.

Avifauna

Most bird species found within the cleared areas were also located in the woodland, indicating a close association between the two land types. Several bird species were associated with water, for example White-backed Swallow, Wood Duck, Spur-winged Plover, Little Grebe, Grey Teal, Black Duck and White-faced Heron, and were found only on dams or on the occasional pools of water lying beside the railway line. Many of the birds were found only within the woodland, the diversity and density of vegetation being more attractive to a wider range of birds. One species, the White-browed Babbler, was found nesting within the middle storey vegetation layer of the woodland.

Mammals

The mammals identified in the survey area were typical of an open woodland environment. The larger species, such as kangaroos and wallabies, use the woodland as a refuge, sheltering within the trees during the day and feeding in the open grassy areas in the evening. The tall eucalypts with their many holes in the trunks and branches provide abundant shelter for possums and gliders. Of the small, ground-dwelling, native mammals, there was evidence of the Echidna and Bandicoot, while the moister environment of the small creeklines provides ideal conditions for the Bush Rat (Rattus fuscispes). Other small mammals likely to be found in the area include the Yellow-footed Antechinus (Antechinus flavipes). The Common Wombat is known in the area and part of the railway line has been used for a burrow. Bats were heard flying overhead but were not captured and identified.

Amphibians

Of the two frog species recorded, one (Spotted Grass Frog) was found in Wialdra Creek and the other (Booroolong Frog) was heard in a pool beside the railway line. Two other species of frog were heard calling but could not be identified.

5.7.3 EFFECTS OF THE PROPOSAL ON FLORA AND FAUNA

Local effects

The land through which the railway passes is already substantially modified. Although partially covered with native vegetation and supporting a wide range of wildlife it can not be considered part of the natural environment. Parts of the route associated with the woodland area maintain a vegetation that is denser than that found elsewhere along the route. This is partly because of the creation of pools of water beside the railway line embankment where natural drainage patterns were altered during the initial construction of the formation 45 years ago. These pools are up to 20 m long and support a wide range of flora and fauna. However, the pools would not hold water throughout a normal cycle of seasons and therefore could not be considered drought refuges, nor would they provide support for the flora and fauna on a year round basis.

Land clearing along the railway easement (to prevent bush fires), will result in the elimination of nearly all vegetation within 15 m each side of the track centre line. Taken in either a local or regional context the loss of such a small amount of vegetation will have no significant impact. Together with the loss of the vegetation will be the disappearance of most of the animals from the cleared easement.

Representatives of all animals located within the railway easement are known to occur over a large proportion of this region. Their disappearance from the relatively small area of the railway easement will not affect their regional distribution.

Disruption of biological corridors

The relatively uncleared area of woodland associated with Cope State Forest provides a continuous strip of vegetation running north from Round Top Mountain and north-west from the Ulan to Mudgee Road. Many animals are dependent on vegetative cover for shelter, particularly when moving from one area to another, and this vegetation should allow for movement of animals through the area. Such movement may be in response to food or reproductive requirements and appears to be an essential part of the long term survival of an animal population. The movement of an animal from one area to another also provides the opportunity for animals of the same species to intermix, thus ensuring the potential for genetic diversity. Similarly, many plants require an uninterrupted distribution to allow the mixing of different genes. Areas of vegetation that allow uninterrupted movement of animals and continuous distribution of plants are called 'biological corridors'.

The re-establishment of a cleared easement along the existing rail line may further disrupt such corridor movement. The existing biological corridor would have been part of a continuous cover of timber extending along the western slopes of the Great Dividing Range.

This corridor links northern and southern populations of animals found along the Great Divide, but is no longer continous because of extensive land clearing. Another important corridor in the region is that along the Goulburn River and travelling west from Ulan. This corridor links the coastal populations of animals in the lower Hunter Valley with the more inland western populations and is sometimes called the 'Hunter Corridor' (Atkinson 1966) but it has also been disrupted by land clearing.

The patches of timber remaining along the Western Slopes allows for limited corridor movement, and the area of woodland in Cope State Forest is no exception. However, this corridor is already severed by the Ulan to Gulgong Road, two electricity transmission lines and numerous small roads servicing forestry and farming interests. These routes are extensively cleared, and widespread small mammal corridor movement is already restricted in the area.

Movement across the railway line by large animals such as kangaroos, wallabies and wombats could continue. Collisions with a train could occur but the loss would not be extensive. The use by wombats of the present embankment sides for burrows indicates little interference of this animal's movement patterns by the construction of the railway line. Movement by small animals such as mice and reptiles, as well as larger mammals like bandicoots, may be restricted by the clearing of the railway easement. However, as fragmentation of the area by other clearing operations has already occurred, further restriction of animal movement will not be significant.

The relatively small sizes of the home ranges of small mammals and reptiles - for example, the average home range for an Antechinus stuartii is about 20 m (Dickman 1980) - allow a number of populations of small animals to exist within a relatively small area. The disruption of small animal corridor movement will be alleviated by the existence of several water courses cutting the railway. Bridges and culverts will allow movement by small animals under the line.

Ecological protection

To ensure minimal disturbance in areas away from the railway line, construction workers will be instructed in conservative attitudes towards plants and wildlife of the region. Restrictions will be placed on the use of firearms, trail bikes, four-wheel drive vehicles, pets and animal trapping.

CHAPTER 6

THE EXISTING SOCIO-CULTURAL ENVIRONMENT AND EFFECTS OF THE PROPOSAL

6.1 SUMMARY

The extension of the Ulan Muswellbrook railway to Gulgong will result in a significant improvement in the environment and the social well-being of the people most directly affected by the current method of coal transport.

The extension of the railway will mean that road transport of coal to the loading facility at Gulgong can be eliminated and that the facility will no longer need to operate. The coal loading facility will be demolished and the site rehabilitated.

The railway extension will affect some properties along the easement in that access across the easement will be restricted to certain specified locations. The location of private and accommodation crossings is currently being organised with individual land holders. Public level crossings will be provided at the junction of public roads and in accordance with the recommendations of the Inter-Departmental Level Crossing Committee.

Noise during both the construction and operation of the railway will affect some residents along the route. At any one location, noise from the construction is expected to be intermittent during the 10 month construction programme. Noise from trains using the railway line will be of short duration at any one location.

6.2 LAND USE, TENURE AND ZONING

6.2.1 LAND USE

With the exception of some heavily wooded areas between the Great Dividing Range and Ulan the predominant land uses are farming and grazing.

The areas of alluvial deposits extending from Gulgong and adjacent to Wialdra and Spring Creeks support fat lamb raising and wheat growing. Fat lambs are supported because the soil has the ability to grow lucerne. Growth of lucerne is mixed mainly with wheat growing, on a 3 year cropping of wheat followed by a 3 to 5 year pasture growth of sub-clover lucerne and annual pastures of rye.

Beyond this area, soil fertility deteriorates and from Deadmans Creek through to Ulan the predominant land use is for grazing. Most stock consists of sheep for wool production, horses and cattle. Lupins are grown to provide enrichment for the granite soils. This, in combination with minimum tillage cultivation, will reduce erosion problems. In the future it is hoped that these soils will support wheat/rye hybrid and other superior crops. The basic pasture has been sub-clover, supporting one merino ewe per acre, with supplementary oats for fodder.

Recent trends have seen the amalgamation of smaller holdings in the area between Wialdra Creek and Cope State Forest to give greater economy of operation. In areas around Round Top Mountain Road, recent subdivisions have resulted in the creation of 'hobby farms'.

6.2.2 LAND TENURE

Adjacent properties

About 15 individual properties are adjacent to the railway, and all these properties are severed by the existing railway easement. Figure 6.1 shows the property subdivisions along the route of the railway easement. Of the 25 km of railway between Ulan and Gulgong, approximately 2 km pass through land owned by Ulan Coal Mines Limited, 1.5 km through Cope State Forest and the remainder through other privately owned lands.

Construction details from the original survey of the railway between Ulan and Gulgong indicated a requirement for 16 private and accommodation crossings. The location of these private and accommodation crossings is currently being reassessed to ensure that such crossings reflect adequately the present land ownerships and land management requirements. Current requirements of land owners are being sought by personal visits by officials of Ulan Coal Mines Limited and by advertisement in the local press.

Railway line easement

For the purposes of constructing the railway line, the ownership of the easement will be transferred to Ulan Coal Mines Limited. On completion of construction the ownership of the easement will revert back to the SRA.

Cope State Forest

The railway line passes through Cope State Forest No. 445 for a distance of approximately 1.5. km. The management of the State forest is directed towards the production of timbers for rural and mining uses to meet local needs.

A forest access road crosses the railway line easement and provision will be made to provide a level crossing at this point.

6.2.3 LAND ZONING

Except for the village areas of Gulgong (Mudgee Shire) and Ulan (Merriwa Shire) all land adjacent to the railway line is zoned non urban.

Approximately 1 km of the track occurs in Merriwa Shire. This section is immediately east of Cope State Forest. The remainder of the track and balloon loop occur in Mudgee Shire.

Land in the Shire of Mudgee adjacent to the railway line is zoned non urban 'A' and land along the main road 598 is zoned non urban 'B' under interim development order No 1 Shire of Cudgegong (now Mudgee). Subdivisions of rural lands are permissible under the provision of clause 11 of the above referred to interim development order.

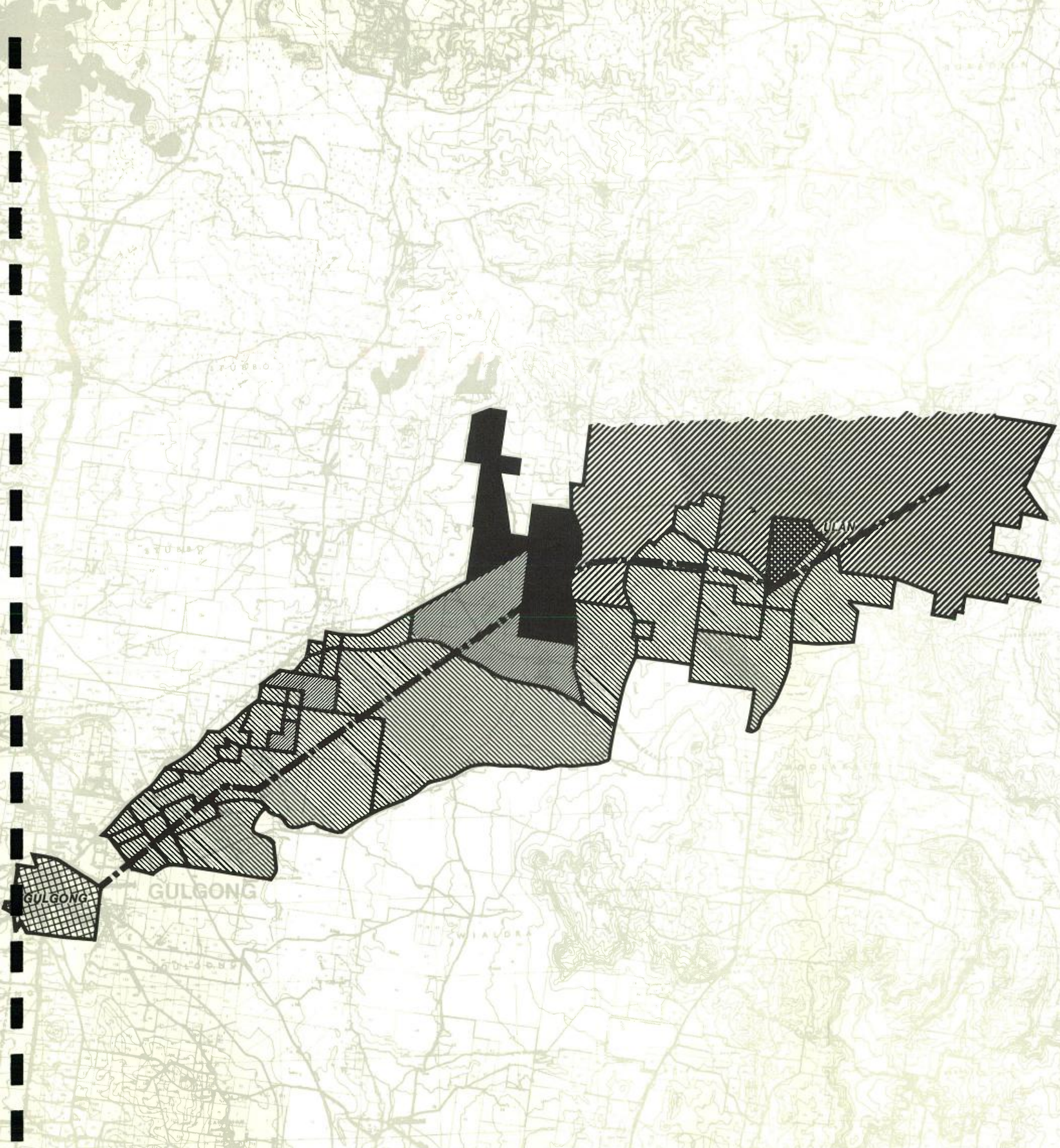


Figure 6.1
PROPERTY DIVISIONS

- Major Property Holdings
- Land Held by UCML
- Cope State Forest
- Recent Subdivisions
- Gulgong Township
- Ulan Village
- Railway Line

Source: Mudgee Shire Council
Central Mapping Authority

N

0 1 2 3 5km

6.2.4 EFFECTS OF THE PROPOSAL ON PROPERTIES ADJACENT TO THE RAILWAY LINE: SEVERANCE

The railway line formation has been in existence for the past 45 years. The completion from Ulan to Gulgong will affect some properties where access has occurred freely across the easement. Every effort will be made to provide private and accommodation crossings that meet current land ownership and land management practices (see section 6.2.2). Adequate provision will also be made for stock underpasses.

6.3 ROADS AND UTILITY SERVICES

6.3.1 MAIN ROADS

Road network

Main roads in the immediate vicinity of the railway line are:

.Main Road 598, which links Ulan to Gulgong
.Main Road 214 and Main Road 208, which connect Ulan to Mudgee and Cassilis.

Other roads in the vicinity include:

.Trunk Road 55 between Mudgee and Gulgong
.Secondary Road 13, which connects Home Rule to Mudgee.

Trunk roads and main roads are under the control of the Department of Main Roads. Main Road 598 was recently proclaimed a main road but is not constructed to main road standard specification. Before its reclassification, MR 598 was a local secondary road.

Figure 6.2 shows the existing road network in the vicinity of the railway line between Ulan and Gulgong.

Traffic and access

Traffic volumes along Main Roads 598 and 214 at selected locations are shown in Table 6.1

Table 6.1 Traffic volumes along MR 598 and MR 214

Location	Road	AADT (1) 1976	AADT (1) 1980 (2)
1 - Gulgong: north of railway crossing	MR 598		870
2 - Ulan: west of MR 214	MR 598		200
3 - Ulan: south of MR 598	MR 214	200	
4 - Ulan: north of MR 598	MR 214	290	

Source: Department of Main Roads

Notes:

1 AADT = Annual average daily traffic
2 The values given for 1980 are projected estimates

TO DUNEDOO

TO CASSILIS

MR 214

MR 214
DEVIATION
(Under Construction)

ROAD BEING
DIVERTED

OVERPASS

MR 598

FOREST TRACK

ROUND TOP
MOUNTAIN ROAD

GULGONG

TR 55

MR 214

TO WARROBIL

TO HOME RULE

TO MUDGEE

Figure 6.2
ROAD NETWORK

Railway Extension

Public Level Crossings
(Identified on original survey)

Main Public Roads in Vicinity of Railway Line

(Public level crossings will be provided on all public roads)

N

0 1 2 3 5km

Main Road 598 is currently used by trucking contractors to transport coal from the Ulan colliery to the coal loading facility, between 7am and 10pm. These hours have been specified by the State Polution Control Commission.

An average of 10 trucks operate between the mine and the loading facility, each making an average of 10-12 round trips per day. At peak times, up to 16 trucks are operating between the mine and the coal loading facility. However, the actual incidence of road transport is dependent on the arrival of coal trains at the Gulgong coal loading facility and the amount of coal at the stockpile.

Approximately 600,000 t of coal per year is currently transported by road to Gulgong. This would drop to 100,000 t per year on the completion of the railway line to Ulan, and will cease when the railway is extended to Gulgong.

Traffic related to the construction of the railway between Ulan and Gulgong will use public roads and the existing railway easement whenever practicable. However when access is needed over private property this will be arranged with land holders and carried out in accordance with their requirements.

Public level crossings

The railway line between Ulan and Gulgong crosses seven public roads including the Forestry Commission access road in Cope State Forest.

A special Inter-Departmental Level Crossing Committee whose membership consists of officers from SRA, Department of Main Roads, the Traffic Authority of NSW, the Police Department, the Department of Local Government and NSW Treasury, will determine the means of control of each level crossing. The committee will assess the method of control by considering such factors as the alignments of the road and rail approaches road and rail traffic average speeds, sight distances, the nature of the road surface and typical prevailing weather conditions.

6.3.2 UTILITY SERVICES

Utility services and private water reticulation systems crossing the railway will be suitably adjusted. Ulan Coal Mines Limited will arrange for the removal-adjustment of electricity power lines, Telecom underground and overhead lines and any other services. All necessary approvals will be obtained from the service authorities prior to construction and local utility authorities and private land owners affected will be consulted prior to any adjustments being undertaken.

6.3.3 EFFECTS OF THE PROPOSAL ON TRAFFIC AND UTILITY SERVICES

Road transport of coal

The completion of the railway from Ulan to Gulgong will mean that road transport of coal to the loading facility at Gulgong will no longer be required. This will have a significant environmental benefit in terms of environmental protection and social well-being (DEP 1981).

The transfer of coal transport from road to rail conforms to Government policy and is significant for energy conservation.

Utility services

Any utility services crossing the railway will be suitably adjusted. Provision will be made were necessary for installing sleeves under the formation to allow for privately owned water reticulation. Power and telephone lines will be adjusted for height in accordance with the requirements of the authority concerned.

6.4 SITES OF ARCHAEOLOGICAL OR HISTORICAL INTEREST

The major civil engineering works associated with construction of the railway formation ceased 30 years ago. It is reasonable to hypothesise that any sites of archaeological interest would have been disturbed at that time. Accordingly, no archaeological survey was undertaken along the proposed route. The National Parks and Wildlife Service has indicated that no registered sites are located along the proposed railway easement.

The existing railway formation with its partially completed bridge structures is a facility that has considerable historical interest. Completion of the rail line on the existing formation will bring to an end speculation on the value and wisdom of the initial undertaking to construct the railway line some 45 years ago.

6.5 VISUAL LANDSCAPE

The principal landscape features of the area comprise the undulating slopes west of the Great Dividing Range and those areas to the east comprised of rolling to rugged hills with some rock outcrops.

6.5.1 EFFECTS OF THE PROPOSAL ON THE VISUAL LANDSCAPE

Railway line

The railway line is part of the present visual landscape and except for clearing and some construction works all other activities will be confined to the substantially completed formation within the railway easement.

Coal loading facility at Gulgong

On completion of the railway from Muswellbrook to Gulgong the coal loading facility at Gulgong will be demolished and the area rehabilitated back to its previous rural character, to the satisfaction of the owner and Mudgee Shire Council. All coal will be removed from the site and the area revegetated using the guidelines set down by the Soil Conservation Service (see section 5.5.4). The dam will remain so that its water can be used to maintain the vegetation during its re-establishment.

Extractive operations

A quarry will be operated to obtain ballast material for the railway line construction, and borrow pits will be established to obtain material for the earthworks. The prosposed quarry will only be visible from within the small valley of Bobadeen creek and will not be visable from MR 214.

Borrow pits will be rehabilitated after extraction is completed to conform with the rural nature of the area and in accordance with the requirements of land owners. Revegetation guidelines set down by the Soil Conservation Service will be followed in the rehabilitation of the areas.

6.6 ACOUSTIC ENVIRONMENT

6.6.1 MEASUREMENT OF EXISTING AMBIENT NOISE LEVELS

Noise level surveys were undertaken on the night of Thursday 20 August and the day of 21 August and 12 October 1981. Background noise levels in the immediate vicinity of the proposed railway line, and the noise levels of the existing operation around the truck loading facility at Ulan, the stockpile and train loading facility at Gulgong and the trucks on the road between Ulan and Gulgong were measured.

Locations

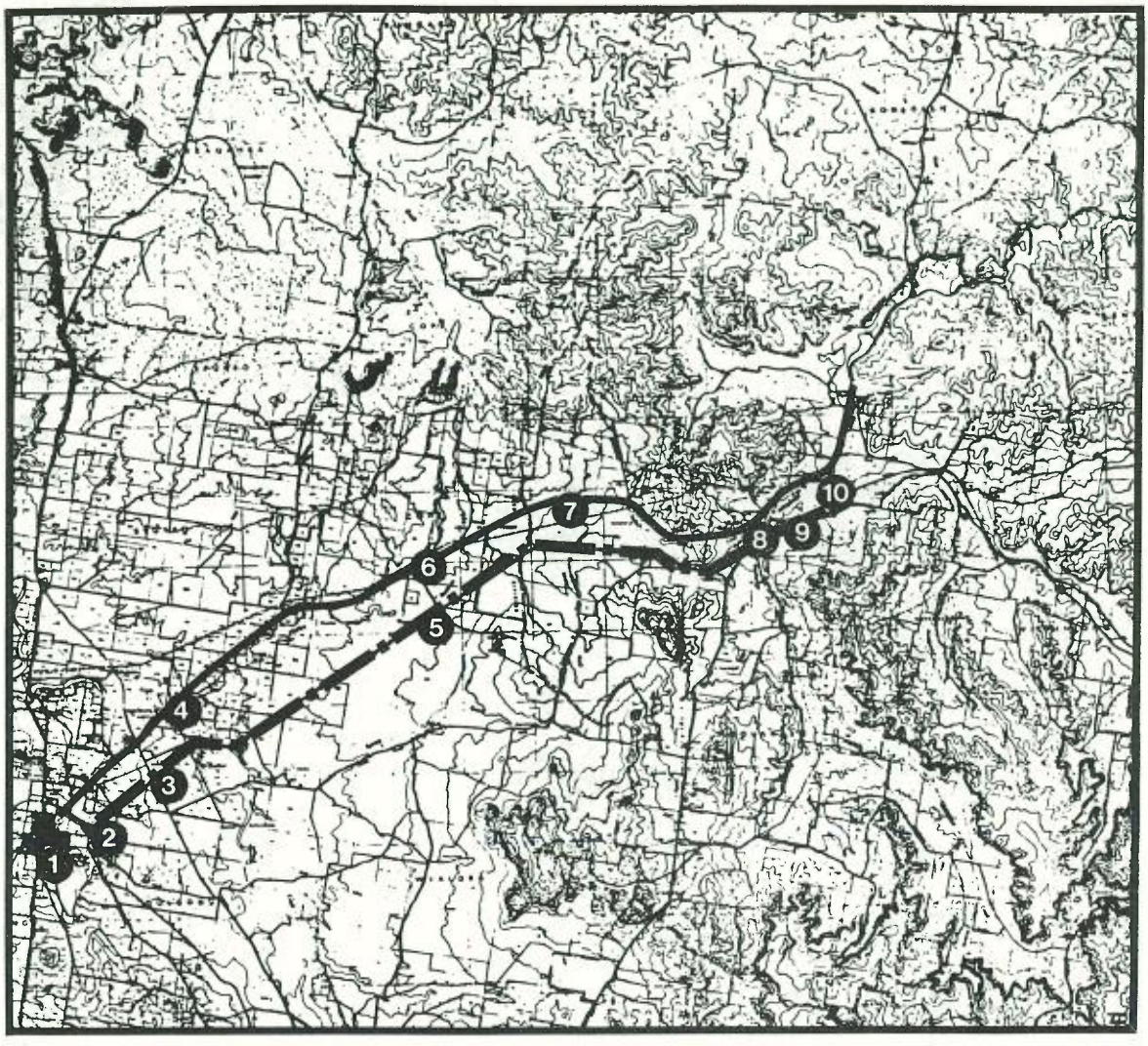
Measurements were made at the following locations (see Figure 6.3)

- Location 1: in a residential area of Gulgong
- Location 2: near the coal stockpile
- Location 3: near Bonnie Doon, a house close to the embankment of the railway line
- Location 4: on the main road between Ulan and Gulgong, near the site of the Jos Davis Bridge over Cooyal Creek (truck noise)
- Location 5: near Deadmans Creek; this site is similar to Location 1, being the point where an unsealed road crosses the railway line, with houses nearby.
- Location 6: on the main road between Ulan and Gulgong, near Deadman's Creek (truck noise)
- Location 7: on the main road between Ulan and Gulgong, near Cope State Forest
- Location 8: in the centre of Ulan, opposite the service station
- Location 9: on the Wollar Road out of Ulan, near the rail loop construction area
- Location 10: opposite Ulan colliery truck facility, east of Ulan (colliery noise).

Equipment

The equipment used consisted of a precision sound level meter, a statistical analyser, and chart recorder, all manufactured by Bruel and Kjaer. Calibration checks were made at regular intervals, using a Bruel and Kjaer calibrator. The statistical analyser automatically analyses the varying noise levels and allows a readout of at least L1, (maximum) L10, (general) L90 (background) and Leq levels. (The L1 to L90 levels are those noise levels that are exceeded for 1 per cent to 90 per cent of the sampling time. The L90 level is regarded as the most reliable descriptor of background noise and has been used to set the acceptable noise levels in this study. The Leq level is the equivalent continuous sound level, which is the mean time-weighted level calculated logarithmically).

Figure 6.3
NOISE MEASUREMENT LOCATIONS



Weather conditions during the survey on 20,21 August were generally poor, with high winds and occasional showers. As a consequence, background noise levels were usually dominated by the sound of leaves rustling in the trees. Considerable effort was made to record background noise levels as far removed from trees as possible but the levels recorded were still considerably higher than those expected on a still day. In contrast the weather on 12 October was fine and calm.

Ambient noise levels

Background noise levels were recorded at Locations 1,2,4,5,7 and 9, as shown in Table 6.2. It should be noted that background noise levels (L90) recorded on the 20 and 21 August were considerably higher than on 12 October.

Table 6.2 also shows the sound pressure measurements of ambient noise levels, coal truck noise levels, and the noise from stockpiling activities.

Table 6.2 Existing ambient noise levels

Date	Location	Time	Noise levels (dBA) L1	L10	Leq	L90
20/8/81	1	2330	-	-	-	24
	2	2350	-	-	-	38
	3	2400	60	43	42	32
21/8/81	4	0020	64	52	56	41
	5	0100	-	-	-	34
	6	1215	81	65	69	48
	2	1245	52	50	49	47
	7	1300	74	64	61	44
	8	1330	76	75	74	73
	4	1345	74	65	62	49
	9	1400	86	53	70	42
	1	1645	68	60	57	41
	10	1700	61	58	54	48
22/8/81	1	0900	54	52	50	49
12/10/81	1	0630	56	52	46	37
	3	0648	68	52	54	31
	5	0708	47	38	35	26

Truck noise: Measurements of the noise from coal trucks on the road between Ulan and Gulgong were made at Locations 4 and 6. A typical chart recording incorporating coal truck movements is shown in Figure 6.4A. These recordings indicate that the maximum coal truck noise levels were between 93 and 96 dBA at 15 m. These levels are typical of similar trucks previously measured. Intrusive noise levels of up to 70 dBA would, be expected at residences approximately 100 m from the road. Some five houses along the road are currently subjected to noise levels of this order.

Coal stockpile area: Figure 6.4B shows a chart recording made at approximately 200 m (Location 2) from the coal stockpile in Gulgong. During this period, several trucks climbed to the top of the stockpile and dumped their loads. Two front-end loaders were also on top of the stockpile, distributing the dumped coal. The general noise level recorded (L10) during this period was 58 dBA, with the maximum noise level (L1) rising to 61 dBA during the sampling period.

Several houses in the Gulgong township are currently experiencing noise levels of this order during daylight hours.

Trains: During the period of the first survey, no trains used the existing railway line through Gulgong. However, a fully laden coal train pulled by three locomotives up a slight incline was recorded on 12 October about 4 km north of Gulgong. A chart recording of this measurement is shown in figure 6.5. The train took about 1 minute to pass the measurement point and recorded a maximum level of 92 dBA at 15 m (see figure 6.5).

In addition an empty coal train arriving at Gulgong recorded a maximum level of 79 dBA at 15 m. This lower level was due to the slower speed of the train which took approximately 2 minutes to pass the measurement point.

6.6.2 NOISE LEVELS ASSOCIATED WITH THE PROPOSAL

Acceptable noise levels

Australian Standard 1055 - 1978, 'Noise Assessment in Residential Areas', is the relevant Standard for assessing potential noise nuisance from developments such as the one proposed. This Standard requires that the background noise level and the intrusive noise level be measured or estimated and that the intrusive noise level be adjusted for characteristics and duration, if applicable. The background noise level is then to be compared with the adjusted intrusive level.

For continuous long term noise, if the adjusted intrusive level exceeds the background level, the noise is likely to be annoying. However, excesses of 5 dBA or less may be of marginal significance only.

Due to the windy conditions during most of the measurement period, the background noise levels measured were above typical levels for the area and are not appropriate for setting acceptable intrusive noise levels.

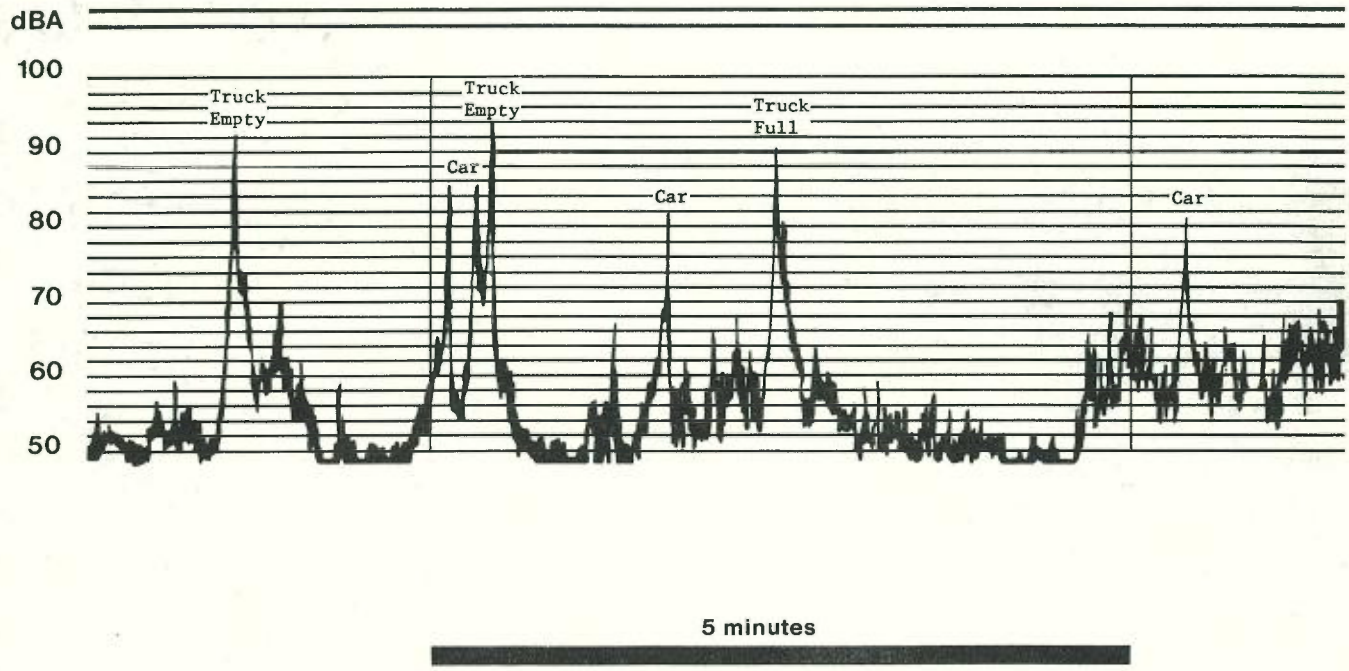
For the purpose of this assesment the background noise levels as estimated in Australian Standard 1055-1978 for the appropriate category, R1, 'Areas with Negligible Transportation' have been used. These levels are consistent with measurements made during the last survey when calm conditions prevailed.

0600 - 0700 hours	-	35 dBA
0700 - 1800 hours	-	45 dBA
1800 - 2200 hours	-	35 dBA
2200 - 0600 hours	-	30 dBA

Construction and train noise are the two major potential noise sources associated with the proposal.

Figure 6.4
NOISE: CHART RECORDINGS OF COAL TRUCKS AND GULGONG COAL STOCKPILE

A. Coal Trucks 6 m from Ulan-Gulgong Road (Location 4)



B. 200 m from Gulgong Coal Stockpile (Location 2)

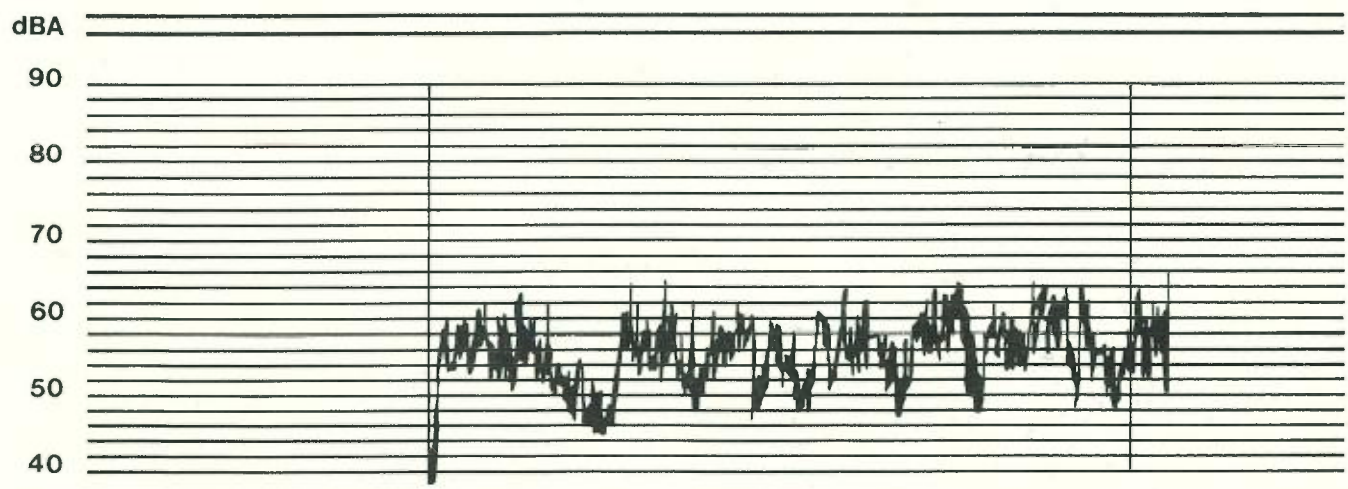
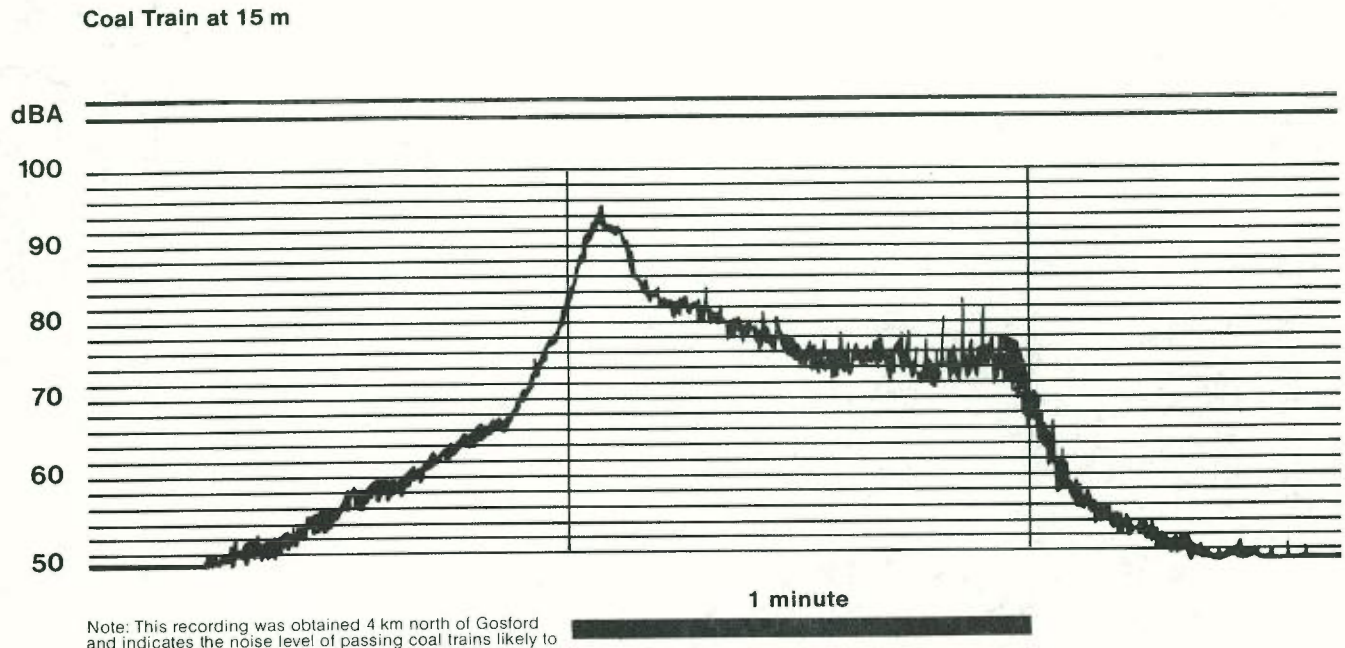


Figure 6.5
NOISE: CHART RECORDING OF PASSING COAL TRAIN



Note: This recording was obtained 4 km north of Gosford and indicates the noise level of passing coal trains likely to occur on the Ulan to Gulgong railway line extension.

Construction noise: Construction operations will take place during daylight hours only (0700 - 1800 hours) between February 1981 and September 1982. Generally, residents are more tolerant of short term construction noise than continuously operating noise. Therefore, taking into account the tonal and intermittent nature of this noise, acceptable levels could be 10 dBA higher than the background noise levels. The acceptable intrusive noise level during this period would, therefore, be 55 dBA, based on the estimated background noise level for the 0700-1800 period.

Train noise: The proposed rail line will result in noise levels emanating from both the passage of trains and locomotive whistles, which may be used when approaching level crossings. Train operations on this link are such that only a small number of trains will operate during any night or day time period, and the duration for which the train is audible is short, therefore maximum noise levels are used for comparison with the background noise level. Generally, occasional levels of 10 to 15 dBA or more, above the background level, are regarded as disturbing at night.

Thus, for night-time conditions noise levels of 40 dBA would be regarded as acceptable.

Expected noise levels of the proposal

Noise levels expected at the nearest residences are a function of the noise produced at the source and the attenuation achieved by distance of the source for the houses. Table 6.3 shows the number of houses and distance from the railway within a kilometre either side of the railway easement.

Table 6.3 Residences in proximity to railway: rural (between the coal loading facility at Gulgong) to 5.5 km East of Ulan

Distance from Railway (metres)	Named	Unnamed	Total
Up to 50	East Star	2	3
50 - 100	Cumbamurra	1	2
100 - 250	-	4	4
250 - 500	Bonnie Doon, Broadfield, Willow Park,	2	6
500 - 1000	Faringhole,	18	20
Total		29	35

Table 6.3 does not list residences within the Ulan village, or along the main line between the level crossing at Gulgong and the coal loading facility. These are listed separately in Table 6.4.

Table 6.4 Residences in proximity to railway Gulgong township and Ulan village.

Distance from railway (metres)	Unnamed
Gulgong Township	
Up to 503	None
50 - 1002	None
100 - 2504	1
250 - 500	4
500 - 1000	10
Ulan Village	
0 - 500	None
500 - 1000	20

Construction noise: Equipment associated with construction falls into two categories. Firstly, earthmoving equipment, including scrapers, bulldozers, front-end loaders and haulage trucks. Secondly, track laying equipment including impact hammers and tamping and laying plant. Earthmoving equipment usually generates between 84 and 89 dBA at 15 m. Tamping and laying equipment generally produce noise levels of around 81 dBA at 15 m. Table 6.6 shows the distance attenuation and resultant noise levels at varying distances for earthmoving and track laying equipment.

Table 6.5 Expected construction noise levels at various distances. Earthmoving equipment and track laying equipment.

Distance from railway (metres)	Distance attenuation (dB)	Earthmoving equipment (dBA)	Track laying equipment (dBA)
100	16	68 - 73	65
250	24	60 - 65	57
500	30	54 - 59	51
1000	36	48 - 53	45

Train noise: The maximum train noise levels measured was 92 dBA at 15m when travelling at normal speed. Attenuation with distance for finite line sources such as trains is less than for a point source. The attenuations expected and resultant train noise levels experienced at varying distances are shown in the Table 6.6.

Table 6.6 Expected train noise levels at various distances from railway when travelling at normal speeds.

Distance from railway (metres)	Distance attenuation (dB)	Train noise (dBA)
100	12	77
250	18	74
500	22	70
1000	27	65

Trains arriving at Gulgong approach at slower speeds and therefore lower noise levels, however their time of influence is longer. Table 6.7 below shows expected attenuation and resultant noise levels near the railway station at Gulgong due to trains arriving and departing.

Table 6.7 Expected noise levels of trains arriving at Gulgong at various distances from railway.

Distance from railway (metres)	Distance attenuation (dB)	Train noise levels (dBA)
100	12	67
250	18	61

Beyond 250 m there will probably be additional shielding from other buildings and other ambuent noise levels such as traffic.

Noise from train whistles is of the order of 93 dBA at 15 m. The whistle is a point source and, therefore, attenuation levels similar to those expected for construction equipment would apply. Table 6.8 shows these attenuations with intrusive whistle noise levels expected.

Table 6.8 Expected whistle noise levels at various distances from railway.

Distance from railway (metres)	Distance attenuation (dB)	Whistle noise (dBA)
100	16	77
250	24	69
500	30	63
1000	36	57

Some noise impact on residences in Gulgong from coal trains operating along the railway from Ulan is expected, however it is likely to be less than currently experienced as the average number of coal trains expected to travel through Gulgong from Ulan will be reduced. Most of the coal from Ulan will be railed eastwards to Newcastle.

Similarly little impact will be noticed in Ulan as most of the rail traffic will be east of the village and any traffic passing will be approximately 500 m south.

6.6.3 NOISE EFFECTS OF THE PROPOSAL ON THE ADJACENT ENVIRONMENT

Adverse effects: The acceptable intrusive noise levels will be exceeded at the nearest houses during the construction phase and during any train passby at day or night.

Short term effects: Some houses close to the line will be affected during the 10 month construction period. This disturbance will be temporary and will not be continuous throughout the construction period.

Long term effects: On average, there will be between one and two train movements in any 24 hour period, but train passbys will be of short duration.Train movements from Ulan through to Muswellbrook were the subject of a separate Environment Impact Statement (Longworth and McKenzie Pty Ltd 1980). However, an increase in the total number of trains using that line can be expected, as a result of foreshadowed increases in coal production and other non-coal related train traffic using the line.

Beneficial effects: Coal truck movements to the coal loading facility at Gulgong (up to 350 per day) will cease, thereby reducing the level of annoyance experienced at houses along the road.

The truck loading operation at Ulan colliery will be eliminated.

The operation of the coal stockpile and train loading facility at Gulgong will be eliminated on completion of the railway to Gulgong.

The average number of coal train movements through Gulgong will be reduced.

7.0 THE ECONOMIC ENVIRONMENT AND EFFECTS OF THE PROPOSAL

7.1 SUMMARY

The regional economy of Mudgee and Merriwa Shires is relatively small and is dependent on employment opportunities in agriculture, manufacturing, mining and service industries (including tourism). Population growth in the region has been relatively stable and is expected to accelerate steadily in the face of expansion of the Ulan coal mine. Unemployment has been increasing steadily over the 1978-80 period. The world wide trend towards a reduction in employment opportunities in agriculture and traditional manufacturing industries effectively increases the instability of the economic base of the region.

The region has the opportunity to capitilise on its comparative advantage in black coal resouces through development of the Ulan coal mine. Stability of the Ulan coal mining activities will diversify the region's economic base through the creation of direct employment opportunities, together with the induced employment opportunities likely to result from the income flows of mine employees. Construction of the Ulan to Gulgong railway line is an opportunity to support the stable operation of the mine and therefore the future growth of the region.

Construction of the railway line offers short term economic benefits to the region through an approximate regional expenditure of $2,350,000 on local goods and services, and temporary employment for approximately 40 local people during the 10 months construction period. The long term economic benefits to the region and surrounding area depend on what terminal and loading facilities are established at Gulgong; this centre could increase its role as service centre to the surrounding agricultural hinterland through the advantage of servicing a more direct rail link to Newcastle. This would result in distance cost savings on the freight of goods and services over a shorter distance both to and from Newcastle, together with strong diversification of Gulgong's economic base.

The extension of the railway line from Ulan to Gulgong will also result in economic advantages for the State as a whole. The Bureau of Transport Economics (BTE 1979) estimate favourable benefit-cost ratios of between 1.85 and 1.98 associated with the Sandy Hollow to Gulgong section of the railway line. The magnitude of the benefit-cost ratio will probably be lowered if the line is not extended to Gulgong.

Coal production at Ulan for domestic consumption is currently transported by road to Gulgong, and then transferred to rail wagons for delivery. Construction of the Ulan to Gulgong section of track will allow this production to obtain the lower costs of rail freight over the entire distance, and also avoid the costs associated with modal transfer (BTE 1979,pp.33-34).

7.2 THE EXISTING REGIONAL ECONOMY

7.2.1 REGIONAL CONTEXT

For the purpose of this EIS, the region of interest is assumed to comprise the local government areas of Mudgee and Merriwa. The proposed railway line extension will have the greatest local impact on these two areas.
The region is located approximately 360 km north-west of Sydney and approximately 270 km west of Newcastle. The total area of the region is approximately 8,991 square kilometres. The main towns in the region are Mudgee, Gulgong, Merriwa and Cassilis.

7.2.2 POPULATION AND SETTLEMENT

The population growth of the region during the period 1961-76 and the estimated population for 1977-81 are listed in Table 7.1. Both of the major towns, Mudgee and Gulgong, have experienced low but steady population growth over this period. This growth may be attributed partly to growth in the local wine and coal industries, together with an increase due to a small drift towards retirement and hobby farms in the region. The population in the rural area of Mudgee shire declined slowly during the 1961-71 period, but increased moderately during the 1971-76 period. The population of Merriwa shire has declined slightly over the 1971-76 period.

The Australian Bureau of Statistics (ABS 1981) 1977-80 intercensal estimates for Mudgee Shire indicate a small increase in the rate of annual population increase to 1.5 per cent over the 1976-80 period. Merriwa Shire is estimated to have increased in population during the 1977-80 period at an average annual increase of 1.1 per cent. This constrasts with the gradual decline in population evident during the 1971-76 period.

Table 7.1 Population growth in Mudgee and Gulgong regions: 1961-1981

Location	1961	1966	1971	1976	1977	1978	1979	1980	1981
Mudgee (urban)	5212	5372	5750	5950	-	-	-	-	-
Gulgong	1396	1441	1500	1700	-	-	-	-	-
Mudgee (rural)	4234	3803	3900	4300	-	-	-	-	-
Sub-total Mudgee Shire	10842	10616	11150	11950	12100	12250	12450	12700	12890
Merriwa Shire	2771	2562	2442	2252	2350	2350	2400	2450	2477

Source: ABS census 1961, 1966, 1971, 1976.
ABS intercensal estimastes, 1977, 1978, 1979, 1980. The 1981 figure was derived by assuming the continuation of the average annual growth rates of 1.5 per cent for the Mudgee shire and 1.1 per cent for Merriwa shire that occurred during 1977-80.

7.2.3 AGE STRUCTURE

The age structure of the region has remained relatively stable over the 1971-76 period as shown in Table 7.2. There has been a slight trend towards a diminishing proportion of the population in the 0-19 year age group and a slight increase in the 50 year and over age group. The proportions of the regional population in the 20-34 and 35-49 age groups have remained relatively stable.

Table 7.2 Age structure of the region 1961-76

Age	Mudgee (urban) 1961	Mudgee (urban) 1976	Gulgong 1961	Gulgong 1976	Mudgee (rural) 1961	Mudgee (rural) 1976	Merriwa (shire) 1971	Merriwa (shire) 1976
0-19	41.0	37.0	40.0	36.0	0.38	39.0	39.0	37.0
22-34	18.0	21.0	19.0	19.0	0.18	20.0	20.0	20.0
35-49	18.0	15.0	17.0	16.0	0.19	19.0	19.0	19.0
50-75	23.0	28.0	24.0	29.0	0.25	23.0	22.0	24.0
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

7.2.4 THE LABOUR FORCE

The structure of the region's labour force in 1976, according to industry,is shown in Table 7.3. This table clearly shows the important functions as service centres that the towns of Mudgee and Gulgong hold within the region and importance of the employment opportunities that these functions represent. This is seen in the relatively high proportions of the labour force in manufacturing, wholesale/retail trade, finance, public administration, community service and entertainment. The structure of the region's workforce according to occupation supports this finding, as shown in Table 7.4. The rural areas of the region are predominantly agriculturally oriented.

Table 7.3 Percentage distribution of the labour force according to industry: 1976

Industry	Mudgee (urban)	Gulgong	Mudgee (rural)	Merriwa Shire	NSW
Agricuture	4.2	7.0	58.9	49.9	5.8
Mining	1.1	4.3	0.5	0.4	1.2
Manufacture	17.0	12.6	7.5	0.6	21.0
Elec, Gas, Water	0.9	6.8	0.4	0.9	2.0
Construction	5.8	7.7	3.4	6.1	6.2
Wholesale/Retail	22.6	17.3	8.7	9.5	18.3
Transport/Storage	6.0	2.9	2.6	3.4	5.4
Communications	1.9	3.2	1.7	2.2	2.1
Finance	5.5	3.8	1.4	1.7	8.0
Public Admin.	5.2	3.4	1.0	5.3	5.7
Community Service	15.7	13.7	5.0	7.7	2.3
Engertainment	6.9	7.4	2.5	3.3	5.2
Other	7.5	9.9	6.6	9.0	6.6
Total	100	100	100	100	

Source: Australian Bureau of Statistics, 1976 Census

Table 7.4 Percentage distribution of the labour force according to occupation: 1976

Industry	Mudgee (urban)	Gulgong	Mudgee (rural)	Merriwa Shire	NSW
Professional & Technical	10.3	10.1	8.1	6.2	11.6
Administrative etc	8.1	7.5	6.1	2.8	6.9
Clerical	11.7	9.2	8.7	5.7	17.2
Sales	11.3	9.0	7.9	5.3	7.8
Farmers, Fisherman	5.8	8.1	26.3	48.9	6.2
Miners, Quarrymen	0.5	2.4	0.7	0.3	0.7
Transport, Communication	6.5	4.6	5.1	6.2	5.3
Production process Workers, Labourers	27.5	28.0	21.9	12.5	29.8
Service, Sport Recreation	11.3	12.3	8.5	4.6	7.9
Armedforces	0.0	0.0	0.0	0.0	1.1
Other	6.9	8.7	6.8	7.5	5.4
Total	100	100	100	100	100

Source: 1976 Census, Australian Bureau of Statistics.

7.2.5 UNEMPLOYMENT

The number of persons in the region registered as unemployed for the period 1978-80, is shown in Table 7. These figures show that the number of unemployed registered with the Commonwealth Employment Service have been steadily increasing in Mudgee shire, while remaining relatively stable in Merriwa shire. To some extent, these figures may under estimate the real level of unemployment as there are likely to be some unemployed persons in the region who have not registered. The recent increase in the number of unemployed people in the Mudgee Shire is attributed partly to the attraction to the area of people seeking, but not being able to obtain, work on the major construction projects in the area. The Muswellbrook CES office, which includes Merriwa Shire, currently reports some difficulties in finding people to fill jobs associated with major projects in the Muswellbrook-Scone area.

Table 7.5 Registered Unemployed, Mudgee and Merriwa Shires: 1978-1980

	Mudgee Shire					Merriwa Shire				
Year	AM(1)	AF(2)	JM(3)	JF(4)	Total	AM(1)	AF(2)	JM(3)	JF(4)	Total
Oct 1978	245	80	115	91	531	25	7	8	11	51
April 1979	244	72	101	134	551	35	5	10	12	62
July 1979	287	67	109	111	574	31	3	2	12	48
Oct 1979	267	75	97	104	543	30	1	2	10	43
July 1980	333	101	110	110	654	19	3	7	8	37
Oct 1980	302	96	99	101	598	27	6	5	12	50
June 1981	350	146	118	130	744	na	na	na	na	na
Sept 1981	na	na	na	na	730	na	na	na	na	na

Source: Commonwealth Employment Service

Notes:

1 AM = adult male
2 AF = adult female
3 JM = junior male
4 JF = junior female
na = not available

7.2.6 ECONOMIC BASE

The region's economic base includes agriculture (mixed sheep and wheat), wine growing, coal and kaolin mining, tourism (particularly in Gulgong) and the service centre functions of Mudgee and Gulgong.

Opportunities for expanding and strengthening the economic base of the region appear to include the following:

- expansion of the Ulan coal mine
- development of the tourism industry in Gulgong
- increased service industries as a result of increased population levels.
- additional manufacturing activity.

Overall, the region's economy is primarily oriented to agriculture and related service industries. The expansion of the coal mining operations at Ulan represents one of the major future growth opportunities for the region.

7.3 PROJECTED POPULATION GROWTH:

The Ulan Community Infrastructure Study (JTCW & P, 1981, p 15-21) forecast the population of the region over the period 1980-1990 based on the expansion of the existing Ulan coal mine to 4.2 Mtpy. These projections were based on assumptions concerning the increase in the Ulan Colliery workforce; the residential distribution of the additional Ulan Colliery workforce and the expected employment and population multipliers associated with the additional workforce. The projected population, adjusted to a 1981 base, is listed in table 7.6

Table 7.6 Projected population, 1980-1900 including Ulan Coal mine expansion to 4.2 Mtpy

Location	1981	1983	1985	1990
Mudgee (urban)	6445	7126	7415	7940
Gulgong	1805	2038	2132	2282
Mudgee (rural)	4640	4827	4970	5335
Sub total for Mudgee Shire	12890	13991	14517	15557
Cassilis	200	250	260	267

These figures are slightly higher than the figures provided in the Ulan community infrastructure study (JTCW, Table 2.10,1981, p 2) because of the slightly higher 1981 base.

The New South Wales Planning and Environment Commission (1979) forecast that population growth in the North-Western region, of which Mudgee Shire is a part, will continue to remain relatively static for the 1981-2001 period. The area as a whole is assumed to represent a declining proportion of the State's total increase in population over this period. Merriwa Shire comprises part of the rural Upper Hunter region. The population of the Lower Hunter region is expected to grow steadily in the face of further energy resource developments in the region. The rural population of the Upper Hunter region is expected to grow slowly. The key determinant of population growth in this area is the rate of coal development.

7.4 REGIONAL ECONOMIC EFFECTS

The regional economic effects of the Ulan to Gulgong railway line may be split into construction and operation effects. The construction effects relate mainly to the economic effects of the expenditure on capital equipment and labour. The operation effects relate mainly to the potential cost savings (due to reduced distance) that the Sandy Hollow to Gulgong railway line will confer on the freight of goods and services to and from the region, and surrounding area, from the major ports of Sydney and Newcastle. The Ulan to Gulgong railway line will also provide a contingency route in the event of the main Ulan to Newcastle line becomes inoperative for any period of time.

7.4.1 CONSTRUCTION EFFECTS

Regional economic multiplier analysis (ie input-output analysis; economic base; inter-regional multipliers) is the conventional method of assessing the magnitude of the effect of construction expenditure on a regional economy. However, because of the brief and temporary nature of the construction period (10 months) it was not appropriate to employ the convential means of multiplier analysis.

The major regional economic effects flowing from the construction of the railway from Ulan to Gulgong will be a proportion of the estimated construction budget spent within the region over the 10 month construction period. Section 3.4 describes the railway construction programme and gives an estimate of the materials required. The regional share of the estimated total construction cost of approximately $11,200,000 is forecast to be approximately $2,350,000 or 21.0 per cent. The figure is based on Ulan Coal Mines Limited's estimate of the cost of each stage of the construction of the line and on experience in the construction of the Sandy Hollow to Ulan railway line.

The region's proportion of the total cost was estimated after reviewing the preliminary railway line construction specification and estimating what proportion of materials and labour might be supplied locally. Estimates for supervision fees, design costs, insurance and other finance costs were disregarded in establishing the region's share.

The figure of $2,350,000 is based on the assumption that the same contractors engaged for the construction of the Sandy Hollow to Ulan railway line will be engaged for the construction of the Ulan to Gulgong railway line.

The project is estimated to need a workforce of approximately 95 people over the 10 month construction period. Based on experience from the Sandy Hollow to Ulan railway line, approximately 40 per cent of this workforce may be from the district,representing employment opportunities for approximately 38 local people. Due to the overlapping nature of the contracts it is not possible to determine whether this employment will last for the full 10 month construction period. The relatively high wages that will be offered to construction workers (approximately $360 per week) could lead to some temporary job switching by local trades people and farmers.

Construction camp accommodation will be located at Ulan and Bylong. The number of occupants will depend on the number of non-local workers requiring accommodation. The towns of Ulan, Mudgee and Gulgong will benefit temporarily from the increased expenditure by construction workers. These towns will benefit from increased sales of foodstuffs and other services including fuel oil, entertainment.

7.4.2 OPERATIONAL EFFECTS

The region will benefit indirectly from the Ulan to Gulgong railway line in that it will ensure that the Ulan coal mine can operate more efficiently and reliably in meeting contracts for the delivery of coal to Sydney or Newcastle. The Ulan coal mine is seen as an increasingly important source of employment and population growth in the region. The establishment of such a contingency route to Gulgong will reinforce the operation of one of the important employers in the region.

The removal of coal trucks from the road between Ulan and Gulgong will result in direct savings to Mudgee Shire Council in road maintenance costs, together with a corresponding increase in road safety for other vehicles.

The extent to which agricultural industries in the region will benefit from the Ulan to Gulgong rail link, and the shorter rail link with the port of Newcastle, will depend on what terminal and loading facilities are established at Ulan or Gulgong. Given suitable terminal and loading facilities, the agricultural industries in the region will benefit from having a shorter rail link to the port of Newcastle.

This will result in savings in freight costs, as the rail distance to Newcastle from Gulgong will be about 238 km shorter than the current shortest distance by rail of 532 km from Ulan to Newcastle via Sydney. Conversely, the region will benefit from lower freight costs on the shipment of goods and service to and from Newcastle. The likely goods and service that will be affected by these cost savings include the import of fuel from Sydney, fertilisers from Newcastle and Port Kembla, and agricultural and consumer goods from Newcastle and Sydney and the export of agricultural and mineral products (BTE, 1979,). The establishment of the Ulan to Gulgong railway line will increase the potential for the establishment of downstream railway related industries in Gulgong and thereby increase the potential for diversifying the regional economy's employment base.

The operation of the Ulan to Gulgong railway line will mean the closure of the Gulgong coal loading facility and the temporary loss of employment for the existing track operators hauling coal to the loading facility. There will also be a temporary loss of employment for the administration and support staff operating the coal loading facility. There are an average ten trucks operating with an occasional peak of 16 trucks, and four support staff including staff for administration and mechanical repair. The total staff employed is approximately 20 people. On completion of the Ulan to Gulgong railway line around late 1982, there will be no demand for those currently employed in servicing the coal loading facility. However, the possibility of employment opportunities in and around the region, particularly in the Hunter Valley, should mean that any unemployment will be temporary.

7.5 STATE AND NATIONAL ECONOMIC EFFECTS

7.5.1 STATE ECONOMIC EFFECTS.

The extension of the railway line conforms with the policy of the New South Wales Government to require coal to be transported by rail in preference to road where possible. The construction of the line will serve to reinforce this policy.

The major economic advantages to the State economy, arising from extension of the railway line are derived largely from the benefits associated with facilitating the transport of coal and other products from the region and surrounding areas through a more direct rail link with the export port of Newcastle. The construction of the railway line to Gulgong will reinforce the operating reliability of the Ulan mine and strengthen its position as a major employer in the region. This will contribute to strengthen the export of New South Wales black coal and directly strengthening the New South Wales economic base.

Construction of the railway line to Gulgong is not required under normal circumstances to service coal export traffic from Ulan to Newcastle. However, the line will be used to distribute coal to domestic markets.

Construction of the line will eliminate the need and operating expense of these coal transfer facilitys at Gulgong and domestic consumer will benefit from the lower freight costs.

Furthermore, it will give a contingency route for coal from other western district mines, (including Ulan) and cement from Kandos and other products to reach the coast or avoid rail and port congestion at Sydney (BTE 1979).

The Bureau of Transport Economics (BTE 1979) estimates that constuction of the Sandy Hollow to Gulgong railway line will yield favourable benefit-cost ratios between 1.85 and 1.98 depending on the construction period and the rate of inflation. While it is unclear what benefit-cost ratios are associated with the section of line between Ulan to Gulgong, it is clear that the magnitude of the benefit-cost ratio will probably be lowered if the Ulan to Gulgong section of the railway line is not constructed.

Furthermore, construction of the railway line to Gulgong represents an important strategic step towards completing the railway line to Maryvale, the original intention of the railway line. The construction of the entire Sandy Hollow to Maryvale railway line will result in considerable distance cost savings. Currently, Dubbo to Newcastle via Sydney involves a distance of 630 km, whereas Dubbo to Newcastle via Sandy Hollow is only 405 km (a shipment distance reduction of 225 km). Furthermore, Newcastle replaces Sydney as the closest directly rail-linked port, since Dubbo to Sydney is a distance of 462 km, whereas Dubbo to Newcastle via Sandy Hollow is 405 km. These reductions will result in extending the railways area of influence as shown in Figures 7.1, 7.2 and 7.3. These figures compare the size of the Sydney and Newcastle trade areas in relation to the extent of construction of the Sandy Hollow railway line.

On completion of the railway line from Gulgong to Maryvale, grain production from the railways area of influence might be diverted from Sydney to Newcastle, thus reducing grain transportation costs because of the 57 km reduction in distance. Metalliferous concentrates and other freight will be able to travel directly to Newcastle via Sandy Hollow rather than via Sydney, thereby saving 225 km.

The Bureau of Transport Economics (BTE 1979) estimates that the benefit-cost ratios associated with extension of the Sandy Hollow to Gulgong railway line on to Maryvale will be between 1.78 and 3.25 depending on the construction sequence and the rate of inflation. These ratios were assessed on the basis of the potential distance savings that will accrue to freight diverted from the existing network.

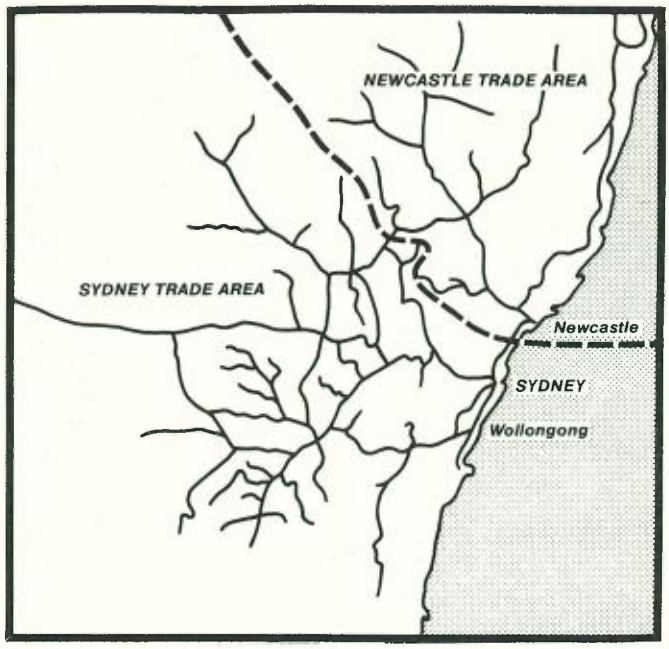
7.5.2 NATIONAL ECONOMIC EFFECTS

The national economic effects flow from facilitating the export of Black coal. Black coal has the potential to earn substantial export earnings for the Australian economy with a direct flow-on of benefits to the balance of payments. The Ulan to Gulgong railway line is a small but important component supporting the export of New South Wales coal.

Domestic consumers will benefit from lower freight costs and lower unit costs

The Muswellbrook to Gulgong railway line will provide the shortest link to a port, Newcastle, which currently has available coal loading capacity. It will also provide a contingency export route, even if longer, for Ulan and other western district coal. Further, the extension of the railway line from Ulan to Gulgong is essential in order to capture the economic advantages of extending the railway line through to Maryvale.

The construction of the Ulan to Gulgong railway line is a small but important part of this overall development of infrastructure for coal transport, with resultant economic benefits to the regional, State and national economies.



COMPARATIVE SYDNEY AND NEWCASTLE TRADE AREAS

Figure 7.1
RAILWAY BUILT TO ULAN

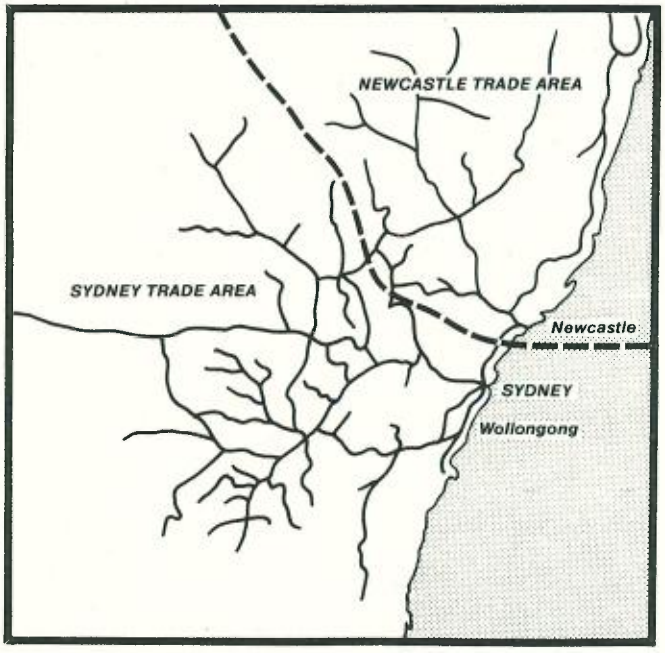


Figure 7.2
RAILWAY BUILT TO GULGONG

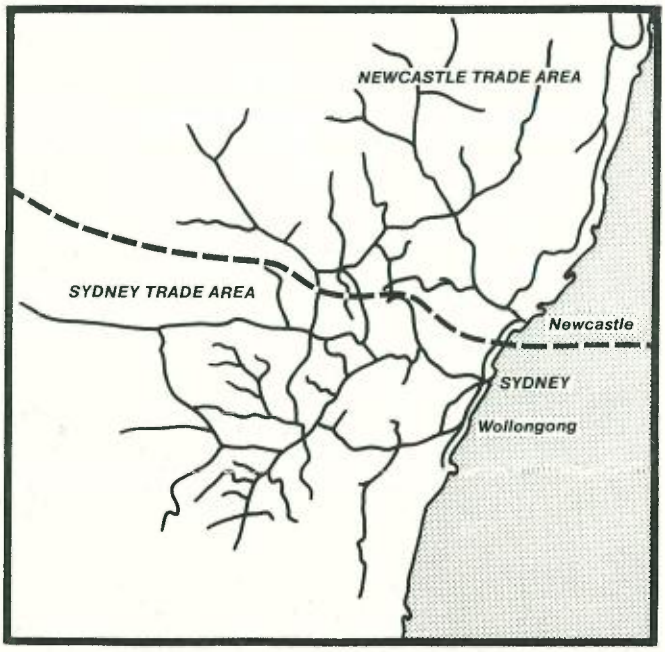


Figure 7.3
RAILWAY BUILT TO MARYVALE

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Technical Abbreviations

AC	alternating current
cm	centimetre
dBA	decibel, measurement using frequency weighting network A
DC	direct current
h	hour
ha	hectare
kg	kilogram
km	kilometre
km/h	kilometres per hour
kV	kilovolt
m	metre
min	minute
mm	millimetre
Mt	megatonne (= 1 million tonnes)
Mtpy	megatonnes per year
t	tonne
y	year

Study Team

In July 1981, Ulan Coal Mines Limited appointed Kinhill Pty Ltd as consultants to prepare this Environmental Impact Statement for extending the Sandy Hollow railway line from Ulan to Gulgong. Kinhill appointed a number of individuals and firms to provide specialist advice on a variety of environmental matters.

KINHILL PTY LTD Principal Consultant.

W. R. Woodhead	Director in Charge
G. McKenzie	Project Manager
M. J. Ives	Project description, physical and social environment.
G. Underwood	Physical and social environment
A. D. Robertson	Economics
J. Hamilton	Graphic design and production
M. Szabo	Art work
C. Bloomfield	Word processing

SUB CONSULTANTS TO KINHILL PTY LTD

Individual consultants.

Dr. M. Denny	Fauna-Flora
Mrs. M. Plessley	Technical editing
R. Travers Morgan Pty Ltd	Transportation (rail)
A. Wardrop	
G. D. Connors	
Wilkinson-Murray Consulting Pty Ltd	Air and acoustic environment
B. Murray	
P. Bridge	

GOVERNMENT ORGANISATIONS CONSULTED

State Government
- Central Mapping Authority
- Department of Environment and Planning
- Department of Main Roads
- National Parks and Wildlife Service
- Soil Conservation Service *
- State Rail Authority
- Water Resources Commission

Local Government
- Merriwa Shire Council
- Mudgee Shire Council

* Officers of the Soil Conservation Service (Lithgow) provided the information for Section 5.5

APPENDIX I

Flora list

CASUARINACEAE

Black she oak (Casuarina littoralis)
River oak (Casuarina cunninghamiana)

COMPOSITAE

Chinese scrub (Cassinia laevis)

CAMPANULACEAE

Native bluebell (Wahlenbergia sp.)

GRAMINEAE

Spear grass (Stipa sp.)
Windmill grass (Chloris sp.)
Wallaby grass (Danthonia sp.)
Kangaroo grass (Themeda sp.)
Cutting grass (Gahnia sp.)

MIMOSACEAE

Small cooba (Acacia ligulata)
Mudgee wattle (Acacia spectabilis)

CUPRESSACEAE

Black pine (Callitris endlicheri)

MYRTACEAE

Bottle brush (Callistemon sp.)
Paper barks (Melaleuca sp.)
Tea tree (Leptospermum sp.)
Rough-barked Apple (Angophora floribundi)
Narrow-leaved ironbark (Eucalyptus crebra)
Caley's ironbark (Eucalyptus caleyi)
Yellow box (Eucalyptus melliodora)
White box (Eucalyptus albens)
Grey box (E. molucanna)
Blakely's red gum (E. blakelyi)
Candlebark gum (E. rubida)
Scribbly gum (E. rossii)

XANTHORRHOEACEAE

Grass tree (Xanthorrhoea sp.)

ZAMIACEAE

Burrawang (Macrozamia secunda)

Fauna list

Fauna known to occur along the route of the proposed Ulan to Gulgong railway line

Avifauna

White-backed Swallow (Cheramoeca leucosternum)	1,6*
Wood Duck (Chenonetta jubata)	1
Masked Plover (Vanellus miles)	1
Little Grebe (Podiceps ruficollis)	1
Grey Teal (Anas gibberifrons)	1,6
Black Duck (Anas supeciliosa)	1
Double-barred Finch (Poephila bichenovii)	1
Galah (Cacatua roseicapilla)	2,3,7
Australian Magpie (Gymnorhina tibicen)	2,3,6
Australian Raven (Corvus coronoides)	2,3
Black-faced Cuckoo-shrike (Coracina novaehollandiae)	2
Nankeen Kestrel (Falco cenchroides)	2,4
Eastern Rosella (Platycercus eximius)	3,6,7
Yellow-faced Honeyeater (Lichenostomus chrysops)	6
Yellow Thornbill (Acanthiza nana)	4
Buff-rumped Thornbill (Acanthiza reguloides)	1,4,6,7
Richard's Pipit (Anthus novaeseelandiae)	4
White-faced Heron (Ardea novaehollandiae)	6
Magpie Lark (Grallina cyanoleuca)	6
White-browed Babbler (Pomatostomus temporalis)	6
Common Bronzewing (Phaps chalcoptera)	6
Willie Wagtail (Rhipidura leucophrys)	6
Red-rumped Parrot (Psephotus haematonotus)	6
White-winged Chough (Corcorax melanorhamphos)	6,7
Jacky Winter (Microeca leucophaea)	1,2
Brown Treecreeper (Climacteris picumnus)	6
White-throated Treecreeper (Climacteris leucophaea)	7
Spotted Pardalote (Pardalotus punctatus)	7
Grey Fantail (Rhipidura fuliginosa)	7
Laughing Kookaburra (Dacelo gigas)	6
Brown Falcon (Falco berigora)	5
Emu (Dromaius novaehollandiae)	6,7
Pied Butcher Bird (Cracticus nigrogularis)	6

* Denotes study site observed (see Figure 5.7)

Mammals

(a) Native mammals

Short Beaked Echidna (Tachyglossus aculeatus)*
Brush Tailed Possum (Trichosaurus vulpecula)
Sugar Glider (Petaurus breviceps)*
Eastern Grey Kangaroo (Macropus giganteus)
Wallaroo (Macropus robustus)*
Red Necked Wallaby (Macropus rufogriseus)*
Swamp Wallaby (Wallabia bicolor)*
Common Wombat (Vombatus ursinus)*

(b) Introduced mammals

House Mouse (Mus musculus)
Feral Dog (Canis familiaris)*
Fox (Vulpes vulpes)
Cat (Felis catus)*
Horse (Equus caballus)
Cattle (Bos taurus)
Sheep (Ovis aries)
Rabbit (Oryctolagus cuniculus)
* Located by indirect evidence

Amphibians

Booroolong Frog (Littoria booroolongensis)
Spotted Grass Frog (Limnodynastes tasmaniensis)

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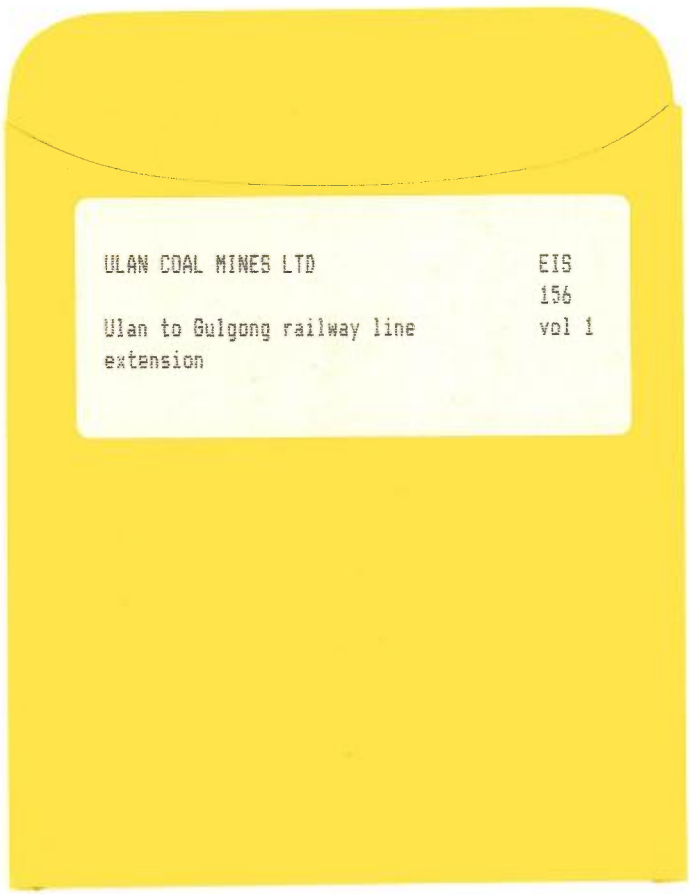
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