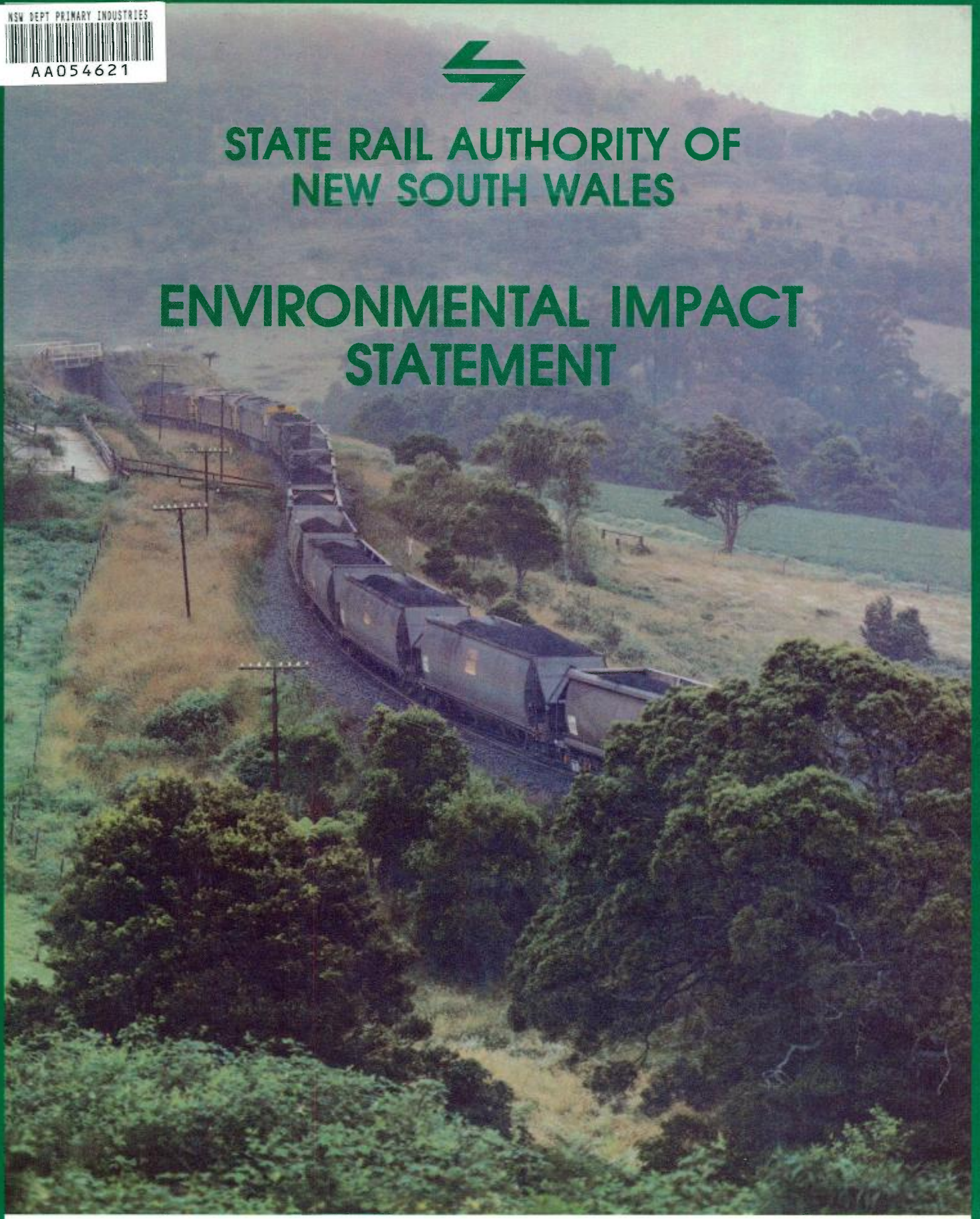
NSW DEPT PRIMARY INDUSTRIES
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STATE RAIL AUTHORITY OF NEW SOUTH WALES

ENVIRONMENTAL IMPACT STATEMENT



MALDON-DOMBARTON-PORT KEMBLA RAILWAY

EIS 209

es & Moore

VOLUME II
OCTOBER 1983

ENVIRONMENTAL IMPACT STATEMENT
MALDON - DOMBARTON - PORT KEMBLA RAILWAY

CERTIFICATE

This Environmental Impact Statement has been prepared in accordance with clauses 57 and 58 of the Environmental Planning and Assessment Act 1979 - Regulation.

Warren J. Atkinson
Principal-in-Charge
DAMES & MOORE

NOTHING IN THIS VOL FOR DMR ASSESSMENT.

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LIST OF ABBREVIATIONS

D&M	:	Dames & Moore
EIS	:	Environmental Impact Statement
GHD	:	Gutteridge, Haskins & Davey Pty Ltd,
MSW&DB	:	Metropolitan Water, Sewerage and Drainage Board
NSW	:	New South Wales
SCS	:	Soil Conservation Service
SKP	:	Sinclair Knight & Partners Pty Ltd
SPCC	:	State Pollution Control Commission
SRA	:	State Rail Authority
WHO	:	World Health Organisation

TECHNICAL ABBREBIATIONS

m	:	metres
cm	:	centimetres
km	:	kilometres
NNE	:	north north east
SSW	:	south south west
WWN	:	west west north
EES	:	east east south
NW	:	northwest
SE	:	southeast

1.0 INTRODUCTION

This Environmental Impact Statement has been prepared for the State Rail Authority of New South Wales in respect to the construction and operation of the Maldon - Port Kembla Railway. The Statement has been compiled in three volumes.

Volume I contains an assessment of the environmental impact of the construction and operation of the Maldon to Dombarton section of the Railway.

Volume II contains an assessment of the environmental impact of the proposed duplication of the existing Moss Vale to Unanderra Railway between Dombarton and Unanderra and of the existing line between Unanderra and the Port Kembla Coal Loader. IN OTHER WORDS, EAST OF TUNNEL AND EXCLUDING TUNNEL.

Volume III comprises technical appendices, on which basis the Impact Statement has been prepared.

The Environmental Impact Statement has been prepared in accordance with the requirements of the Environmental Planning and Assessment Act (1979).

SAME AS P.I VOL. I

This Environmental Impact Statement presents the results of the evaluation of the environmental viability of constructing and operating a duplicated railway line alongside the existing Moss Vale to Unanderra line between Dombarton and Port Kembla, within the existing SRA reserve. The purpose of upgrading and duplicating the line is to maintain the flow of trains from the line proposed from Maldon (near Picton) to Dombarton.

The existing line passes through relatively undisturbed bushland and adjoins the Mt Kembla State Recreation Area. It then passes into the residential area of Farmborough Heights, with trains travelling downhill to Undanderra. From Unanderra to Port Kembla is highly developed industrial, commercial and residential land.

NO DRG REF.

The construction period of the proposed new line and the duplicated line is estimated to be about 3 years.

The daily capacity of the line between Dombarton and Unanderra will comprise of current traffic plus an additional 24 trains in each direction from the Maldon - Dombarton line plus an additional possible 6 trains from Moss Vale. The single line section, Maldon to Dombarton has a capacity for 24 trains per day in each direction but this track capacity will not be reached until after the year 1990.

On current projections, the number of coal trains using the Maldon Port Kembla Railway, pre 1991 will average eight or nine trains per day in each direction, giving a total haulage of 6 to 6 1/2 million tonnes/annum.

Of these coal trains, one or two would load at West Bellambi (if operating) with a further one or two from Tahmoor and the remainder from the Burragorang, Glenlee Point and western coal fields.

As well as coal trains, the section from Dombarton to Unanderra would carry the trains proceeding to and from Moss Vale.

Current train traffic on the existing line varies between 4 and 8 trains per day. Trains will operate day and night. The line will be electrified but will be used by both electric and diesel-electric locomotives.

The existing environment is reported in terms of both the physical and social elements of the environment. The areas examined include; geology, land evaluation, soils, hydrology, water quality, climate and air quality, vegetation and wildlife, bushfires, archaeology, visual considerations, ambient noise, social and economic considerations and the local community.

The environmental impact of the duplicated line was assessed for both the construction and operational phase of the project. The majority of environmental impacts occur during the construction phase and are fairly short term impacts. The main areas of impact are increased noise, land stability, soil erosion and drainage, fires, vegetation and wildlife, visual effects and the local community. Impacts and mitigating measures are discussed in Section 7.0.

The need for an improved coal transportation system to Port Kembla and options to meet this need have been the subject of numerous studies over the past seven years. Coal from the Western District, Burragorang Valley District and South Coast is exported through Port Kembla and Balmain.

The export of coal is limited in part by the capacity of the Port Kembla Coal Loader. The background to the development of the coal loader is contained in the Environmental Impact Statements prepared by the Maritime Services Board (MSB) for Stages I and II of the loader.

Planning has proceeded for the construction of a new transport system to link the coal mines in the Western and Burragorang Valley Districts and some mines from the South Coast District, to the loader.

In October 1982, after detailed evaluation of alternative land transport proposals for export coal and after consultations with the South Coast Labour Council and the Coal industry, the Government decided in principle that a new rail link from Maldon to Dombarton would be constructed.

The duplication of the Dombarton - Unanderra - Port Kembla line is a part of this development.

3.0 GEOGRAPHICAL SETTING

The regional setting is shown in Figure 3-1. The proposed railway duplication will pass through two distinct physical regions; the escarpment and the coastal plain. From Dombarton, it passes along and below the middle and lower slopes of the Illawarra Escarpment. It enters the coastal plain at about the point it crosses the Princes Highway.

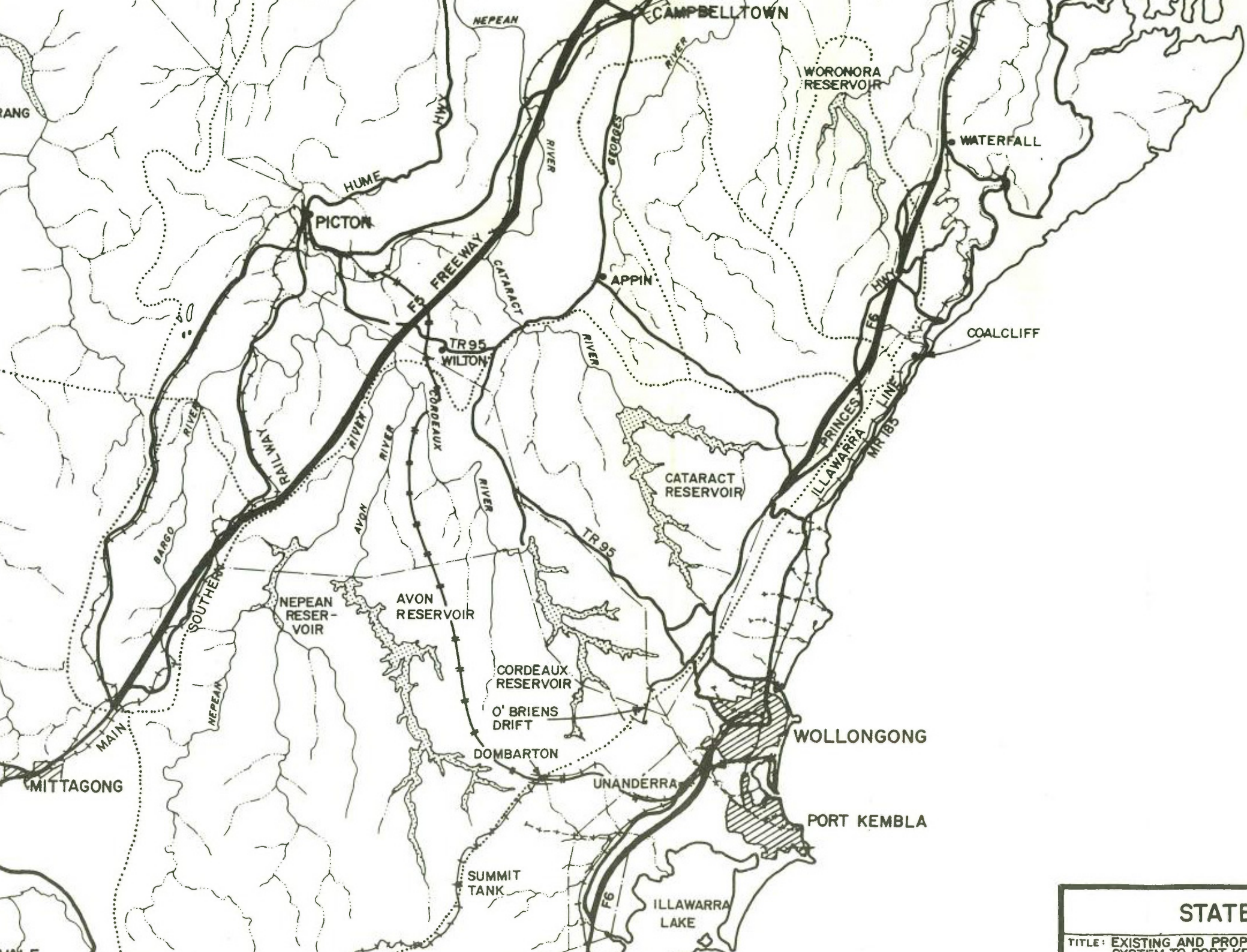
The existing railway line links Moss Vale, on the Southern Line, to Unanderra on the South Coast Line, a distance of 62 km. Unanderra is then linked by rail to the Port Kembla Coal Loader. The line is single track and serves, at present, to transport limestone to Port Kembla in 2 to 4 trains per day and for passenger transportation in a two carriage rail motor which makes one return trip per day.

Urban development has extended over much of the coastal plain and is first encountered by the line at Farmborough Heights just before the Princes Highway crossing. Following agricultural development in the late 18th and early 19th Centuries on the Wollongong plains, outcropping coal seams were exploited and a landscape of rural and mining villages established. This gradually grew into the City of Greater Wollongong which extends from Helensburg to Lake Illawarra covering an area of about 700 square kilometres.

Wollongong itself grew around the small open harbour north of Flagstaff Hill. Port Kembla, several kilometres south, outstripped Wollongong as a coal port and in the 1930's became the focus of one of Australia's largest industrial complexes with Australia's largest iron and steel works. The Tom Thumb lagoon between Wollongong and Port Kembla has been partly filled for the steel works and partly dredged to form the sheltered inner harbour through which coal, iron ore and steel are shipped.

Above Farmborough Heights, the lower slopes of the escarpment have been cleared for grazing. The steeper slopes remain as uncleared forest. The Mt. Kembla State Recreation Area has been established between Dombarton and Farmborough Heights.

Duplication of the railway line will not effect any areas of land planned as future residential areas in the draft Illawarra Regional Plan. Except through the established urban and industrial development between Farmborough Heights and Port Kembla, it passes through the escarpment and land planned for rural use.


CAMPBELLTOWN
NEPEAN
RIVER
WORONORA RESERVOIR
WATERFALL
HUME HWY
PICTON
GEORGES RIVER
F5 FREEWAY
CATARACT RIVER
APPIN
TR 95
WILTON
F6
COALCLIFF
PRINCES HWY
ILLAWARRA LINE
MR 185
CORDEAUX RIVER
AVON RIVER
BARGO RIVER
SOUTHERN RAILWAY
CATARACT RESERVOIR
NEPEAN RESER-VOIR
AVON RESERVOIR
CORDEAUX RESERVOIR
O' BRIENS DRIFT
DOMBARTON
WOLLONGONG
UNANDERRA
PORT KEMBLA
MITTAGONG
MAIN
SUMMIT TANK
ILLAWARRA LAKE
STATE RAIL
TITLE: EXISTING AND PROPOSED TRANSPO
SYSTEM TO PORT KEMBLA

4.0 BACKGROUND TO PROPOSED DEVELOPMENT

4.1 HISTORICAL BACKGROUND

The historical background of the decision to construct the Maldon to Port Kembla railway is provided in Section 4.1 of Volume 1.

4.2 TRANSPORTATION OPTIONS

Implicit in the decision to construct the new railway from Maldon to Dombarton was the need to upgrade the existing Moss Vale to Unanderra rail line. The new line from Dombarton through to Port Kembla, will provide sufficient capacity on for the additional traffic.

The alternative of not constructing the duplicated section of line between Dombarton and Port Kembla would result in limitation on the capacity of the Moss Vale - Unanderra and the proposed Maldon - Dombarton Line.

The proposed Maldon - Dombarton line will have a capacity of 24 trains per 24 hour period in each direction. The capacity of a line is governed by average speeds as well as by the distance apart of crossing loops. The existing line from Dombarton to Unanderra has a capacity of 13 trains per 24 hours in each direction. This includes those trains which run between Unanderra and Moss Vale.

When the projected traffic from the Moss Vale end and the Maldon end are combined to run on the Dombarton - Unanderra section, the existing single line falls far short of the required capacity and duplication is essential.

Alternative routes of the Maldon to Dombarton line are reviewed in Volume 1 and Appendix A. There is no route available from Dombarton to Port Kembla except along the present railway line.

4.3 ENVIRONMENTAL ASSESSMENT PROCEDURES

This Environmental Impact Statement is submitted pursuant to Clauses 57 and 58 of the Environmental Planning and Assessment Regulation, 1980. The N.S.W. State Government is preparing enabling legislation for the construction of the proposed new railway line and the proposal is subject to

assessment under Part V of the Environmental Planning and Assessment Act, 1979 with the State Rail Authority as Determining Authority.

Consultations have been held with the Director of the Department of Environment and Planning and his requirements, in relation to the contents of the Impact Statement, were issued. These requirements have been taken into account in the preparation of this document.

Consultations have also be undertaken with officials of the Department of Environment and Planning, Metropolitan Water Sewerage and Drainage Board, State Pollution Control Commission, Soil Conservation Service, National Parks and Wildlife Service, Maritime Services Board and Wollongong City Council during the preparation of the Environmental Impact Statement.

5.0 PROPOSED RAILWAY DEVELOPMENT

A full description of the proposed railway development is contained in Appendix A. This section summarises those aspects which are pertinent to the assessment of environmental impact. Figure 5-1 shows the route of the line and the location of major structures.

5.1 DESCRIPTION

The existing Moss Vale - Unanderra - Port Kembla Line will be duplicated from the junction with the new line to Port Kembla, a distance of approximately 15 km. The proposed work will follow the existing route and will be located within existing railway land, apart from bridge-works proposed at the crossing of the Princes Highway and a small area of land at Dombarton.

The new line will be constructed on the northern or up-side of the present line from Dombarton to just before Farmborough Heights. Investigations are being undertaken to determine the feasibility of locating the new line from that point through to the Princes Highway, on the southern or down-side. From the Princes Highway through to Port Kembla, duplication will generally be on the southern side.

Details of the method of duplication of the railway between Dombarton and Unanderra can only be determined following a geotechnical investigation of the slope stability of rock cuttings and the embankment widenings necessary for duplication. This investigation is being undertaken and will primarily indicate which side of the existing track duplication should occur.

No land clearing will be required outside the SRA reserve except for a small area adjacent to the Dombarton Loop. A number of new or reconstructed bridges and causeways will be required. These include:

- a new bridge at the Dombarton Loop;
- the replacement of two or three small access bridges over the line in the Farmborough Heights area;
- a new road over the rail bridge at Drummond Street at Mt. St Thomas;

- a new bridge over American Creek;

- a possible bridge structure over a potentially unstable area in the upper gully of Dapto Creek.

A major structure will be required for the railway line at the crossing of the Princes Highway. At present there is a level crossing with flashing lights at this point. It is proposed to construct bridgeworks to allow the Princes Highway to cross the railway line at that point. It is described in Section 5.4. The alternative of a rail over road crossing is being investigated.

The level crossing at old Five Islands Road will be closed following agreement with Wollongong City Council. Traffic has alternative access via the new Five Islands Road system and the Princes Highway.

The existing line then would be duplicated from Dombarton to Port Kembla. a distance of 15 kilometres and both lines electrified. The cost of this section of work is estimated as $32 million. This estimate is based on preliminary study work which is estimated to have an accuracy of +25% to -15%.

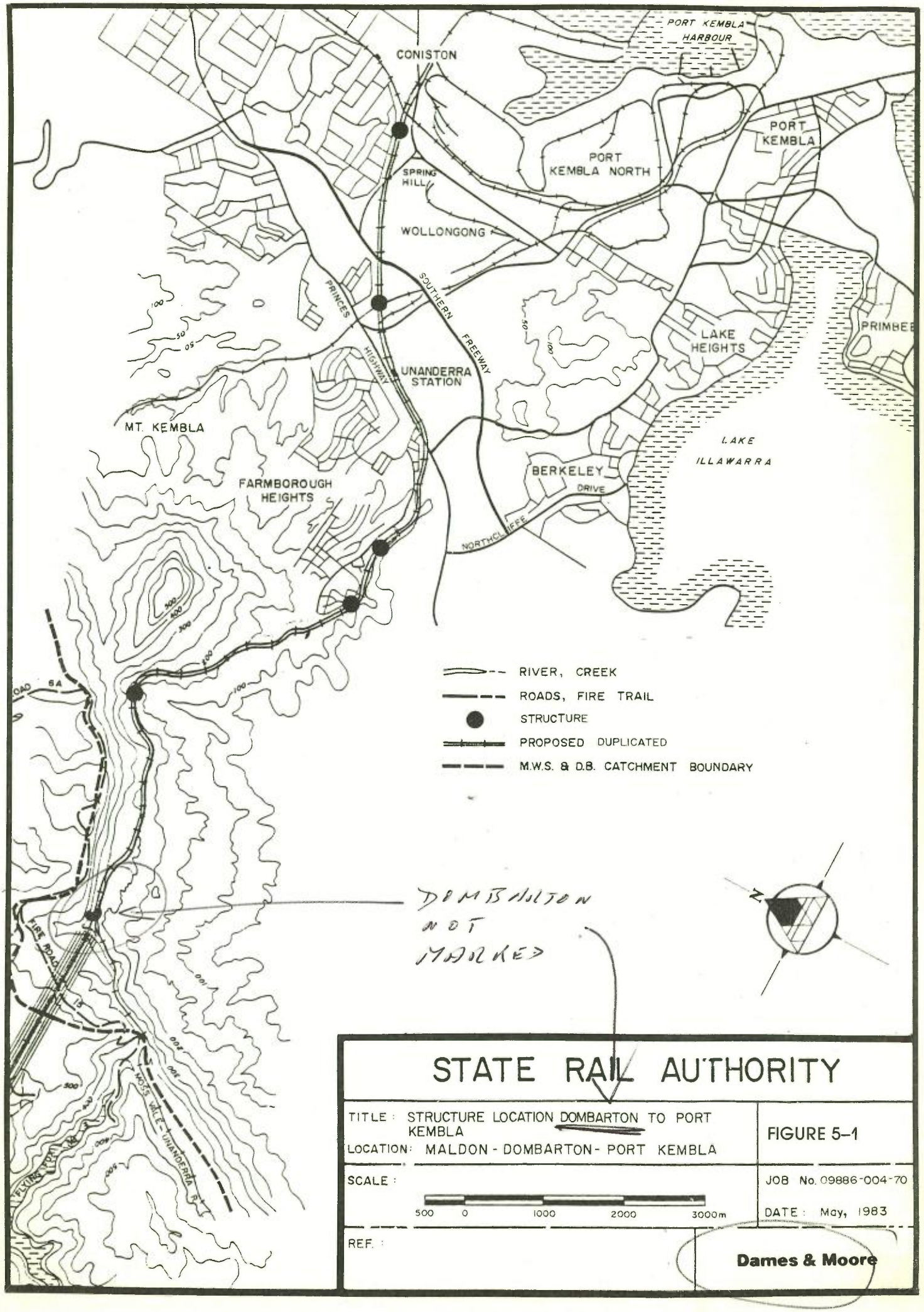
5.2 ALTERNATIVES

There are no feasible alternatives to the duplication of this line. No other suitable route exists from Dombarton to Port Kembla.

The alternative location of the new line on the north and south sides of the existing line was examined. It is preferable, to minimise land disturbance and costs, to locate the line on the Northern side of the existing route. In the Farmborough Heights area this would result in the construction activity and the new line being located closer to local residences. An investigation is being undertaken to determine the feasibility of locating the new line on the southern side.

There is no alternative to line location from Unanderra to Port Kembla.

A number of alternatives are being examined for the crossing of the Princes Highway. Detailed design of the currently preferred road over rail bridge will make provision for



STATE RAIL AUTHORITY

TITLE: STRUCTURE LOCATION DOMBARTON TO PORT KEMBLA

LOCATION: MALDON - DOMBARTON - PORT KEMBLA

FIGURE 5-1

SCALE: 500 0 1000 2000 3000m

JOB No. 09886-004-70

DATE: May, 1983

REF.:

Dames & Moore

continued access to the four houses situated alongside the Highway near the crossing. One house, an old gate keepers cottage owned by the SRA will have to be removed.

5.3 DOMBARTON LOOP

The Dombarton crossing loop was opened in May 1943 to relieve congestion over the difficult 19 km Unanderra - Summit Tank section of the line to Moss Vale. It is a complex crossing loop. Its unique arrangement is designed to allow for the passing of trains travelling in both directions and to provide relatively flat standing room for waiting trains. The line in that area climbs almost continuously at grades of 1 in 30.

Figure 5-2 illustrates the proposed development of this loop to allow for duplication and the increased traffic from and onto the Maldon - Dombarton line.

Alternative layouts were considered but all involved a more complex system incorporating additional crossovers. The re-development will be undertaken chiefly within the existing SRA land reserve.

5.4 CROSSINGS & BRIDGES

5.4.1 PRINCES HIGHWAY CROSSING

As discussed in Section 5.1, duplication of the Dombarton to Port Kembla line and the additional traffic anticipated on the line as a result of the new line will require the construction of a structure at the crossing of the Princes Highway.

Final design of this crossing has not been undertaken pending further consultations with relevant State Government Authorities, Wollongong City Council and local residents. Figures 5-3 and 5-4 show the preliminary railway layout at the crossing for a road over rail structure.

The small former gate-keepers cottage alongside the line and Highway will have to be removed. It is SRA property. Other properties close to the crossing will have their access altered as direct access to the Highway will be restricted.

5.4.2 OTHER CROSSINGS

A number of replacement small bridges will be required, as indicated in Section 5.1.

5.5 ENGINEERING DESIGN

The new line will be constructed with continuous welded rail on concrete sleepers. It will be constructed by modern engineering methods and in accordance with accepted design criteria. These criteria are summarised in Appendix A.

5.5.1 ELECTRIFICATION

This section of the line will be electrified. The system is illustrated in Appendix A. No decision has yet been made on the voltage or type of current for this electrification.

The advantages of the electrification of the complete railway from Maldon to Port Kembla including the Main Southern Railway between Glenlee and Maldon Junction are as follows:

- completes the electrification network between the Main Southern Railway and the Illawarra Line to allow through-running of electric locomotives;

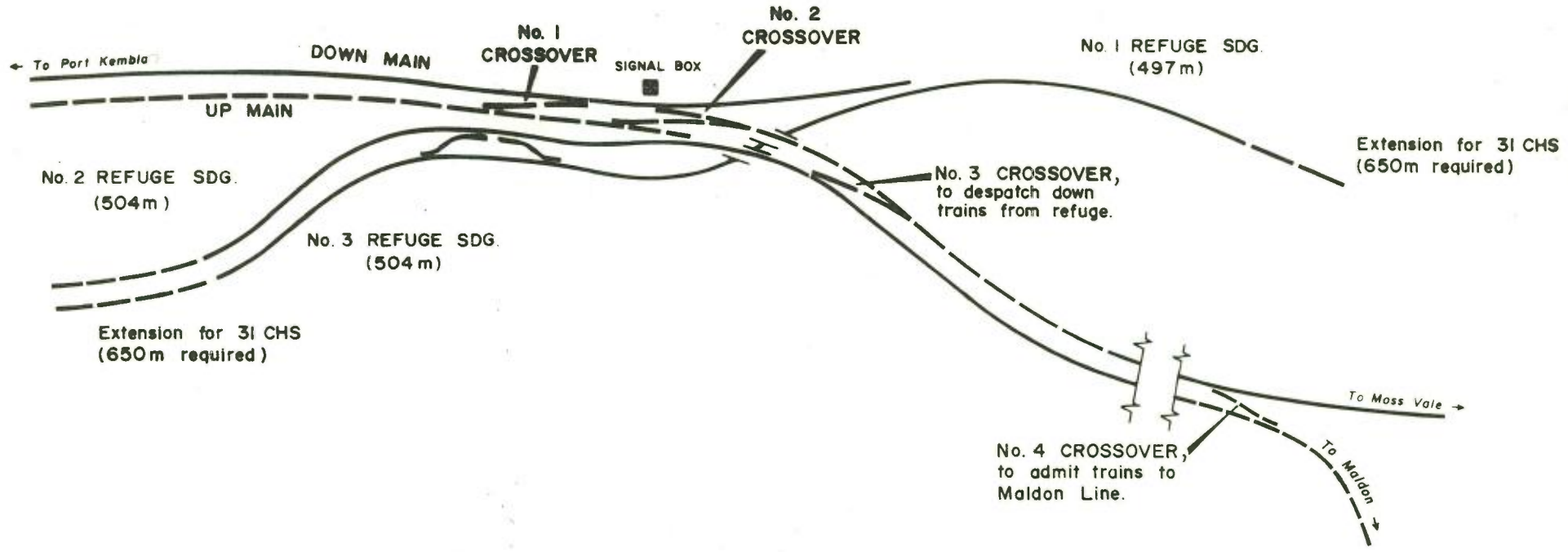
- allows through-running of electric-hauled coal trains from Lithgow to Port Kembla via Maldon without the need for changing to diesel traction at Enfield or Campbelltown.

  A locomotive exchange in the Campbelltown area would require exchange sidings, staff to operate it and tie-up of locomoties waiting for trains.

  Exchanging locomotives at Enfield would mean diesel traction running under electric overhead wires from Endfield to Glenlee.

  Also, noise levels from the diesel locomotive would be greater than the electric locomotive through the south western suburbs;

- electric locomotives are presently being built to haul coal to Port Kembla;

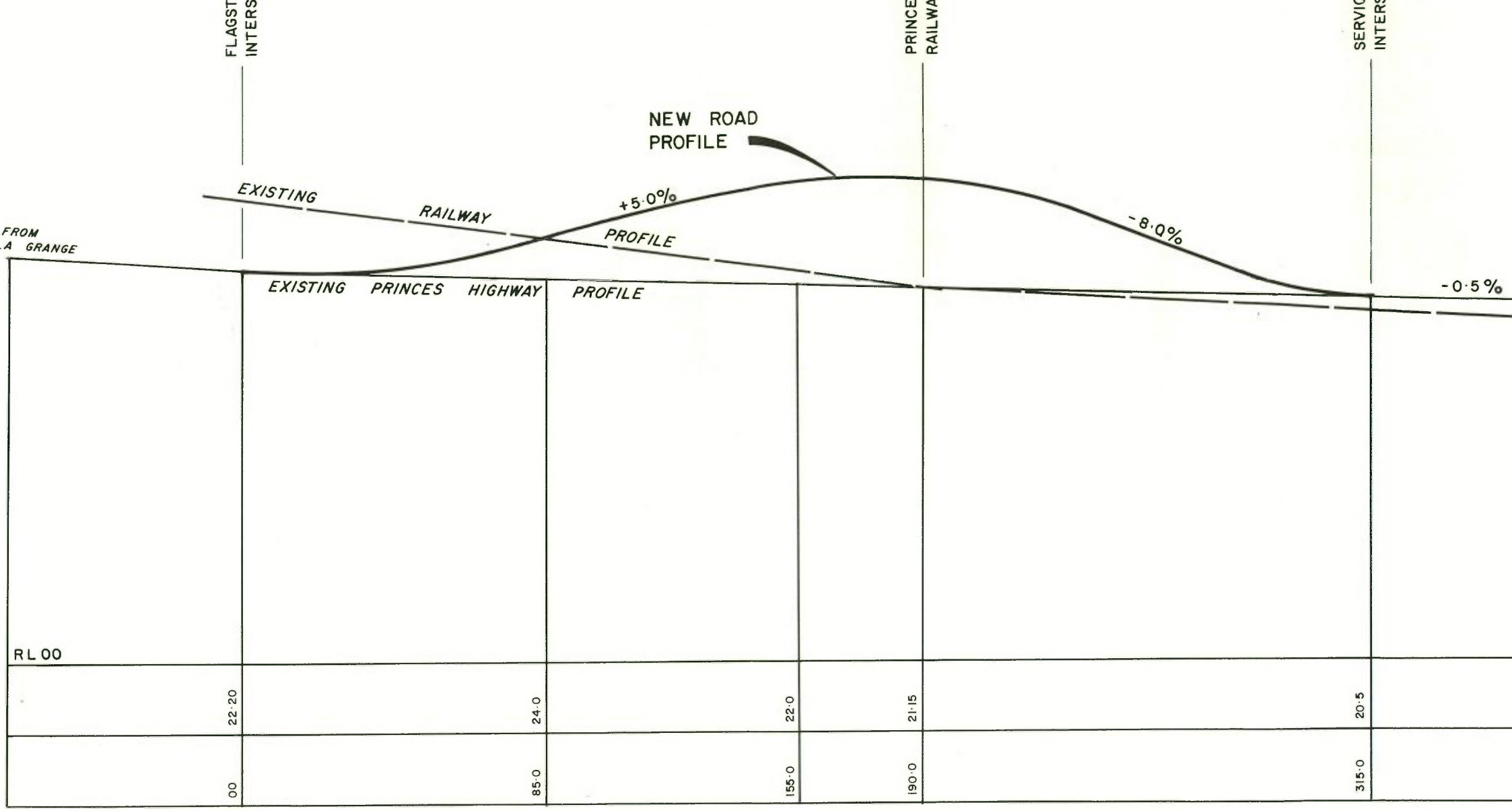


Existing Track

Proposed Track

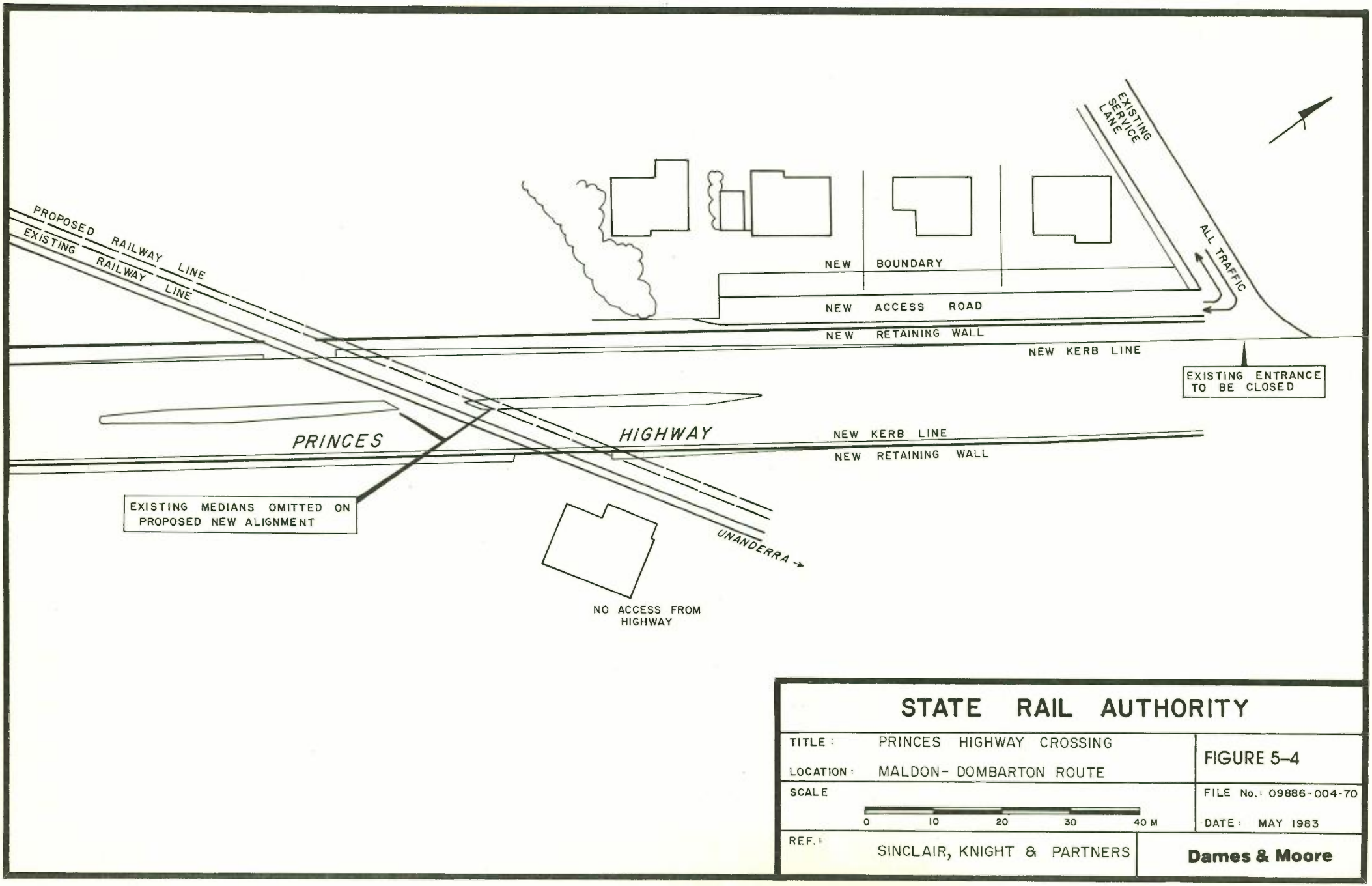
STATE RAIL AUTHORITY

TITLE DOMBARTON LOOP - EXISTING LAYOUT LOCATION : DOMBARTON - PORT KEMBLA	FIGURE 5-2
SCALE NOT TO SCALE	JOB No 09886-004-70 DATE MAY 1983
REF : S R A	Dames & Moore



STATE RAIL A

TITLE: PRINCESS HIGHWAY CROSSIN



STATE RAIL AUTHORITY

TITLE : PRINCES HIGHWAY CROSSING	FIGURE 5–4
LOCATION : MALDON - DOMBARTON ROUTE	
SCALE 0 10 20 30 40 M	FILE No. : 09886-004-70
	DATE : MAY 1983
REF. : SINCLAIR, KNIGHT & PARTNERS	Dames & Moore

- electric locomotives are more environmentally acceptable due to quieter and cleaner operating. These locomotives are also more energy efficient.

Aerial supply lines will originate at the Electricity Commission sub-station on Port Kembla Road and then travel up Port Kembla Road and Flinders Street to the nearest rail track.

The supply aerials will generally follow the boundary of the proposed and existing railway reserves. Aerials will be supported by single poles and no metal towers will be required.

Sub-stations will be located at about 8 km intervals. The exact location depends on detailed design. The sub-station located near to the upper section of Farmborough Heights will be situated so as to minimise visual obstruction.

Sectioning huts will be located approximately midway between sub-stations. Figure 5-5 illustrates the design of the sub-station. Figure 5-6 illustrates typical mast design. Distance between masts varies depending on the route and terrain. However, in general, masts are located 30 - 40 metres apart.

5.5.2 EARTHWORKS

Earthworks will be required along most of the route. The shoulder width for the duplicated line and access tract will be increased by about 6 metres. This will require cutting and stabilization of slopes crossed by the existing line and some areas of fill below the line. Earthworks are discussed further in Appendix A.

Proposed batter slopes are shown in Figure 5-7.

5.5.3 TRACK STRUCTURE

The track structure comprises rails, sleepers, fastenings and crushed rock ballast. The typical structure is as shown in Figure 5-8.

Australian Standard rail will be used. The rails will be manufactured at Whyalla, South Australia and transported to the site by rail. They will be continuously welded and laid into standard gauge.

The sleepers will be pre-stressed concrete manufactured off the site, probably in Denman, N.S.W. They will be transported by rail to a major stacking area in the Port Kembla - Unanderra district. This area will be about one hectare in size with a rail siding access. Rails will also be stored in this area. Both sleepers and rails will be loaded at this point onto wagons and transported by rail to the track laying machine on-site.

The ballast consists of crushed rock under and around the sleepers to distribute vertical and horizontal loads from the sleepers. This will be obtained from existing ballast quarries in the area.

5.5.4 STATIONS AND SIDINGS

No additional railway passenger stations will be provided along the duplicated line.

The existing loops at Dombarton and Unanderra will be upgraded.

5.5.5 SIGNALLING SYSTEM

The signalling system for the proposed line and duplication section will be track - circuited automatic colour light signals and will form part of the SRA Centralised Traffic Control (CTC) Network.

The Network will be dual controlled from Campbelltown and Wollongong.

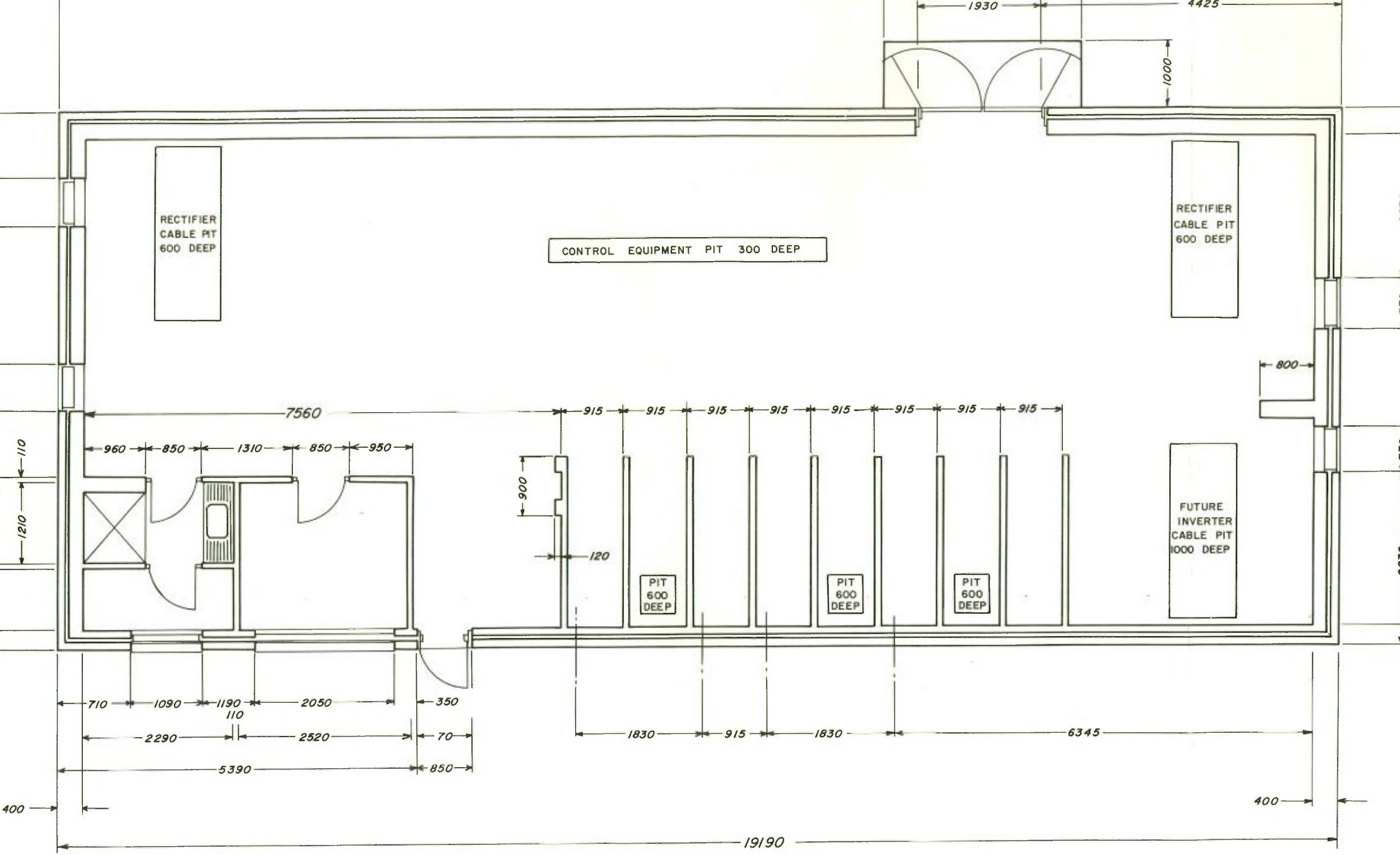
The Wollongong Centre will control the section from the exchange siding at Wilton to Port Kembla.

Power supply to signalling will be fed by two supply systems, a main and back-up.

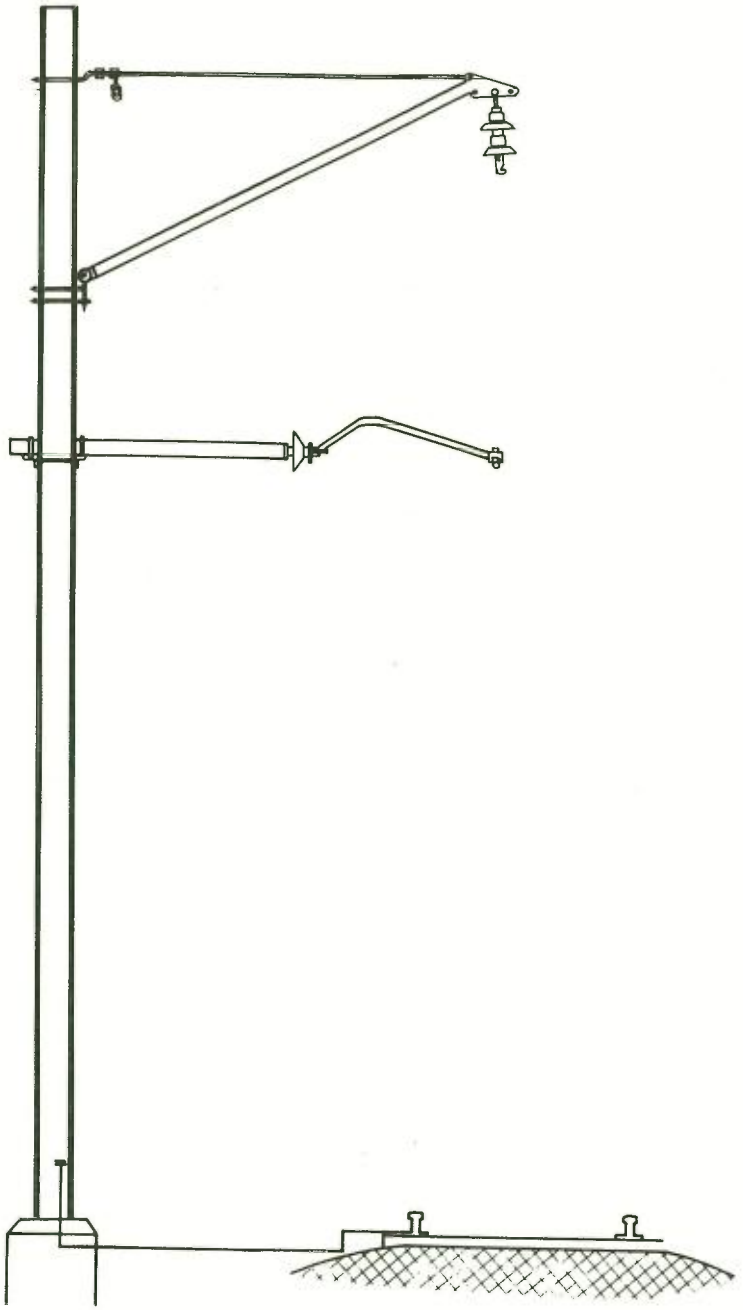
Cables along both sections of the line will be located underground and will be installed concurrently with line construction.

5.5.6 FENCING

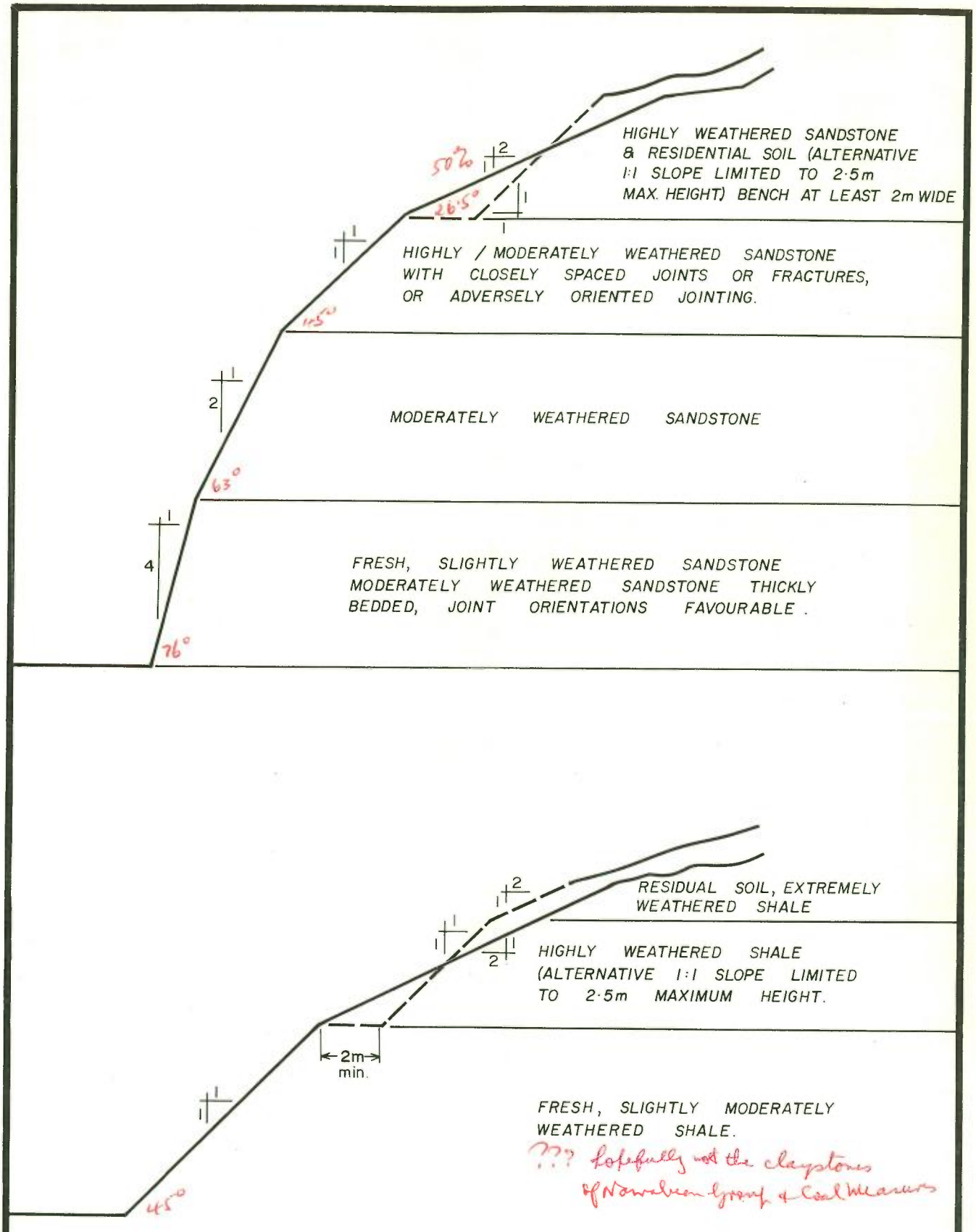
The new line between Dombarton and Port Kembla will be fenced except where special considerations apply at escarpments and



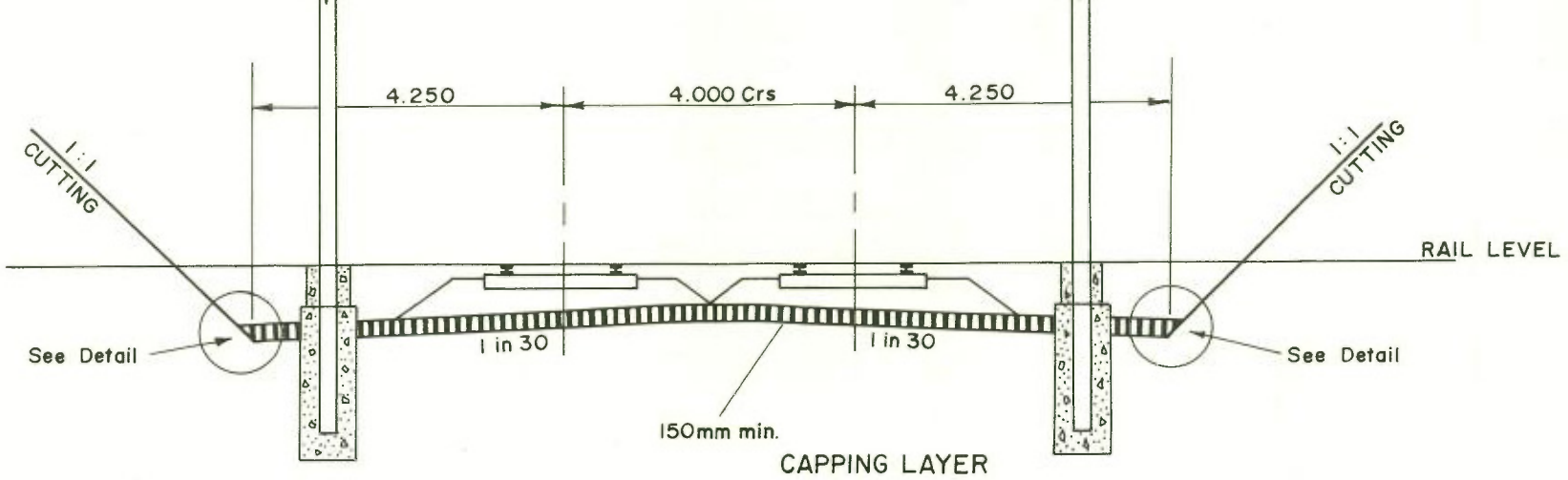
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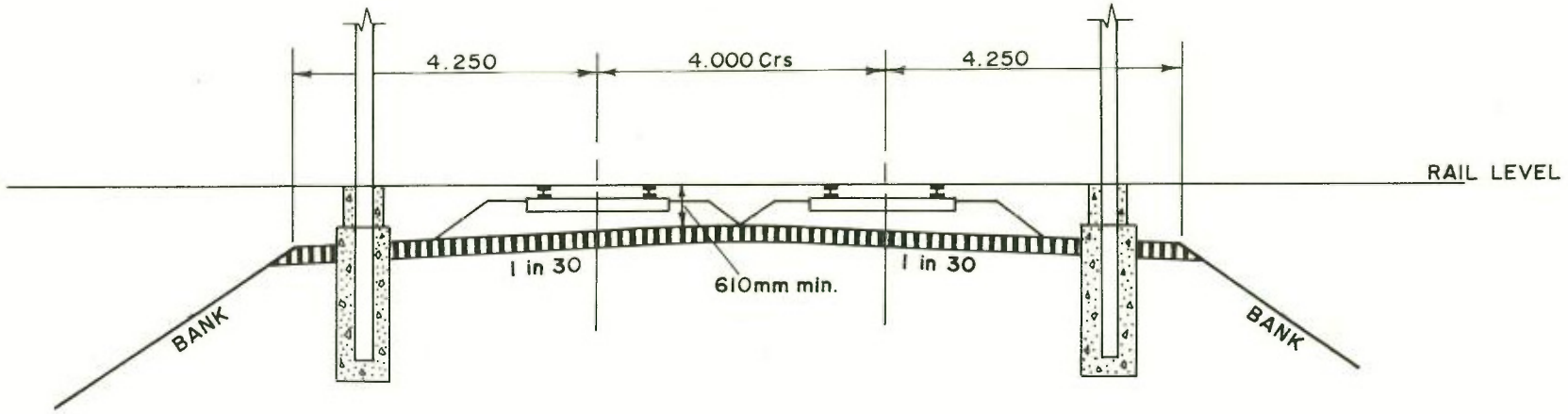


STATE RAIL AUTHORITY		
TITLE : OVERHEAD WIRING - TYPICAL CROSS SECTION LOCATION : MALDOM - DOMBARTON ROUTE		FIGURE 5–6
SCALE		FILE No. : 09886-004-70 DATE : MAY 1983
REF. : SRA		Dames & Moore

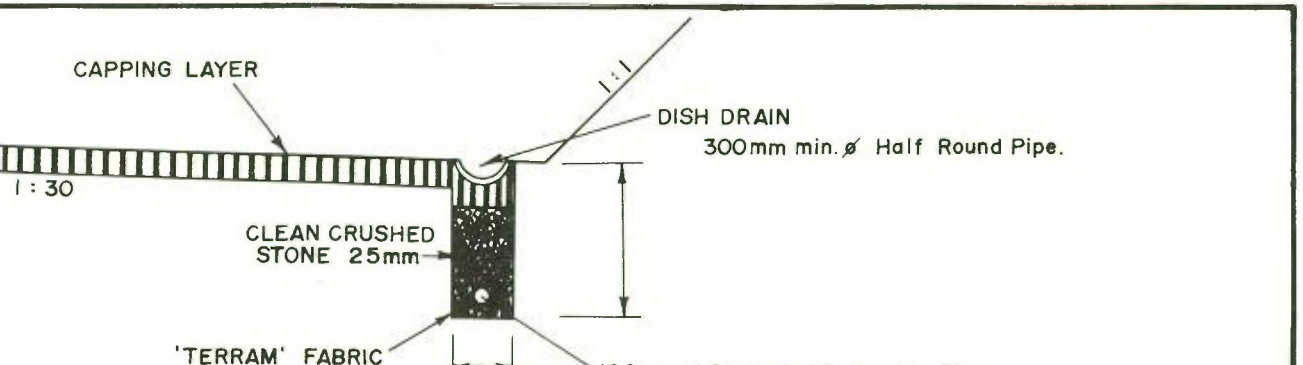


STATE RAIL AUTHORITY		
TITLE : RECOMMENDED BATTERS FOR ROCK CUTTINGS LOCATION : MALDON - DOMBARTON ROUTE		FIGURE 5–7
SCALE		FILE No.: 09886-004-70 DATE : MAY 1983
REF.:		Dames & Moore





NOTE: SUB SOIL DRAIN TO
IN CUTTINGS WHERE
MATERIAL IS CLAY
THERE IS ANY POSS
SUBGRADE BECOMING
WORKING CONDITION
THIS WILL BE DETE
SOILS INVESTIGATI



STATE RAIL AUTHORIT

TITLE: TYPICAL CROSS SECTION

deep gullies. The line is classified by Act of Parliament as unfenced and there is no obligation for the SRA to fence it.

5.6 RAILWAY CONSTRUCTION

5.6.1 SCHEDULE AND EMPLOYMENT

The construction programme for this work and the construction of the Maldon-Dombarton line, as shown in Figure 5-9 indicates a desirable construction period of about 3 years.

Figure 5-9 sets out employment levels during this construction period. It is anticipated that construction workers will be drawn from local areas.

Construction operations will not require the erection and maintenance of construction camps for living quarters. Most of the construction workforce will come from nearby areas or will be able to reside in nearby urban areas, including Wollongong.

However, contractor's working and storage areas will be required along the route. These will be fenced and catch drains provided to intercept dirty run-off water. The location of these areas will be decided in consultation with local landholders and other appropriate authorities, including the National Parks & Wildlife Service and Forestry Commission.

5.6.2 CLEARING

On the section of the duplicated line between Dombarton and Farmborough Heights, clearing will be on a selective basis with due regard to environmental and stability requirements.

Because of restrictions on open burning, cleared timber will be disposed of by other means.

5.6.3 BRIDGES

Detailed engineering design for the bridges at American Creek and Drummond Street have not been completed at this time. Consequently a detailed outline of the construction activities associated with these works cannot be provided.

The SRA do not envisage any major disruption to existing traffic flows during construction of bridges and crossings.

5.6.4 EARTHWORKS

To provide for the widening of the shoulder to accommodate the second railway line, earthworks must be conducted in the form of cut and fill. Where possible heavy earthmoving equipment will be used for this purpose. As far as practicable, this equipment will be restricted to the route during the construction period.

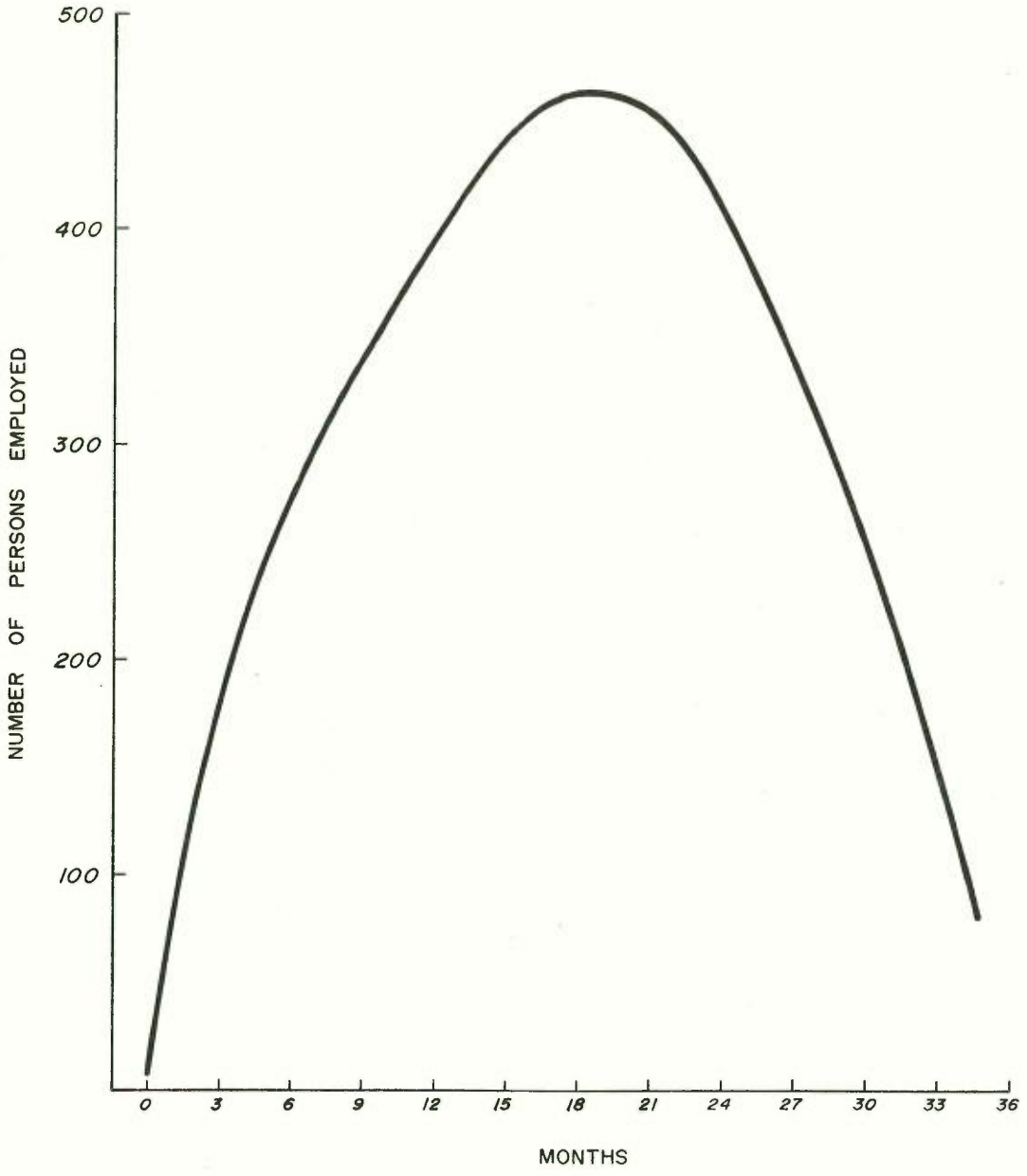
Most of these earthworks are an extension of works carried out for the existing line and are of a relatively simple nature.

Excavating techniques used will be suited to the geological formation being excavated. Where explosives are used, the charges will be so proportioned and placed, that they will not loosen material outside the excavation profile. Many deep cuttings are rippable by dozer, a technique which will be adopted wherever feasible. No explosives are expected to be used in the Farmborough Heights to Port Kembla area except for minor "popping" of any floating boulders encountered. Site drilling will determine this.

Excavated material from the cuttings and tunnel will be used as fill for embankments. The excess material will be placed on embankment batters to flatten their angle and so reduce the erosion potential.

The new track structure will be constructed by a mechanised track-laying procedure based on large machines handling rails, sleepers and fastenings. Rails and sleepers are loaded onto the track laying machine directly from rail wagons positioned on the recently laid rail behind the laying machine. These wagons will have transported the rails from the major stacking area at Port Kembla - Unanderra described in Section 5.5.3. The work will be carried out during day-time hours.

Construction activity will be planned and undertaken in such a manner as to cause minimal disruption to existing traffic on the line. The line in the area adjacent to the eastern tunnel portal will be constructed on the up-side or northern side of the existing line. Excavation of the escarpment



STATE RAIL AUTHORITY	
TITLE: ON-SITE CONSTRUCTION WORKFORCE LOCATION:	FIGURE 5-9
SCALE:	JOB No: 09886-004-70 DATE: September, 1983
REF: S.R.A.	Dames & Moore

face will be undertaken with minimal interference to the existing rail line ensuring the safe running order of trains. Normal SRA safety procedures will apply.

5.6.5 DRAINAGE AND EROSION CONTROL

Construction and operation of the proposed railway must be within the requirements regarding water quality of the SPCC. Consultations have been held with SPCC officials concerning these requirements. The environmental control officer on the project management team will be required to liaise with the civil design team and relevant authorities to ensure that drainage and erosion control are to acceptable environmental criteria and standards. Once design of the proposed railway is completed, it will be vetted by the SPCC to check that their requirements have been incorporated in the design. The Soil Conservation Service will be consulted in respect to soil erosion control.

Throughout the entire works, a drainage system will be established which at all times will drain water directly off or keep water away from the structures, formation, access roads, cuts and fills, and work areas. Areas once cleared of vegetation will be susceptible to erosion. Erosion control measures and drainage diversion will be implemented at the commencement of clearing to minimise soil movement.

Apart from provision of adequate drainage to channel water away from exposed earth, other soil erosion measures will also be undertaken. Details of proposed measures are discussed in Appendices A and B.

5.6.6 CAPPING AND BALLASTING

After finishing the cut and fill to the required profile and establishment of the formation to the specified grade, a natural or processed gravel capping will be placed on the formation. If suitable capping material cannot be gained from the cutting and tunnelling works, it will be obtained from readily-available commercial sources.

Ballast material will be placed over the capping into which concrete sleepers will be laid. Ballast will be obtained from existing railway quarries at Bombo, supplemented, if necessary, from existing commercial supplies.

5.6.7 ACCESS ROADS

The present access road to the line will be upgaded. As required, new all-weather access roads from public roads will be established for both railway line construction and maintenance purposes. The routes have not yet been determined but will be in accordance with the requirements of relevant Authorities and local landholders.

5.6.8 VIBRATION

During construction, where blasting occurs, seismic monitoring of vibration is undertaken to keep vibrations at a safe level to avoid architectural and structural damage to nearby cottages and houses. A series of trial charges will establish the maximum level of blasting that can occur. Blasting will not occur outside normal working daylight hours and only if alternative means of excavation can't be economically achieved.

5.6.9 RELATIONS WITH ADJOINING LAND USERS

During construction of the proposed railway line every effort will be made to avoid causing inconvenience to land users adjacent to the line. Construction activities will not conflict with the normal activities of these land users. Every effort will be taken to prevent pollution of waterways, dams and grass areas which may in turn affect stock.

5.6.10 LAND ACQUISITION

It will be necessary to acquire a small portion of land in the Dombarton Area to enable the extension of the two arms of the loop.

Negotiations will be undertaken with the landholders.

5.7 RAILWAY OPERATIONS

Enabling legislation in repsect to the railway is currently being prepared. Timing of construction will be co-ordinated with the Maldon - Dombarton section of the line. Construction is expected to commence in December 1983 for completion about three years later, subject to satisfactory funding arrangements.

5.7.1 CAPACITY

The daily traffic down the duplicated line between Dombarton and Unanderra will comprise of current traffic on that line, plus the additional possible maximum of 24 trains in each direction from the Maldon - Dombarton line plus an additional possible 6 trains from Moss Vale. Current traffic on the existing line varies between 4 and 8 trains per day. Trains will operate during the day and night.

The single line section, Maldon to Dombarton has a capacity for 24 trains per day in each direction but this track capacity will not be reached until after the year 1990.

On current projections, the number of coal trains using the Maldon Port Kembla Railway, pre 1991 will average eight or nine trains per day in each direction, giving a total haulage of 6 to 6 1/2 million tonnes/annum.

Of these coal trains, one or two would load at West Bellambi (if operating) with a further one or two from Tahmoor and the remainder from the Burragorang and western coal fields.

As well as coal trains, the section from Dombarton to Unanderra would carry the trains proceeding to and from Moss Vale.

Coal trains will be comprised of 31 x 100 tonne gross (CHS) wagons hauled by two or three locomotives depending on the type. The total length of train will be about 610 metres.

Until electrification is extended south from Maldon Junction, trains from Tahmoor, Bargo and any from Moss Vale using the new line will be hauled by diesel-electric locomotive to Port Kembla.

5.7.2 TRAIN OPERATIONS

Coal trains will be powered by two or three main line locomotives. They will be diesel/electric or electric depending or origin.

Locomotives will be equipped with two braking systems, each individually capable of stopping the train. The SRA's standing instructions on train braking will apply to this line to ensure safe train operations.

5.7.3 VIBRATION

Measurements of ground vibration resulting from the passage of coal trains of similar size to those proposed have been made at distances of 10 and 22m from the track at sites geologically similar to the Farmborough heights area. (Peter Knowland and Associates, 1983).

On the basis of these measurements it is expected that ground vibrations will be below the threshold of perception even at the closest residences and well below levels used by the SPCC to protect sensitive buildings.

Trees will be grown along the railway easement. The roots reduce ground vibration and the rest of the tree reduces air vibrations during train operation.

5.7.4 MAINTENANCE

Preventative maintenance of rolling stock will be undertaken at Port Kembla. Other maintenance will be carried out at Lithgow or Enfield depending on the type of work required. No expansion of existing facilities will be required.

As the new line is constructed of concrete sleepers, minimum track maintenance will be required. Regular line inspections as currently undertaken will be continued. There will be a track maintenance staff of about six employed and they will be based at Unanderra.

5.7.5 VEGETATION CONTROL

As part of safety requirements and action taken to minimise bushfire risk, vegetation is controlled adjacent to railway lines. The provision of clear vision and an uninterrupted line of sight for the locomotive driver is of prime concern. Vegetation is controlled chiefly by chemical treatment or mechanical clearing and cutting.

Because of the sensitivity of the undeveloped areas between Dombarton and Unanderra, special care will be taken to ensure a satisfactory vegetative cover is retained adjacent to the line. Vegetation control along the line adjacent to residential and commercial areas from Farmborough Heights to Port Kembla is important from a visual concern and for safety purposes.

5.7.6 BUSHFIRE CONTROL

Fire hazard reduction in or adjacent to urban areas is generally achieved by mowing and cutting vegetation. In rural areas burning-off is the most common practice.

Burning-off practices are carried out in accordance with the Bush Fire Act 1949.

Sufficient suitable fire fighting equipment will be kept on the site ready for use at all times. Any fire bans will be strictly observed. Existing access tracks will be maintained or improved and will continue to provide access for fire control.

6.0 EXISTING ENVIRONMENT

This section summarises those aspects of the existing environment pertinent to the environmental assessment of the proposed rail duplication. A more detailed review of the existing environment is contained in the Appendices.

6.1 LAND STUDIES

6.1.1 GEOLOGY

Geological details are contained in Appendix B. The generalised geology of the region in which the proposed new railway line is located has been mapped by the Department of Mineral Resources. A generalised stratigraphic sequence is presented in Figure 6-1.

The railway line is located within the southern part of the Sydney Basin. The dominant surface lithology is sandstone of the Hawkesbury Sandstone Formation.

Underlying the Hawkesbury Sandstone are the shales, claystones and sandstones of the Narrabeen Group. Underlying this Group are the Illawarra Coal Measures which consist of sandstones, shales and coal seams. At the base of the escarpment the Illawarra Coal Measures are covered by a combination of material eroded from the escarpment and material deposited from marine sources.

Coal measures frequently outcrop in railway cuttings along the lower slopes of the escarpment. Downhill towards Unanderra, the rail line crosses onto the rolling denuded hills of the Pheasants Nest Formation (lower Illawarra Coal Measures) comprising volcanic sandstone, shale, carbonaceous claystone, tuff and coal.

It then crosses the Budgong Sandstone which is also heavily denuded at about the location of the Princes Highway.

Although the southern margin of the Sydney Basin is recognised as being one of two areas of high seismic activity within N.S.W., the order of magnitude and frequency of occurrence of earthquake activity is low when compared to other parts of the world with high seismicity. This aspect is discussed in Appendix A.

The area between Dombarton and Unanderra traversed by the railway line is generally classified as being stable. The moderately sloping hills, ridges and sideslopes at the base of the escarpment present no difficulties.

The areas of broad talus deposits on the lower and middle slopes are essentially stable although some railway cut batters have frequently failed in the past because of excessively steep slopes and unfavourable groundwater conditions. Filling for the existing railway has also failed in some areas.

A specific unstable area is located at the head of the Dapto Creek gully. At this point, the railway is on a narrow formation on a steep hillslope. On the uphill side, the cutting is in bedrock with deep fill below the downhill shoulder of the track.

6.1.2 SOILS

As a part of EIS procedure, the soil resources of the area traversed by the route were documented using a combination of aerial photograph interpretation and field survey. Soils are described in Appendix B.

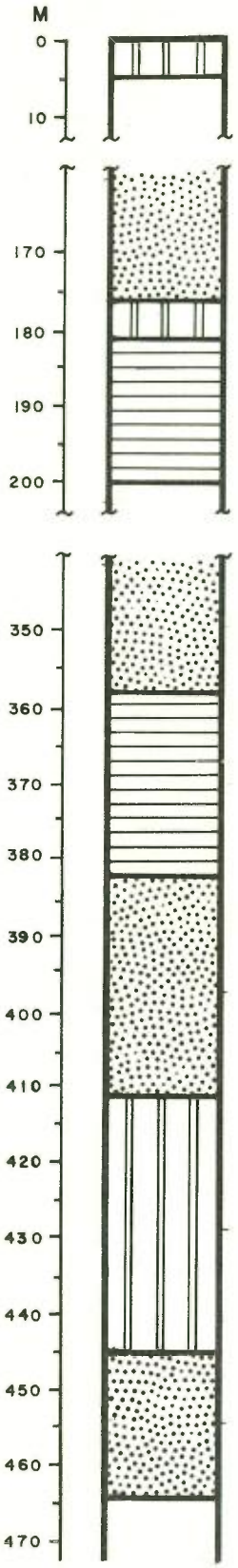
There is a strong relationship between geology, terrain and soil type. Consequently, the soil types identified are discussed in terms of their occurrence in the landscape.

6.1.3 EXISTING SOIL EROSION

Within the areas of the State Forest and State Recreation Area, the general status of erosion is very low due to the uncleared and undisturbed state of the surface.

Surface runoff and erosion rates within these areas greatly increase following bushfires. Following the destruction by fire of surface litter and vegetation, the sandy, non-coherent surface soils of the Catchments are subjected to severe erosion.

On grazing lands below the escarpment, erosion is inhibited by the maintenance of a good protective cover of improved pasture. However, where overgrazing or insensitive track location has occurred, erosion can be severe in the light-textured, porous soils that occur.



WIANAMATTA GROUP	5 m	Occurs as capping on crests of hills. Predominantly shale but with some siltstone.
HAWKESBURY SANDSTONE	170 m	Occurs over most of the area. Consists of massive bedded quartzose sandstones with minor shale lenses and bands.
GOSFORD FORMATION	6 m	Shales with a few beds of quartz lithic sandstone.
BALD HILL CLAYSTONE	19 m	Claystones with a few bands of lithic sandstones.
BULGO SANDSTONE	158 m	Lithic and quartz lithic sandstone with minor shales.
STANWELL PARK CLAYSTONE	24 m	Claystone, siltstone and minor lithic sandstones.
SCARBOROUGH SANDSTONE	29 m	Quartz lithic and lithic sandstones and lithic conglomerate.
WOMBARRA SHALE	34 m	Shales and siltstones
COAL CLIFF SANDSTONE	19 m	Quartz lithic sandstone with minor shale lenses.

NOTE – EXCEPT FOR THE WIANAMATTA GROUP, DEPTH MEASUREMENTS ARE FROM DIAMOND DRILL HOLE I-32, WHICH IS 350 m WEST OF THE WEST CLIFF-4 SHAFT.

STATE RAIL AUTHORITY

TITLE: STRATIGRAPHIC SEQUENCE - LOCAL GEOLOGY LOCATION: MALDON - DOMBARTON ROUTE		FIGURE 6–1
SCALE		JOB No. 09886-004-70 DATE: MAY 1983
REF.: GHD		Dames & Moore

6.1.4 LAND EVALUATION

The primary characteristics of the physical environment which combine to define a land unit include landform, slope, geology, soils and vegetation.

Two distinct land units have been identified covering the area relevant to this section of the railway line. They are:

- coastal escarpment;
- coastal slopes.

The characteristics of each unit are descibed in Table 6.1.

6.1.5 LAND USE

The existing land uses along the proposed railway can be grouped into these categories:

- largely undisturbed land over the Illawarra Escarpment;
- pastoral land below the escarpment;
- urban land between Farmborough Heights and Port Kembla.

The SRA will ensure that the construction of the railway line results in a minimum of interference to the land users, both natural and introduced, of the area.

The duplicated section between Dombarton and Unanderra passes alongside the Mt. Kembla State Recreation Area.

Illawarra Escarpment

Two major land uses occur within this area. Below the surface of this area are the Illawarra Coal Measures which have been won by underground mining techniques for many years. In many places, the location of tunnels and shafts of old mine workings are unknown, and these have contributed to the instability of the escarpment. New underground coal mines have recently commenced operations or are planned for the future in this area.

The State Recreation Area, located on the escarpment slopes between Dombarton and Farmborough Heights, provides attractive natural areas and views over the coastal plain.

TABLE 6.1

CHARACTERISTICS OF LAND UNITS

COASTAL ESCARPMENT	
TOPOGRAPHY	
Landform	- Erosional; cliffs leading to talluvium slopes[1]
Slopes	- Cliffs are near vertical to vertical, talluvium slopes range from 15° to 50°; average approximately 25°
Relief	- Maximum: 250 m
Drainage	- Ill defined, mostly sheet flow with a few ephemeral streams. Seepage zones are present
GEOLOGY	
Classification	- Hawkesbury Sandstone, Narrabeen Group, Illawarra Coal Measures
Lithology	- Sandstone, siltstones, claystone
SOIL	
Parent Material	- Sandstones, siltstone, claystone, colluvium
Surface Texture	- Fine sand clay loam; light sandy clay loam; sandy clay loam; loam, fine sandy
Profile Depth	- Ranges from a few millimetres to many metres on colluvial deposits; average of around 0.5 m
Great Soil Group	- Red Podzolic
VEGETATION	- Essentially undisturbed subtropical rain-forest

1 Talluvium slopes consist of talus and colluvium mixed in varying proportions

TABLE 6.1 (cont)

COMMENTS	- This unit has a past history of slope instability. Extreme care is necessary to prevent mass movement. Drainage needs to be very efficient, and cut and fill limited.
COASTAL SLOPES	
TOPOGRAPHY	
Landform	- Erosional; hilly, heavily dissected terrain
Slopes	- Range from gentle to very steep (3° - 35°) with an average of about 10°. Slope profile is irregular due to structural characteristics
Relief	- Maximum: 200 m
Drainage	- Aligned in a NW - SE direction, all streams are ephemeral
GEOLOGY	
Classification	- Quaternary talus, Illawarra Coal Measures
Lithology	- Sandstone, siltstone, claystone, talluvium
SOIL	
Parent Material	- Sandstone, siltstone, claystone, talluvium
Surface Texture	- Fine sandy clay loam; light sandy clay loam; sandy clay loam; loam, fine sandy
Profile Depth	- 30 cm to 3 m; average about 70 cm
Great Soil Group	- Red Podzolic
VEGETATION	- Mostly cleared for grazing and urban development - grassland; subtropical rainforest is present adjacent to the drainage lines
COMMENTS	- Areas which have been cleared are prone to mass movement. Surface soils need to be protected because of high runoff volumes that can occur.

This is the only area of recreational interest near the existing line.

Figure 6-2 illustrates the terrain and vegetation adjacent to the existing line in this area.

Grazing Land

Land use in this area is primarily rural activity including:

- horse and cattle studs;
- cattle grazing;
- rural residential blocks.

Most of the agricultural pursuits are restricted to gently sloping terrain. On steeper slopes much of the land remains uncleared. Soils developed on the sandstone are so poor that this area remains essentially undisturbed.

Urban Development

Residential development has taken place alongside the existing Moss Vale - Unanderra railway line in the Farmborough Heights to Unanderra area. Housing comprises a combination of very modern brick houses on the higher areas and older style Housing Commission fibro houses lower down the ridge and beside the Princes Highway.

Between Unanderra and Port Kembla, the line passes through land developed or to be developed for commercial and industrial use.

6.2 HYDROLOGY AND WATER QUALITY

Hydrology and water quality aspects are discussed in Appendix C.

6.2.1 HYDROLOGY

Along the section of existing line between Dombarton and Farmborough Heights, drainage is into Robins and Dapto Creeks which flow into Mullet Creek and then into Lake Illawarra. The area between Farmborough Heights and the coal loader drains into Allens Creek and the inner Harbour. Hydrological data for these streams are not available.



FIGURE 6–2

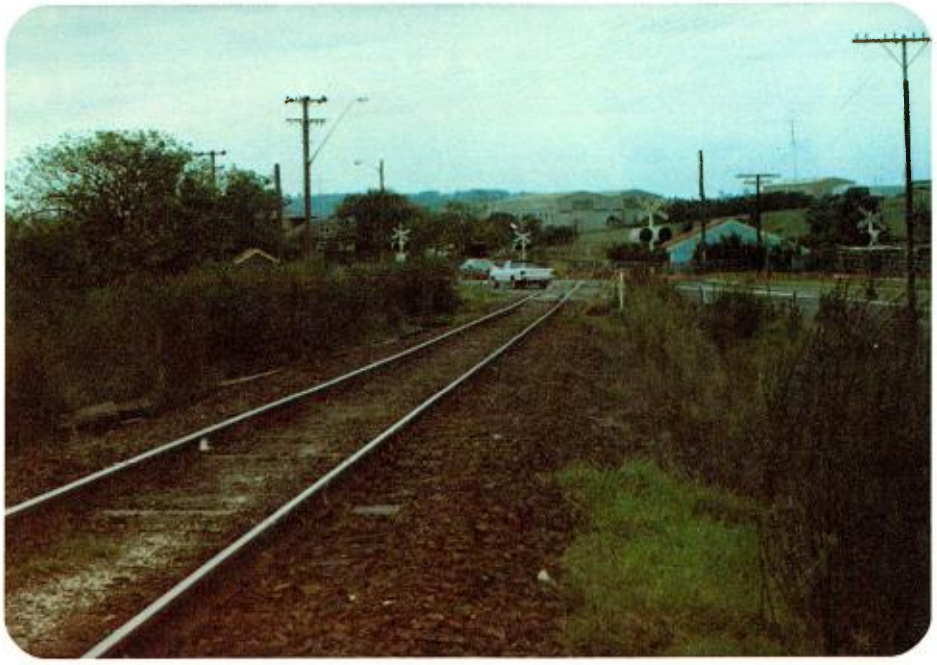


FIGURE 6–4

In the area underlain by Hawkesbury Sandstone the soils are sandier and surface absorption of water is much more rapid. However the underlying sandstone strata are only slightly permeable and, after prolonged rain, the surface soil becomes saturated and runoff occurs.

The groundwater hydrology of the area is in general poorly known. From geological observations it appears that the near surface, groundwater situation is complex. Groundwater probably occurs in numerous small, unconnected or "perched" zones separated by layers of low permeability.

Groundwater is not utilized in this area. It is unlikley that there is any potential for significant groundwater development, unless more substantial aquifers are present at depths below the coal seams.

6.2.2 WATER QUALITY

Water quality information for the streams draining the area of the rail route is generally lacking. Water in local streams is of good quality, being suitable for drinking water and other purposes.

There is no monitoring being undertaken of water quality of these streams. Monitoring during construction and operation is discussed in Section 7.0 of this Volume.

6.3 AIR QUALITY

Between Dombarton and Port Kembla, the route will run parallel to existing track running, initially through about 6 km of rural land then through 4 of 5 km of low density residential land (Farmborough Heights, Allans, Unanderra, Cobblers Hill, Mount St. Thomas and Consiton) and finally into the heavily industrialized area of Port Kembla. All of these areas are influenced by emissions of particulates, sulphur dioxide and oxides or nitrogen from the Port Kembla industrial area.

According to SPCC data, particulate deposition rates (insoluble solids) in Port Kembla typically lie in the range of 1 to in excess of 40 g/(m^2.month), and air quality with respect to particulates thus ranges from acceptable to extremely poor, depending on meteorology and the industrial

activity for the period of interest. SPCC monitoring data from Mt St. Thomas and Coniston also indicate highly variable deposition rates which would lead to air quality being classed as acceptable to poor. Although there is no deposition data, the residences further from the industrial areas, such as Farmborough Heights, could be expected to enjoy good to acceptable air quality.

SPCC data for Port Kembla shows that although concentrations of acid gases have on occasions exceeded WHO standards, for the majority of the time concentrations are well below acceptable concentrations. Although direct data is not available for most of the route, it is likely that air quality will be well within accepted levels for acid gases for most of the time. Further information is provided in Appendix D.

6.4 VEGETATION AND WILDLIFE

The route from Dombarton to Farmborough Heights traverses the lower but still relatively steep slopes of the Illawarra escarpment for most of its length, reaching land with gentler slopes at Farmborough Heights. A vegetation survey was conducted of areas adjacent to the existing rail route. The results of this survey are discussed in Appendix E.

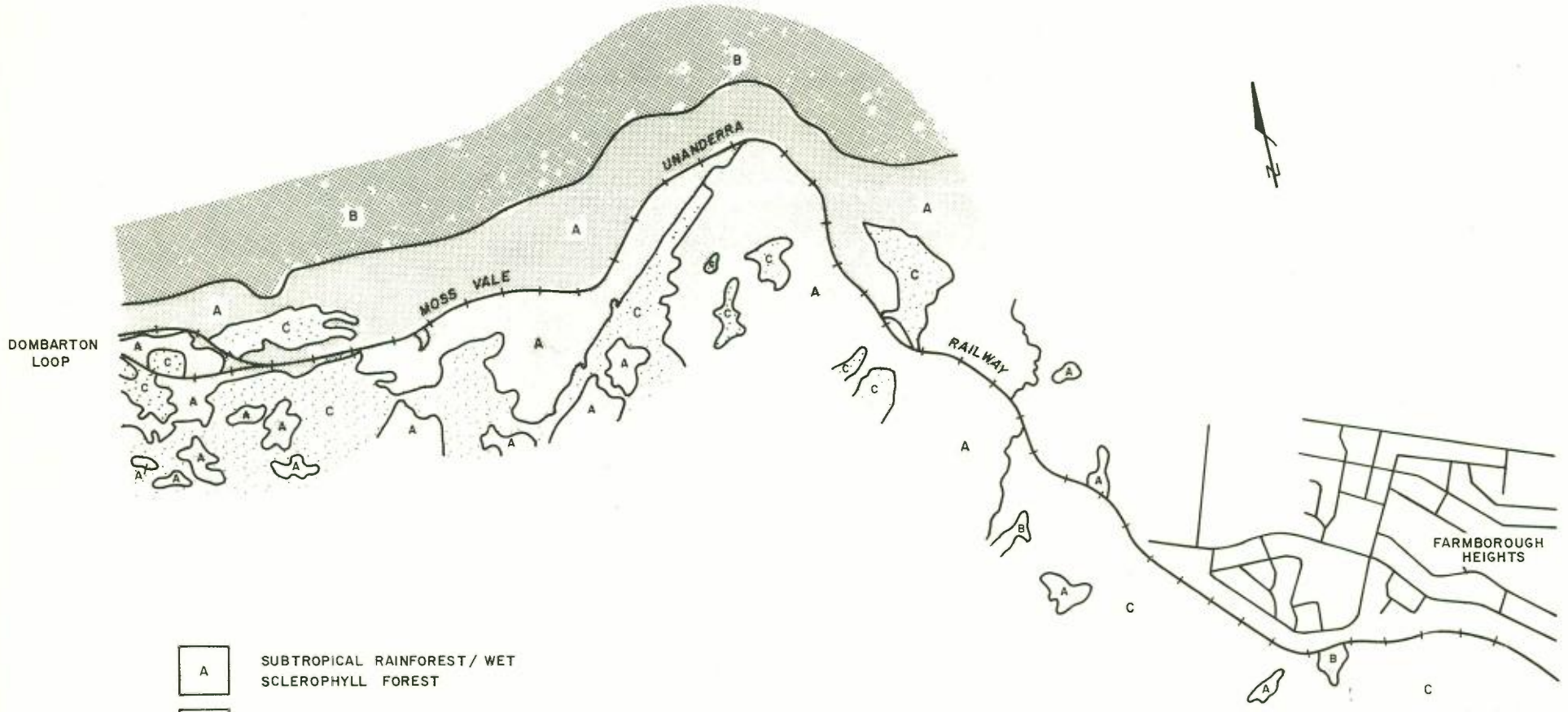
6.4.1 MAIN VEGETATION TYPES

Figure 6-3 displays three mapping units; rainforest/wet sclerophyll forest, dry sclerophyll woodland and forest, and cleared/largely cleared land.

Subtropical rainforest and wet sclerophyll forest

Subtropical rainforest occupies 30-40% of the area mapped in Figure 6-3 as the combined unit. The largest continous stands of rainforest are immediately to the east and north of Dombarton and in the valley of Dapto Creek. Rainforests elsewhere are present as a mosaic of small and large forests.

The condition of the rainforest above the rail easement is good. Palms are rather thinly dispersed, however seedlings are frequently encountered. Below the rail easement, land clearing has reduced the extent of remnant stands and the



STATE RAIL AUTHORITY

TITLE:	DOMBARTON to FARMBOROUGH HEIGHTS - VEGETATION UNITS	FIGURE 6-3
LOCATION:	MALDON - DOMBARTON ROUTE	
SCALE	1 : 25,000	FILE No.: 09886-004-70
		DATE : MAY 1983
REF.:	T.J. Fatchen & Assoc.	**Dames & Moore**

remnants tend to contain a higher proportion of alien species.

The wet sclerophyll forest merges into the subtropical rainforest, and shares many of the rainforest species particularly along its margins. It reaches its best development, however, on the small ridges about the easement.

Dry Sclerophyll Woodland and Forest

Upper slopes of the Illawarra escarpment carry an open forest of Black Ash (Eucalyptus sieberi) and other species. This vegetation is discussed further in Appendix E.

Small remnant stands of lowland forest are present near Farmborough Heights. These have not been examined as they are beyond the area of impact of the rail duplication.

Cleared Land and Induced Open Woodlands

Much of the land on the escarpment lower slopes, below the rail easement, has been partially cleared. This has resulted in a mosaic of completely treeless land, open woodlands with wet sclerophyll or rainforest trees as remnants, and areas where the rainforest canopy has been partly opened.

6.4.2 Protected Species

One specimen has been identified, taken from wet sclerophyll forest at Dombarton as Rudder's Box (Eucalyptus rudderi). Pryor (1982) records this species as one of relatively limited extent which may be threatened in the near future with continued land clearing.

Species protected under the N.S.W. National Parks and Wildlife Act are listed in Appendix E. The ferns listed are common within the rainforest.

Bangalow Palm is restricted to the gully of Dapto Creek, with the nearest individual occurring well beyond the area of immediate impact. Several individuals of Cabbage Palm are present next to the existing easement. None of the species noted appear in the threatened species lists of Leigh et al. (1981).

6.4.3 SIGNIFICANT HABITATS AND VEGETATION TYPES

Rainforests generally assume considerable conservation significance beause of the small proportion of the State's area they occupy. However, the stands intersected by the railway are only a small portion of the total rainforest remnants along the base of the Illawarra escarpment, and they do not have particular regional importance. They do however contribute to the retention of floristic and habitat diversity in the locality, and may be of considerable local value for the maintenance of wildlife partially or wholly dependent on the presence of at least islands of rainforest. For example, the Dapto Creek stand provides both roosting and food sources for a large colony of Red Flying Fox.

6.4.4 WILDLIFE

The route between Dombarton and Farmborough Heights passes through wildlife habitats that are representative of the region and are relatively undisturbed. There has been some affect of clearing of the middle and lower slopes of the Illawarra.

As a result of previous patterns of land use, and the management regime imposed on the area by the Forestry Commission and National Parks and Wildlife Service, a suitable situation has been created for the herbivorous marsupials.

No account was made of terrestrial wildlife around Farmborough Heights and on the Wollongong Plain as most of this area across which the railway line will pass, has been largely cleared of natural habitats. In this area, study results outlined in Appendix F in relation to the MWS&DB Catchment Area are relevant.

6.5 ARCHAEOLOGY

An archaeological survey was undertaken of the route of the proposed duplication from Dombarton to Port Kembla in the preparation of this EIS. This survey and its results are described in Appendix G.

Although archaeological sites had not been recorded on the Illawarra Escarpment in the vicinity of the proposed route,

during discussions with Ms. Caryll Sefton of the Illawarra Prehistory Group, it was advised that rock shelter sites have been recorded by them in the escarpment further to the north.

It was therefore considered worthwhile checking the escarpment area from Dombarton Loop to the coastal plain.

Archaeology sites and relics have not been encountered in or near the proposed railway. Poor ground visibility in the area of sub-tropical forest may be partly responsible for this result. Certainly, urban development of the low-lying land has had a negative impact on site frequency and visiblity.

6.6 VISUAL CONSIDERATIONS

The proposed duplication will follow the present railway route. While the areas through which this route passes possess significant visual characteristics, the presence of the existing route has mitigated against some of these and the route itself must be viewed as part of the visual nature of the area.

Between Dombarton and the southern edge of Farmborough Heights the route passes along the middle and lower slopes of the Illawarra Escarpment. Because of the steepness of some of the slopes there is a strong feeling of exposure at some points along the line. The undisturbed nature of the natural vegetation on the steeper slopes provides a sense of remote wilderness. The rainforest areas are particularly attractive.

Along this section of the route however, the major visual influence is the towering escarpment above the line of the route and coastal plain panorama below.

From observation points on the plain the present line is not visible, except the occasional view of a cutting face in the distance. In general it is hidden by the vegetation on both sides. From viewing points on the escarpment, the line is partially visible, in particular the area around the Dombarton Loop. From these points, it provides an interesting and not unattractive contrast to the undisturbed nature of the escarpment on virtually the boundary with agricultural development on the lower slopes.

The Farmborough Heights area is an attractive residential area with good quality subdivision and housing, particularly on the upper slopes. From the plain, viewing points along the Princes Highway and from residential and industrial areas, the line is clearly visible passing alongside the residential and industrial areas. As described in Appendix I, some residences in Farmborough Heights have views to the coast or southwards. Some of those look over the line which is screened by vegetation or in a cutting. A number of residences look directly onto the line from the rear of the house.

The line crosses the Princes Highway south of Unanderra. Figure 6-4 illustrates the existing crossing and adjacent residences.

From the Princes Highway through to Port Kembla, the line passes through commercial and industrial developments to the Port. The existing rail network is an integral part of the character of this area.

6.7 AMBIENT NOISE

The existing acoustic environment has been investigated during a 24-hour monitoring programme, and additional measurements have been made at Farmborough Heights, which has been identified as being the most noise sensitive part of the route. Details are provided in Appendix H. To supplement the physical noise measurement data for Farmborough Heights, an attitudinal survey, designed in part to determine attitudes to the existing noise climate, has also been undertaken and is described in Appendix I. Figure 6-5 illustrates the location of buildlings along the railway line in this area.

6.7.1 MONITORING PROGRAMME

The 24-hour noise survey was conducted on the 3rd and 4th of March, 1983. Table 6.2 describes the locations of the monitoring sites and Table 6.3 summarises the results of the study.

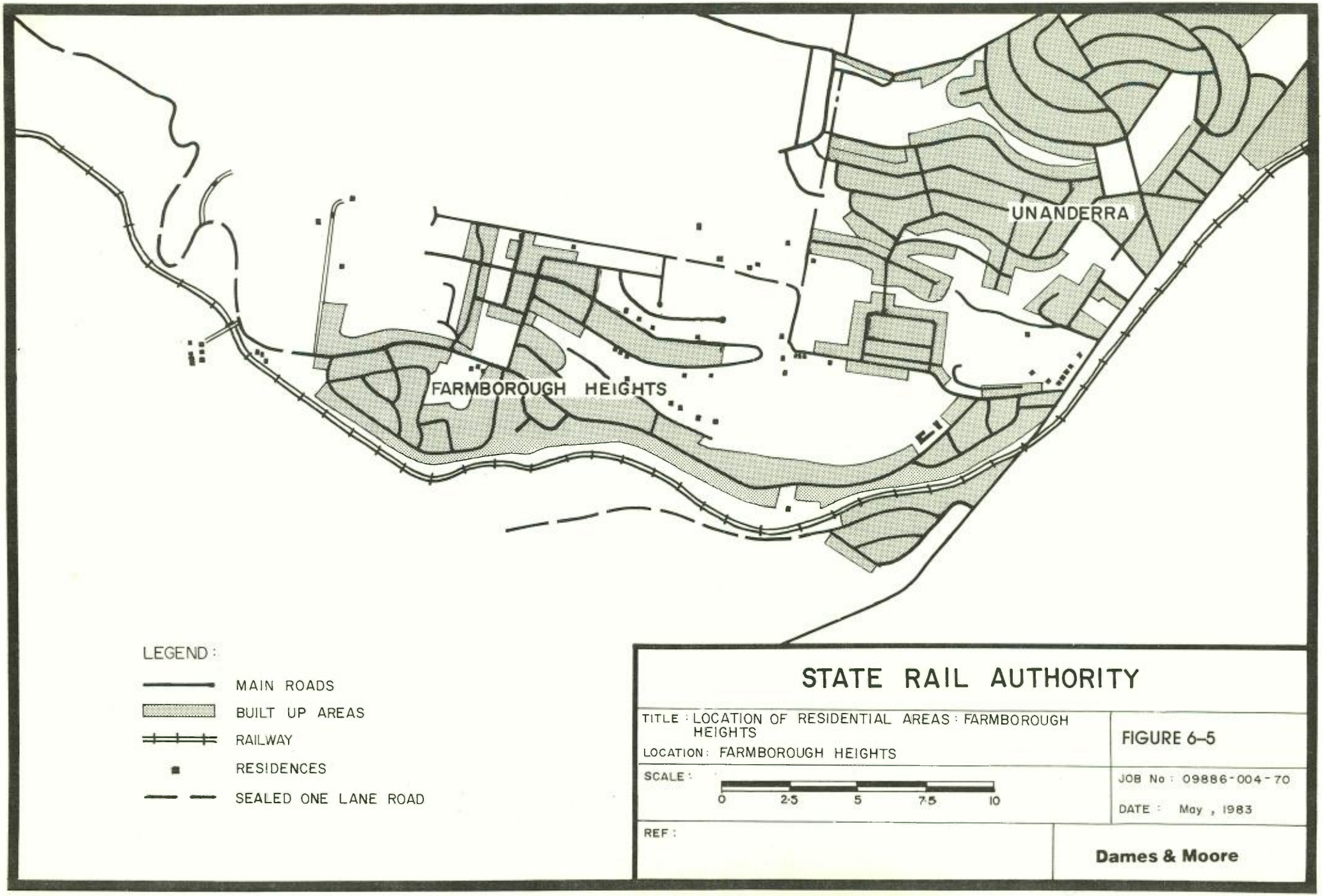

UNANDERRA
FARMBOROUGH HEIGHTS
LEGEND :
MAIN ROADS
BUILT UP AREAS
RAILWAY
RESIDENCES
SEALED ONE LANE ROAD
STATE RAIL AUTHORITY
TITLE : LOCATION OF RESIDENTIAL AREAS : FARMBOROUGH HEIGHTS
LOCATION : FARMBOROUGH HEIGHTS
FIGURE 6-5
SCALE :
0 2·5 5 7·5 10
JOB No : 09886-004-70
DATE : May , 1983
REF :
Dames & Moore

TABLE 6.2

DESCRIPTION OF NOISE MONITORING SITES

SITE	DESCRIPTION
1	On the north side of road leading from the Freeway to Maldon approximately 15 metres from the centre of the lane carrying Wilton-bound traffic. Ground surface was compacted earth.
2A	Approximately five metres from the road edge on the eastern side of Peel Street and about 100 metres from the Wilton-Appin Road. Ground surface was grass.
2B	Approximately 15 metres from the centre of the Appin-bound carriage way of the Wilton-Appin road and five metres from the eastern side of Camden Street. Ground surface was grass.
2C	As for (2B) but 34 metres from the Wilton-Appin Road.
3A	On the eastern side of the Lake Cordeaux picnic area. Ground surface was grassed.
3B	On the western side of the Cordeaux Lake access road approximately 30 metres from the entrance gate to the picnic area. Ground surface was grass.
4	On the grass verge on the eastern side of Bardess Road (a short cul-du-sac) and about 10 metres from the Dombarton - Port Kembla railway which passes through a deep (approximately 5 metre) cutting at this point.
5	On grassed area 34 metres from the railway line by Fairloch Road, Farmborough Heights.

TABLE 6.3

RESULT OF NOISE MONITORING PROGRAMMES

SITE	DATE	START TIME	WIND SPEED (m/s)	WIND DIRECTION	TEMP (°C)	RELATIVE HUMIDITY (%)	PRESSURE (mb)	CLOUD COVER (eights)	L_{99} dB(A)	L_{90} dB(A)	L_{50} dB(A)	L_{10} dB(A)	L_{1} dB(A)	L_{eq} dB(A)	PRINCIPAL NOISE SOURCES (see footnotes)
1	3 Mar 83	11.58 am	0-5	N	33	42	1006	1	30.3	31.5	38.3	57.5	72.3	58	C, T, I, A, Tr
2A	3 Mar 83	12.45 pm	calm	-	32	39	999	1	33.0	35.0	42.5	56.3	66.3	53	C, T, Br, I
3A	3 Mar 83	2.00 pm	5	SE	28	72	986	4	34.3	37.8	40.8	44.0	48.8	42	F, Br, DT
4	3 Mar 83	3.30 pm	0-5	NE	29	69	1011	1	38.3	39.5	41.8	47.3	56.3	45	I, F, DT (man washing car 20 metres away for last 5 minutes)
1	3 Mar 83	4.50 pm	3-5	SE	30	47	1004	3	39.8	41.0	50.0	68.3	79.3	66	Tr, T, C
2A	3 Mar 83	5.30 pm	0-5	NE	26	71	998	3	32.5	35.0	44.5	59.3	70.3	58	C, T, Br, V, DLM
3B	3 Mar 83	7.20 pm	calm at surface, some wind in trees	NE	24	73	983	3	30.0	31.5	35.0	40.3	45.3	37	DT, Br, F, Co
4	3 Mar 83	10.10 pm	calm	-	25	70	1012	1	34.3	35.0	36.5	44.3	54.8	42	Dg, I, DT, A
1	3 Mar 83	11.28 pm	calm	-	23	83	1007	6	31.8	32.8	34.5	50.5	72.3	57	C, I, T
2B	4 Mar 83	12.05 am	calm	-	20	91	1000	3	29.3	30.0	33.8	48.3	58.3	45	Fr, I, A, Dg, DT, C, T
3	4 Mar 83	12.50 am	calm	-	21	91	984	2	24.3	25.3	27.5	34.5	38.8	30	DT, I
4	4 Mar 83	5.45 am	calm	-	22	88	1010	2	34.5	35.3	37.5	39.8	42.8	38	I, T, DT, R, Dg
1	4 Mar 83	7.02 am	0-1	N	18.5	95	1006	4	43.5	46.8	46.8	72.5	80.0	78	T, I, Tr
2C	4 Mar 83	7.35 am	calm	-	21	91	998	8	38.3	39.5	46.0	64.3	74.3	61	T, C, R, Dg, DT
3	4 Mar 83	8.15 am	0-4	N	21	91	988	7	37.8	38.8	40.5	43.3	47.5	41	F, DT, Br
4	4 Mar 83	9.20 am	0-4	N	27	71	1012	3	36.3	37.8	43.3	49.5	54.3	46	Br, C, DT, DLM
5	12 May 83	3.00 pm	0-1	N	18	73	1020	0	37.8	39.0	32.0	53.0	60.8	49	C, MC, Br, V, I

V = VOICES
R = ROOSTER
DT = DISTANT TRAFFIC
Tr = TRAIN
C = CARS
T = TRUCKS
I = INSECTS
Br = BIRDS

DLM = DISTANT LAWN MOWER
F = WIND IN FOLIAGE
Dg = DOG BARKING
A = AIRCRAFT
Fr = FROGS
Co = COLLIERY
MC = MOTOR CYCLES

6.7.2 RESULTS OF MONITORING PROGRAMME

The data in Table 6.3 shows the typical background noise levels (L_{90} values) and also shows other statistical parameters such as L_1 (a measure of the "maximum" noise levels during the monitoring period), L_{99} (measure of noise during the quietest periods) and lists the principal noise sources.

In the Farmborough Heights area (Sites 4 and 5) L_{90} values ranged from 35 dB(A) (night-time) to 40 dB(A) (day-time), and L_1 noise levels were in the range of 43 to 61 dB(A) and were associated with cars, lawn mowers, aircraft and other artificial noises associated with a suburban environment.

The sound levels reported above are more or less those that would be expected for the respective environments.

In the residential area of Farmborough Heights prior to the line joining the South Coast Line, there are approximately 100 residences whose back gardens lead onto the line. Many of the houses are within 25 to 30 metres of the line.

Figures 6-6 and 6-7 illustrate the locations of the line in respect to some residences in the area.

An attitudinal survey was undertaken in the Farmborough Heights area to determine the type of train sound found most irritating. A synopsis is presented here and further details of the survey are in Appendix I.

In the higher areas of Farmborough Heights, where there are newer houses, people complained they were disturbed by present railway line usage. Complaints came from both those whose houses backed onto the railway line and those whose houses were across the street approximately 200 metres from the railway. They felt any increase of train numbers would disturb them more frequently. The majority of people in the area complained about the high pitched screeching or squealing noise heard from braking on the downhill run as the most disturbing effect. Some complained of the locomotive engine noise from uphill trains, although this comment was most frequent from people who live further down the hill.

Construction and operation of the line in 1932 pre-dates the construction of these houses. Residents chose to build in this area in full knowledge of the presence of the railway.

The duration and intensity of train noise and its effect on residences is highly dependent on the location of the house and the surrounding topography. Residences near monitoring site 4 could hear the train approaching and leaving, but experienced very little noise when it was passing. This is because of shielding afforded by the deep (5 metre) cutting through which the line passes in this section.

6.8 SOCIAL AND ECONOMIC ASPECTS

For the purposes of the socio-economic studies, the local area was assumed to be the Shire of Wollondilly and the City of Wollongong. A comprehensive review of the existing situation in these two areas is set out in Appendix K.

6.8.1 EMPLOYMENT STRUCTURE

The employment structure of the two areas reflects the size and growth rate of their respective economies. Wollondilly Shire's workforce grew by 31% in the 1976 - 1981 period. In contrast, Wollongong's workforce grew by 7.2% in the same period and is as established metropolitan area based on the manufacturing and mining industries.

6.8.2. EMPLOYMENT MULTIPLIERS

Total employment multipliers which express the changes in total employment as a result of changes in basic industries are estimated as 2.6 for Wollondilly Shire and 7.0 for the City of Wollongong for the period 1976-81. The total area multiplier is 4.7. This figure means that for each job created in the basic sectors of the economy, 3.7 jobs are created in the service industries.

Unemployment levels are high in both the Shire and the City, due largely to retrenchments in the coal mining industry, the steel industry and local manufacturing plants.

6.8.3 POPULATION DISTRIBUTION

The majority of the population of the area is concentrated in the City of Wollongong.

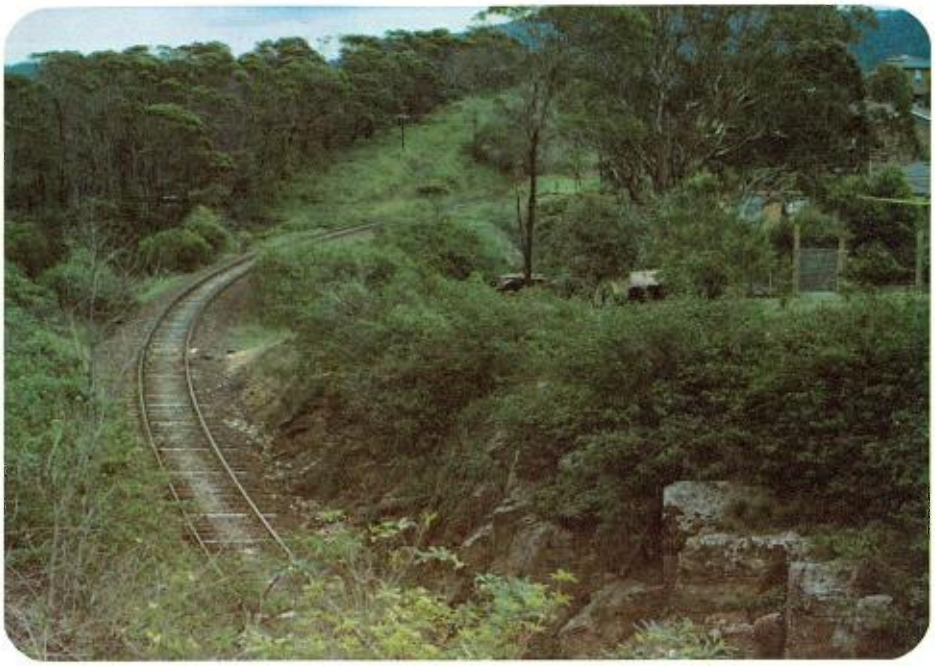


FIGURE 6–6



FIGURE 6–7

6.9 LOCAL COMMUNITIES

The main populated area which will be effected by the project is Farmborough Heights, a suburb of Wollongong. To a minor extent, the residential area at Mt St. Thomas may be affected. The Moss Vale - Unanderra line passes through the area to Port Kembla. The existing line is a single track on which an average of 4 - 8 trains travel daily. The proposal is to duplicate the line to accommodate the increased rail traffic from the proposed new line.

As part of the environmental studies for this project, surveys were conducted and meetings held with communities likely to be affected by the proposed development.

Farmborough Heights surveys were conducted on 12th and 13th May, 1983. A sample of residences were interviewed throughout the area, i.e. from the top of the hill to the bottom of the hill, and adjacent to the line and away from the line. Prior to the survey, a letter was delivered to householders informing residents of the project and the purpose of the survey.

The objectives of the Farmborough Heights survey was to:

- establish the type of noise that disturbed residents;
- establish the areas where there was concern about train noise and their attitude towards it;
- establish concerns of residents to an increase of trains and their attitude to the duplication of the line.

The Farmborough Heights area was initially populated through the development of Housing Commission homes at the bottom of the Farmborough Heights hill over 30 years ago, after the existing railway line had been constructed in 1932. A gradual expansion of the area has occurred up to the top of the hill. In more recent years, subdivision has occurred at the top of the hill, consequently many of the houses in the area are less than ten years old.

From the survey results, it was found that the amount of disturbance experienced by local residents varied. This variation was through the location of the house and the length of time a resident had lived in the area.

The type of noise that disturbed most residents when a train passed is brake squealing noise and engine noise. The most disturbing noise for residents at the top of Farmborough Heights is the brake squealing noise. This noise was described by these residents as being most disturbing at night and most annoying while talking on the telephone, in general conversation, while watching television or listening to the radio. Residents, whose houses were located next to the line appeared to be disturbed more than those who lived further away from the line. Night trains occasionally woke both adults and children, more often children, when travelling downhill.

Residents at the bottom of the hill complained more about engine noise than brake noise. People who lived beside the railway were occasionally disturbed by noise but generally said they got used to it. There were more comments in relation to road traffic noise disturbance than rail traffic noise disturbance from residents in this area.

Analysis of the results in terms of the location of the house i.e. beside the railway, or off the railway, and rail traffic noise, shows that residents towards the top of Farmborough Heights who live adjacent to the railway expect an increase of traffic to be of sufficient concern that they would contemplate moving away from the area. Generally, residents living towards the bottom did not consider an increase in rail traffic would be disturbing.

Another factor that related closely to attitudes to noise, was the length of time a resident had lived in the area. Residents who had lived in the area over 15 years said they were accustomed to noise, and "did not notice the trains anymore". The majority of these people lived toward the bottom of the hill.

Other concerns in relation to increased rail traffic were coal dust, land devaluation, soot from diesel trains, night lights, loss of views, loss of trees, birds and wildlife, fires, vibration from trains passing, blasting during construction.

Of the residents surveyed, only a few people in Bristol Street have views of the surrounding landscape. The proposed duplication of the railway would only effect them if the trees were cut down. People towards the bottom of

Farmborough Heights generally had views which included the existing railway, thus were not concerned with any loss of amenity in this regard.

Residents at the top of the hill were concerned with a loss of trees and thus a loss of birds and wildlife that may occur from increased rail traffic.

Residents at the bottom of Farmborough Heights Hill were concerned about weed pollution increasing the number of snakes in their back garden.

7.0 ENVIRONMENTAL MANAGEMENT PROGRAMME AND IMPACTS

This section summarises the anticipated environmental impact of the proposed duplication of the railway line between Dombarton & Port Kembla. It sets out these components of the the environmental management programme designed to minimise and ameliorate the impacts. Descriptions of the programme are provided in the various Appendices and in Section 5.0 of this report.

Impacts relate to both the construction and operational phases. The former are likely to be more acute and evident. Both must be considered in the context of the existing line. The SRA will retain an environmental control officer on the project management team to ensure that environmental management is effective throughout the duration of the railway design and construction.

During the construction of the railway, the SRA will maintain constant supervision of the works undertaken by the construction contractors. A superintendent will be appointed to maintain a continuous inspection and ensure that all work is done to the satisfaction of the SRA. Survey checks to ensure the work is laid to the design geometry will also be carried out prior to commissioning of the line.

7.1 LAND

Details of impacts and proposed management plans are provided in Appendices A and B. The line duplication will take place alongside the existing railway line and within the existing SRA reserve. A small portion of land will be acquired at Dombarton to enable the extension of one arm of the Dombarton Loop. The construction of the underpass at the junction with the Princes Highway will require activities outside the reserve.

Concern has been expressed by the NP&WS that improved access to the route and construction operations may result in increased vehicular access to the State Recreation Area which adjoins the line between Dombarton and Farmborough Heights. The SRA will maintain the level crossing at the point of access to the Area but will restrict vehicular access to the line and maintenance track by erection and maintenance of gates at appropriate locations. Construction workers will be instructed to restrict the use of vehicles and equipment to

the SRA reserve in that area. Otherwise there will be no effect on recreational use of the area.

7.1.1 GEOLOGY

The area between Dombarton and Unanderra traversed by the railway line is generally classified as being stable.

A specific unstable area is located at the head of the Dapto Creek gully. There may be a need at this point to construct a bridge structure to minimise potential stability problems. Design of this structure has not been undertaken.

7.1.2 SOILS AND DRAINAGE CONTROL

Because of the sensitivity of the undeveloped areas between Dombarton and Unanderra, special care will be taken to ensure a satisfactory vegetative cover is retained adjacent to the line. Vegetation control along the line adjacent to residential and commercial areas from Farmborough Heights to Port Kembla is important from a visual concern and for safety purposes.

Construction and operation of the proposed railway must be within the statutory requirements and regulations regarding water quality imposed under the Clean Waters Act.

As part of the drainage control system, drains will be formed at the toes of batters on the sides of all cuttings and in benches of cuttings. Drains will also be established at the tops of cuttings, where land slopes towards the cutting, to divert water from the cutting faces. Similarly, drains will be established at the toes of embankments where land slopes towards the embankments. Outlets will be directed to natural waterways.

Soil erosion measures will also include grassing of all earth-faced embankments and cuttings, and all major earth drains and levee banks. These measures are outlined in Appendix A.

Native species of grasses, shrubs and trees should be encouraged on revegetated sites because they are well adapted to the low fertility and low pH soils of the area. They encourage the return of native flora, fauna and their

habitats. Initial stabilisation with temporary exotic, faster growing species may be necessary.

Additional stabilisation techniques such as hydro mulching, bitumen emulsion, and hay mulching on areas requiring special erosion treatment will be considered with the advice of the SCS.

7.1.3 LANDFORM AND LAND USE

The construction and operation of the duplicated line will have no effect on landforms or land use as it will follow the route of the existing line. Encroachment on land outside the existing SRA reserve will take place only on a small area at Dombarton and at the Princes Highway intersection. There will be no effect on recreational use of the area adjacent to the line.

7.2 HYDROLOGY

Construction of the line will have no effect on existing surface or groundwater hydrology. Some temporary diversion measures may be required during the construction phase which may result in slight temporary modification to drainage regimes along the route.

There is potential for significant short term water quality impacts during and immediately after the construction phase. It will be difficult to control run-off during this phase. In some locations it may be possible to construct silt and sediment control structures. Water quality impacts will be minimised by retaining the maximum amount of existing vegetation, by implementation of bunds and sediment control dams, and where necessary by stabilisation of the exposed banks and steep areas to reduce run-off. Water flows will be diverted away from these areas during construction until they are stabilised. This work will be undertaken in conjunction with SCS.

The SRA will establish a monitoring programme on streams draining areas which will be affected by construction operations prior to work commencing. The programme will continue until the effects of operations have been ascertained. In the event that a significant deterioration in water quality is observed, action will be taken to remedy this.

Further information can be found in Appendix C.

7.3 AIR QUALITY

As discussed in Appendix D, there will be minor contributions of diesel exhaust to the environment but no adverse air quality impacts are to be expected. In particular, monitoring programmes show no evidence of adverse effects due to coal dust in areas where coal trains are presently used. No adverse effects are expected along this section of the line from railway operations.

Some temporary local dust may be produced during the construction phase but no adverse impacts are expected. If necessary, construction sites and dirt access roads will be watered to minimise dust emissions.

Under Section 16 of the Clean Air Act, an approval to commence construction is required from the SPCC. This approval relates to dust generation, buring off, etc., during the construction period.

7.4 VEGETATION AND WILDLIFE

7.4.1 VEGETATION

The major direct impacts on native vegetation are expected to be the clearing of an additional area of vegetation for line duplication, in places, cutting and filling to a greater distance, and the temporary storage of fill.

Line clearing and cutting will remove a total of less than ten hectares of subtropical rainforest and wet sclerophyll forest along the easement. The impact will be slight. Clearing may entail removal of some individuals of Livistona australis, but this should not affect the viability of the local population.

Impacts on vegetation upslope from the easement will be negligible provided construction vehicles are restricted to the development area.

The potential for indirect impact is greater downslope from the easement, through alteration or blocking of stream flows

or "spillover" of cut and fill material. Further details are provided in Appendix E.

7.4.2 WILDLIFE

It is not envisaged that construction of the proposed railway will cause any major adverse impact on regional fauna populations since the duplication will be adjacent to the existing line in an already disturbed area. At worst only a thin line of potential habitat will be affected.

Noise from train operations may scare some animals away from it, at least soon after construction and increased operation commence. This already happens with the existing line and the wildlife has probably adjusted to it.

7.4.3 BUSHFIRES

Risk of wildfires will be increased during line construction. Potential ignition sources include lunch-time fires, cigarettes and machinery and vehicles with faulty or unsuitable exhaust systems.

Once the line is in operation, risks will be very slight, resulting primarily from train braking, and should be effectively minimised by maintenance of fire breaks within the railway reserve.

The Clean Air Act, 1961 is binding on the SRA. The effect of this is to restrict the use of fire for the disposal of matter in specified areas by the SRA. This means that fire hazard reduction in or adjacent to urban areas is generally achieved by moving and cutting vegetation. In rural areas controlled burning-off is the most common practice.

Fire control and prevention measures will be developed and implemented in association with local landholders, bushfire Authorities and on the areas adjacent to the Kembla State Forest and State Recreation Area in conjunction with the Forestry Commission and NP&WS.

Sufficient suitable fire fighting equipment will be kept on the site ready for use at all times. Any fire bans will be strictly observed.

7.5 ARCHAEOLOGY

Archaeological sites and relics were not encountered in or near the proposed railway in the course of the survey described in Appendix G.

In the event of archaeological sites or relics being uncovered during construction work, the SRA will act in accordance with the State Legislation enacted to protect Aboriginal Heritage.

The SRA is undertaking consultations with members of the aboriginal community in the region to ensure that the community is advised of the proposed development and that the importance of any areas or sites encountered can be evaluated.

7.6 VISUAL EFFECTS

The visual impact of the proposed rail duplication must be considered in the context of the presence of the existing line. While the area between Dombarton and the Princes Highway crossing has important and attractive visual characteristics, the addition of a rail line beside the existing one will not impose upon or cause significant deterioration to these characteristics. However, some effect will be observed due to the construction activities.

The variables that form the components of visual impact are summarised below, together with actions proposed to ameliorate any adverse effects.

SCALE: There will be a slight increase in the scale of the railway development due to duplication and electrification. It will be chiefly observable in the Farmborough Heights area and at the crossing of the Princes Highway. The latter will be a significant structure, although the railway line will pass under the road.

FORM: There will be no change in form as a result of duplication apart from the introduction of electric masts and sub-station buildings.

COLOUR: There will be no long term change in colour as a result of duplication. The only impact will be the colour of

disturbed soil and other material in new cuttings and embankment areas. Over time and with revegetation, the colour of those exposed surfaces will match the existing rural and natural colour scheme. The colour of passing trains will be similar to those at present but more frequently seen.

MOVEMENT AND ACTIVITY: The principal source of impact incorporated in this variable will be the movement of construction equipment and personnel, and train operations. The former will be significant but temporary. The latter will be more frequent than at present but intermittent. Both are unavoidable. They will be most significant in the Farmborough Heights - Princes Highway area. The Highway underpass will be the major construction activity along the route. These will be some disturbance at the Drummond Street bridge at Mt St. Thomas during its reconstruction but this will be similar to local roadworks.

LIGHT: The major effect of lighting will be the night lights on passing trains and the new lighting on the bridgeworks at the Princes Highway crossing. The former will be intermittent and more frequent than at present but should not cause disturbance. The latter will be planned and if necessary shielded to minimise disturbance to houses adjacent to the crossing.

CHARACTER: There will be no direct change in visual character of the area along the route. The increased train traffic may have an indirect effect.

Action will be taken by the SRA to minimise visual obtrusion. The retention of all possible native vegetation, in particular trees, along the route will provide visual shielding. In some locations, it may be appropriate to plant a tree screen if safety considerations allow. Revegetation of disturbed surfaces will harmonise with local conditions.

7.7 NOISE

7.7.1 CONSTRUCTION PHASE

Section 27 of the Noise Control Act requires that approval be given by the SPCC prior to the commencement of construction.

The noise producing items of equipment, that will be used in the construction phase, and their maximum associated noise levels (at 15 metres) are listed below:

- one D10 dozer (equipped with blade and ripper - 90 dB(A);
- one front end loader - 87 dB(A);
- two 25-tonne trucks - 88 dB(A);
- one sheeps foot roller; and,
- one vibrating roller.

The chief areas likely to be affected are Farmborough Heights, at the crossing of the Princes Highway and near the Drummond Street bridge.

The closest residences in Farmborough Heights to the construction area will be about 15 metres away. These residences will experience L_{max} levels up to about 93 dB(A) and L_1 and L_{10} levels of about 88 and 84 dB(A) respectively. Other residences in the 30 to 60 metre range will experience L_{max} noise levels in the range 87-81 dB(A) and L_1 and L_{10} noise levels in the range 82-76 and 78-72 dB(A).

No blasting is anticipated for this section of the line. If blasting is required, the SPCC will be informed and blasting will only take place with their permission and in compliance with the controls. Working will be confined to day-time hours. Equipment will be fitted with "silencing kits".

A special study will be commissioned to determine methods of minimising inconvenience to residents and below those indicated above. Factors to be examined will include the fitting of special noise control equipment to the bull dozer and front end loader, and the construction of temporary acoustic shielding.

7.7.2 OPERATIONS PHASE

Increased frequency of higher noise levels will be experienced along the line during train operation. The most signficant area of effect will be at Farmborough Heights. This is examined in more detail in Appendix H.

The railway noise impact may be assessed in terms of three groups of parameters which are respectively:

- those related to emission from noise sources (train motive source, train rolling stock, extent of traffic and condition of track);

- those associated with the transmission or propagation path which is determined by the topography between rail track and perceiver; and

- those associated with the perceiver and specifically whether the perceiver is indoors or outdoors.

The specific avenues available to the State Rail Authority to provide a reduction of train noise impact on the houses located immediately adjacent to the railway line in the Farmborough Heights area are as follows:

- the introduction or optimisation of the noise reduction provided by cuttings through which the railway line will pass;

- the construction of wayside acoustical barriers for those sections of the rail line passing over embankments or sections of the line constructed on fill. The height of these barriers would be determined by a critical assessment of the conflicting requirements of attenuation and visual impact;

- the use of new brake shoe technology and improved driver techniques;

- the utilisation of rail grinding to reduce wheel-rail noise interaction;

- the acoustical treatment of the facades of those residential buildings closer than a specified distance from the railway track; and

- the purchase of houses by the government in appropriate cases;

A separate acoustical study has been commissioned by the State Rail Authority to evaluate each of these options in much greater detail. The study is scheduled for completion by the 14th October, 1983.

The nearest houses are about 20 metres from the existing railway line and as such are currently exposed to high peak sound levels as a result of train movements on the existing rail track. The measured peak sound levels from the existing trains has been shown to be 92dB(A) at the closest residences for diesel electric locomotives and typically 8 dB(A) lower for self powered passenger trains using the railway line.

The existing acoustical background noise levels in the Farmborough Heights area have been assessed on a statistical basis. That assessment has confirmed that the daytime equivalent noise levels in the area, based on 20 minute sample periods, range between 44dB(A) and 68 dB(A).

By contrast the equivalent night-time noise levels range between 35 dB(A), in the early hours of the morning, to 68 dB(A) for those periods in which trains are operating on the existing rail lines.

An alternative criteria for the assessment of community noise impact is based upon the assessment of the equivalent A-weighted noise level which may typically be measured over a 24 hour period. The typical values for L_{eqA24} at Farmborough Heights are 48-52 dB(A) with the dominant or most significant noise source being the result of the operation of trains on the existing rail track.

The desirable noise level criteria for a residential location may also be specified in terms of the following criteria:

NOISE LEVEL CRITERIA

Environmental Noise Acceptability Rating	Daytime Equivalent Level in dB(A)	Night Time Equivalent Level in d(B(A)
Clearly Acceptable	Less than 49	Less than 42
Normally Acceptable	Less than 62	Less than 56
Normally Unacceptable	Less than 76	Less than 67
Clearly Unacceptable	More than 77	More than 68

These criteria are based on both overseas and local experience and the views of SPCC are being sought as to the levels appropriate in this area.

If no special mitigating measures were to be taken, then the computed A-weighted equivalent noise level at the houses nearest to the railway line, with the specified number of trains operating on the line (54 per day) will be approximately 77 dB(A). This level may be compared with the above criteria on a daytime and night time basis. In terms of those criteria, the level of environmental noise resulting at the nearest residential properties may be regarded as being unacceptable.

It is apparent that it will be necessary to institute one or more of the acoustical options listed above in order to ameliorate the acoustical impact of the proposed railway line at the houses nearest to the railway line. The final recommmendations on the most appropriate option are currently being assessed. The SRA will evaluate and, as appropriate, implement these recommendations in the detailed project planning.

7.8 VIBRATION

During the operational phase of the railway, it is not expected that any structural or architectural damage will occur to houses or cottages adjacent to the railway or utility facilties.

Higher vibratios levels are experienced by houses in the Sydney metropolitan area adjacent to operating railway lines, without significant effects. Similar levels are experienced currently in the Farmborough Heights area. In the course of the survey of residents described in Appendix I, the majority of those interviewed experienced no adverse effects from vibration.

The construction methods proposed for the new line will minimise vibration caused by train movement.

7.9 SOCIAL AND ECONOMIC

An examination of the impact of the proposed development on the socio-economic environment is discussed in Appendix K.

It is not possible, in relation to social and economic impact to differentiate meaningfully between the construction and

operational activities of the new line between Maldon and Dombarton and the duplicated section between Dombarton and Port Kembla. As a consequence, the following information relates to the full project.

7.9.1 CONSTRUCTION PHASE

Total man-hours by each major labour and task during the construction phase are shown as Table 7.1.

When these figures are applied to the construction schedule for this project, the estimate of total man hours for the construction programme is 2,084,544.

Presently, the programme is planned over 33-36 months with the earthworks, bridges and culverts team assumed to be working considerably in advance of the ballast, track-laying and signalling groups. The latter task does not commence until about 9 months into the schedule. The peak on-site workforce of about 470 should occur around month 18. After month 6 the number of on-site jobs would remain relatively stable at around 280 workers. In addition, there will be an off-site workforce directly associated with the project.

As the railway line is located in close proximity to both Wollongong and Sydney, all of the workforce is expected to either commute to the job on a daily basis or stay in hotel or motel accommodation for the work-week. The latter would most probably consist of sub-contractors with the shorter tasks to perform.

As the workforce will mainly commute to the site, the stimulus to the local labour market and economy is difficult to estimate. Assuming as a minimum that all operator jobs and unskilled jobs are taken by local workers, a substantial short-term boost to the local economy from the re-spending of their income may be anticipated.

Assuming total payments to labour for the project are $32.65 m, some $21.42 m would flow to the local economy over 33-36 months. As there are a relatively high proportion of tradesmen presently available in both areas, the injection of salaries to the local area could be considerably higher.

The effect on service industries in the City of Wollongong will also be substantial. Up to 970 short-term jobs can be

TABLE 7.1

MAN-HOURS

CATEGORY	UNSKILLED	TRADESMAN	OPERATORS	STAFF	TOTAL
Major Bridges	93,530	78,710	18,750	43,050	234,040
Minor Bridges	27,960	23,220	4,360	13,140	68,680
Tunnel	276,880	125,460	129,510	191,180	723,030
E/W and Drainage	76,860	69,660	287,610	108,350	542,480
Trackwork	70,070	31,750	32,770	42,330	176,920
Sigs/Comm/Elec	77,440	210,550	-	31,190	319,180
TOTAL	622,740	539,350	473,000	429,240	2,064,330

Source: SRA

predicted to result from the stimulus to the construction industry. This figure must be tempered by the present high level of excess capacity in the City's manufacturing sector.

7.9.2 OPERATIONAL PHASE

The operational workforce required to operate the line will be a train crew plus a six man maintenance and inspection gang on the line. Additional signalling personnel would be necessary at Wollongong. It is not expected that this labour would be drawn from the smaller centres on the western portion of the line. They are most likely to be from existing staff in Wollongong or Sydney.

Operation of this line and the proposed Maldon - Dombarton line will reduce road truck traffic on Trunk Road 95, the Princes Highway and on roads leading to the Coal Loader in Wollongong. The amount of coal truck traffic on the roads have been the subject of concern and complaint over recent years. A reduction in truck movements will result in improved amenity, better traffic flow, fewer road accidents and lower road maintenance costs.

The line will also provide improved access to the Port Kembla Coal Loader and will facilitate the supply of coal to the proposed Stages IIA and IIB of the Loader.

7.9.3 ENERGY STATEMENT

The anticipated fuel requirements for a 3000 tonne train tavelling between Maldon and Port Kembla is 1,700 litres for three 442 class diesels or 5530 kilowatt hours for three 85 class electric locomotives.

Energy use during the construction phase cannot be accurately estimated until detailed design of the works has been undertaken.

7.10 LOCAL COMMUNITIES

The principal local community affected by the proposed development is at Farmborough Heights. As discussed in Section 6.9 a survey was conducted of residents in that area.

A factor that related closely to attitudes to noise, was the length of time a resident had lived in the area. Residents who had lived in the area over 15 years said they were accustomed to noise, and "did not notice the trains anymore".

Other concerns in relation to increased rail traffic were coal dust, land devaluation, soot from diesel trains, night lights, loss of views, loss of trees, birds and wildlife, fires, vibration from trains passing, blasting during construction.

Residents of the higher areas were concerned that if coal train wagons were uncovered, during periods of high wind, the area would be polluted with coal dust. Some residents were also concerned by the land devaluation that would occur with an increase of train traffic in the area. Residents were concerned that after a period of time, plumes of "soot" from the diesel locomotives would change the character of the area by covering the houses with dirt.

Houses close to the railway were sometimes effected by night lights but generally residents were not concerned. One resident described seeing a train light as a comforting feeling.

Of the residents surveyed, only a few people in Bristol Street have views of the surrounding landscape without seeing the existing railway. The proposed duplication of the railway would only effect them if the trees were cut down. People living on Farmborough Road and towards the Princes Highway generally had views which included the existing railway, thus were not concerned with any loss of amenity in this regard. These residents commented very generally about vibratation caused by passing trains. Generally, these houses are constructed of fibro or wood, thus are more likley to be affected by vibration than brick houses at the top of Farmborough Heights hill. Residents were concerned about the effect of vibration in the structure of their houses in the long term. However, vibration caused by passing trains were not often noticed by residents.

Residents at the top of the hill were concerned with a loss of trees thus a loss of birds and wildlife that may occur from increased rail traffic. Even without a loss of trees,

some felt the increased noise would drive them away and endanger their existance.

Residents at the bottom of Farmborough Heights hill were concerned about weed pollution increasing the number of snakes in their back garden.

8.0 STUDY TEAM

SRA Maldon - Port Kembla Project:

Project Manager	:	Mr Doug Neil - SRA

SKP Project Management Team

Project Director	:	Mr. David Howarth - SKP
Project Environmental Engineer	:	Mr. Tim Macoun - SKP

Environmental Studies and EIS Preparation:

Study Director	:	Mr Warren Atkinson - D&M
Study Manager	:	Ms. Kerry Morrison - D&M
Land Studies	:	Dr Stuart Miller - D&M
	:	Mr Peter Ryan - D&M
	:	Mr Malcolm Hughes - D&M
Hydrology and Water Quality	:	Dr Ian Irvine - D&M
Climate and Air Quality	:	Dr Nigel Holmes - D&M
Vegetation	:	Dr Tim Fatchen
Wildlife	:	Dr Bob Root - D&M
Archaeology	:	Ms. Val Attenbrow
	:	Dr Johan Kamminga
Noise	:	Dr Nigel Holmes - D&M
Local Communities	:	Ms. Kerry Morrison - D&M
Social and Economic	:	Mr Doug Martin - D&M