



ELECTRICITY COMMISSION OF
NEW SOUTH WALES

ELECTRICITY TRANSMISSION LINE FROM LISMORE TO MULLUMBIMBY

ENVIRONMENTAL IMPACT STATEMENT

ASSESSMENT OF ENVIRONMENTAL IMPACT OF ELECTRICITY TRANSMISSION LINE FROM LISMORE TO MULLUMBIMBY

PUBLIC EXHIBITION

It is proposed to construct a 132kV pole transmission line from Lismore Substation to the site of a future substation adjacent to Mullumbimby Power Station.

The proposed transmission line is required to meet the rapidly growing demand for electricity in the Lismore, Ballina and Byron Council areas. The line forms part of a multi-stage program of works and will enable the establishment of a 132kV substation at Mullumbimby in the mid 1990s to provide an adequate and reliable electricity supply well into the future.

An Environmental Impact Statement has been prepared which examines the proposed transmission line and assesses its likely impact on the environment. Alternatives to the proposal have also been considered in the Environmental Impact Statement.

Arrangements have been made for copies of the Environmental Impact Statement to be placed on public exhibition during normal office hours for the period 4 November to 11 December 1987 at the following locations:

Bangalow: Post Office
Bexhill: Post Office
Byron Bay: Council Chambers
Clunes: Post Office
Dunoon: Post Office
Eureka: Post Office
Federal: Post Office
Lismore: Council Chambers
 City Library
Mullumbimby: Shire Council Library
Rosebank: Post Office
The Channon: Post Office

SYDNEY:
 Electricity Commission of NSW,
 Ground Floor, Hyde Park Tower,
 Park and Elizabeth Streets.
 Department of Environment and Planning,
 Ground Floor, Remington Centre,
 175 Liverpool Street.
 NSW Government Information Centre,
 55 Hunter Street.
 NSW Environment Centre,
 176 Cumberland Street.

To assist community appreciation of this proposal enquiries are welcomed and in particular, "information centres" have been established during the period of exhibition.

INFORMATION CENTRES

Displays of maps and photos have been established in the Lismore City Library, the Mullumbimby Library and in Sydney on the ground floor of the Hyde Park Tower, Park and Elizabeth Streets. Officers of the Electricity Commission will be available for private consultation by appointment at the Information Centres during the exhibition. Appointments may be made by phoning Tamworth (067) 65 8371 or Sydney (02) 268 6540. Officers may be consulted during normal office hours at the Hyde Park Tower information centre, without appointment.

PURCHASE OF ENVIRONMENTAL IMPACT STATEMENT

During the period of public exhibition copies of the Environmental Impact Statement may be purchased from the Electricity Commission of NSW for fifteen dollars (\$15) as follows:

- by application to the Regional Transmission Engineer, Goonoo Goonoo Road, South Tamworth (P.O. Box 526, Tamworth 2340);
- by application to the Contracts Superintendent, Shopping Level, Hyde Park Tower, Park and Elizabeth Streets, Sydney (GPO Box 5257, Sydney 2001).

A booklet summarising the Environmental Impact Statement, has also been prepared and is available by application to the two sources listed above.

SUBMISSIONS

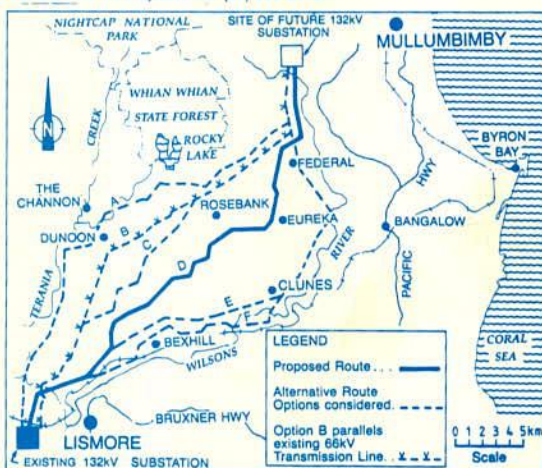
Any person or organisation wishing to make representations with respect to this activity is invited to do so in writing to:

**Chief Manager/Transmission,
Electricity Commission of New South Wales,
GPO Box 5257,
SYDNEY, NSW 2001.**

Representation should be received on or before 11 December, 1987.

The Commission will give consideration to all such representations and forward copies to the Secretary of the Department of Environment and Planning.

Further information is available from the Regional Transmission Engineer, Tamworth (067) 65 8371 or from the Project Officer (02) 268 6540.



**W. P. PRICE,
CHIEF MANAGER/TRANSMISSION.**

Electricity Commission of New South Wales





ELECTRICITY COMMISSION OF
NEW SOUTH WALES

ELECTRICITY TRANSMISSION LINE FROM LISMORE TO MULLUMBIMBY

ENVIRONMENTAL IMPACT STATEMENT

OCTOBER 1987

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**Prepared by Sinclair Knight & Partners Pty Ltd
Job No NT033**

**Electricity Commission of
New South Wales**

**Electricity Transmission Line
from Lismore to Mullumbimby**

Environmental Impact Statement

CLAUSE 59 CERTIFICATION

This is to certify that this Environmental Impact Statement has been prepared in accordance with Clauses 57 and 58 of the Environmental Planning and Assessment Regulation, 1980.



R D Crooks
Associate
Manager, Environmental Services
Sinclair Knight & Partners Pty Ltd

October 1987

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Study Team

This Environmental Impact Statement has been prepared for the Electricity Commission of N.S.W. by Sinclair Knight & Partners Pty Ltd and related subconsultants.

The Consultant's study team members responsible for the preparation of this document were as follows:

SINCLAIR KNIGHT AND PARTNERS PTY LTD

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MILLINGTON AND MILLS

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Liaison with the Electricity Commission was through Mr T. Perram, the Commission's Assistant Supervising Engineer for environmental matters relating to transmission lines.

Many others contributed to the study, including all the authorities mentioned in Appendix H who provided information essential to completion of the study. Particular thanks are extended to all members of the community who participated during the route location phase of the study. The assistance of all those who have contributed to this document is gratefully acknowledged.

Introduction and Summary

Introduction

BACKGROUND TO THE PROPOSAL

The Electricity Commission of New South Wales is responsible for the generation and bulk transmission of electricity throughout the State. The Commission carries out development necessary to meet the growing demand for electric power throughout New South Wales.

The Far North Coast region of New South Wales is experiencing a substantial rate of growth, in terms of both population and economic activity. The consumption of electricity in the region has also been rapidly increasing at approximately 7% per annum over the last ten years, compared to a state-wide average of 3% per annum. The Commission has responded to this increasing power need with the formulation of a multi-stage program to ensure continuing adequate and reliable bulk supply of electricity to the region.

The proposed 132 kV transmission line between Lismore and Mullumbimby which is outlined and assessed in this Environmental Impact Statement (E.I.S.) is a component of this long term strategy for augmenting bulk electricity supply to the north east corner of the State. Other elements of the strategy are construction of a new 132/66 kV substation near Mullumbimby and a second Lismore to Mullumbimby 132 kV transmission line. The strategy is outlined in more detail in Section 1.

These works will be adequate to meet the expected long term electricity requirements of the Lismore, Ballina, Byron, and if necessary, Tweed local government areas.

ENVIRONMENTAL IMPACT ASSESSMENT PROCEDURES

The Environmental Planning and Assessment (EPA) Act, 1979, as amended, specifies procedures which must be followed in public and private development projects in the assessment of environmental impact. State Environmental Planning Policy No. 4 permits certain public utility undertakings, including the construction of electricity transmission lines, to be carried out without development consent by Local Government Authorities in those areas where such land uses are permissible under the relevant environmental planning instrument.

Construction of the proposed transmission line consequently falls under Part V of the EPA Act. The Electricity Commission is the Determining Authority and is required under the Act to fully take into account the project's environmental consequences before making any decision to proceed. The Electricity Commission has decided that the preparation of an Environmental Impact Statement (E.I.S.) is desirable for the proposed transmission line. The Act requires that the E.I.S. be prepared in accordance with Clauses 57 and 58 of the Environmental Planning and Assessment Regulation.

The Electricity Commission has consulted with the Department of Environment and Planning concerning the form and content of this Environmental Impact Statement and the Director's requirements have been received and incorporated into this document. A copy of the Director's letter to the Electricity Commission is included as Appendix C to this document.

This E.I.S. will be placed on public exhibition and will be advertised in the press to give the public notice of the exhibition. During this period any person may inspect or purchase the document and may make written representations to the Electricity Commission with respect to the proposal. Copies of all submissions received will be forwarded to the Department of Environment and Planning for that Department's consideration.

The Board of the Electricity Commission will examine and consider the E.I.S. and all matters raised in submissions, together with any subsequent advice or report received from the Department of Environment and Planning, before making a final decision as to whether the project should proceed. This examination and consideration will be detailed in a report, known as a "Clause 64 Report", which will be subsequently published by the Commission.

STRUCTURE OF THIS ENVIRONMENTAL IMPACT STATEMENT

This Environmental Impact Statement is organised into two main parts, Part A and Part B. In Part A, the need for the development is established, features of the area described, constraints to route selection determined (including an account of the community consultation program undertaken), a number of route concepts evaluated and a preferred route concept selected.

In Part B, the proposed development is described in terms of its principal physical components and its nominal route alignment. The procedures that would be used in the determination of its precise alignment are also discussed. Safeguards that have been incorporated into the design process are described, together with an assessment of likely environmental impacts.

A number of Appendices are also included which provide technical details, specialist studies undertaken in the preparation of this document and other reference documents.

Summary

THE NEED FOR THE LINE

The Far North Coast region has experienced considerable development in recent years. Over the past ten years there has been an average annual population growth in the region of 3.2% and a corresponding annual 7% increase in maximum electricity demand. The growth in demand for electricity in the City of Lismore, and the Ballina and Byron Shire areas is expected to remain relatively high in the future, though moderating to a slightly lower rate of about 5-6% per annum.

The predicted growth in the community's maximum electricity needs will soon render the existing power system deficient. An examination of alternative courses of action has revealed that a new 132 kV transmission line between Lismore and Mullumbimby (the proposed development) would provide the most satisfactory solution to current and future power supply needs. Alternatives considered included increased utilisation of renewable energy sources such as solar and hydro-electric energy, reconstruction of the existing Lismore to Ewingsdale 66 kV transmission line to 132 kV and construction of a new 132 kV line along the coastal strip. If the proposed transmission line was not built electricity restrictions are expected to become necessary in the City of Lismore and the Ballina and Byron Shires by about 1991, to avoid overloading and low voltage conditions.

The proposed line will initially be operated at 66 kV, to strengthen the Northern Rivers Electricity system between Lismore, Dunoon, Ballina and Mullumbimby. It will be reconnected for 132 kV operation when the proposed Mullumbimby 132/66 kV Substation is constructed. If this subsequent reconnection was not carried out in the mid 1990's, and no alternative action taken, the electricity demand of all areas fed by the Lismore 132/66 kV substation would reach that substation's capacity limit and electricity restrictions or interruptions would then be unavoidable in the local government areas of Richmond River, Casino, Lismore, Kyogle, Ballina and Byron.

REGIONAL SETTING

As shown on Exhibit S1, the proposed development is located in the Far North Coast region of New South Wales and encompasses a locality commonly referred to as the 'Rainbow Region'. Dominant natural features in the area include the steep, forested slopes of the Nightcap Range, an incised plateau and the coastal escarpment. The area is also characterised by remnant stands of the 'Big Scrub' native forests.

The scenic quality, climate and proximity to the coast combine to create an extremely attractive area. Large numbers of retiring urban dwellers and 'new settlers' have migrated to the area in the past twenty years and it is now a relatively densely populated rural region. Traditional agricultural activities such as grazing and dairying have been supplemented by the widespread introduction of horticultural plantations.

The density of the population in the region, together with the region's unusually high and diverse environmental and agricultural characteristics, means that there are many areas that constitute a constraint to transmission line location. Detailed studies of the physical, biological and social environments were undertaken to enable these constraints to be identified and mapped.

COMMUNITY CONSULTATION

A consultation program was undertaken in conjunction with specialist environmental studies to involve the community in the planning process prior to the selection of a route alignment, and before preparation of this document had begun. A principal aim of the program was to gain an appreciation of community views and opinions as to the relative importance of the identified constraints to route selection. The hierarchy of constraints that was developed formed the basis for the selection of the preferred route alignment for the proposed transmission line. Other issues raised during the program were noted as requiring detailed coverage in this document. The program also enabled the community to be informed of the proposal, its planning justification and the planning process.

Major elements of the program were a series of workshops held with local community groups, exhibition of a Route Concepts brochure and provision of background planning information, release of a number of press statements, attendance at public meetings and demonstration measurements of existing electric and magnetic fields in the area.

ROUTE SELECTION PROCESS

Analysis of the physical, biological and social environments of the area, and conclusions drawn from the community consultation program, led to the establishment of a hierarchy of constraints to transmission line location. Constraints were ranked into primary and secondary categories. Primary constraints were identified as areas within foreground views of towns and villages, areas of existing horticulture and stands of undisturbed native vegetation. Areas of primary constraint are shown in Exhibit 3.2 and represent locations which the transmission line should avoid wherever possible. They constitute areas of highest constraint to transmission line location.

Secondary constraints represent areas within which transmission line location should be minimised and include areas within foreground views of rural dwelling clusters, the number of dwellings within 250 metres of the nominal route alignment, ridgelines, stands of disturbed native vegetation, unstable areas with erosion potential, prime quality agricultural land and areas designated for future residential or horticultural uses.

All identified constraints were mapped and a number of route concepts developed which avoided areas of primary constraint. Options A, C, D and E shown on Exhibit S1 are based on the options that were shown in the Route Concepts brochure and generally conform to the above criteria. Option B constitutes a route which parallels the existing Lismore to Mullumbimby 66 kV transmission line, while Option F was developed from the concept of a route which would parallel the Lismore to Bangalow railway line. Options B and F were both considered due to community requests.

These options were analysed and compared with respect to the hierarchy of primary and secondary constraints. As shown in Table 3.3 and Table 3.4, Route Concept D emerged as the most satisfactory option and its alignment has been adopted as the preferred route for the proposed development.

THE PROPOSED DEVELOPMENT

The route alignment of the proposed transmission line runs from the existing Lismore Substation to the site of a new substation to be constructed near Lavertys Gap, approximately five kilometres south west of Mullumbimby. The line is located centrally in the study area, passing through predominantly open pasture in gently to steeply undulating terrain.

The preferred route concept avoids all primary constraints and minimises intrusion into areas of secondary constraint. It is generally removed from population centres and has the least number of residences in proximity to its nominal alignment. The proposed route avoids stands of undisturbed native vegetation, crosses a relatively minor length of prime quality agricultural land and minimises areas designated for possible future residential and horticultural uses.

The line would be approximately 40 kilometres long and would consist of twin pole supporting structures of concrete, wood or steel carrying conductors and earth wires. The structures would be located within an easement predominantly 45 metres wide to permit construction, maintenance and safe operation of the line. The easement would not be fenced but certain land uses would be restricted or controlled by the Electricity Commission.

The nominal route alignment shown on Exhibit S1 has been selected to avoid all primary constraints and to minimise intrusion into areas of secondary constraint. However, the final alignment of the line would not be determined until after detailed site surveys and discussion with affected landowners. This would take place when and if it is decided to proceed with construction of the line.

ENVIRONMENTAL SAFEGUARDS

A number of environmental safeguards have been incorporated into the selection of the preferred route concept and nominal alignment shown in Exhibit S.1. The line is generally removed from population centres and visual quality has been maintained by avoiding view catchments of towns and villages (a primary constraint), and minimising intrusion into view catchments of rural dwelling clusters, prominent ridgelines, stands of dense vegetation and areas designated as scenic preserves (secondary constraints).

Agricultural impacts have been safeguarded against by avoiding horticultural plantations (a primary constraint) and minimising intrusion into prime quality agricultural land. The ecological significance and value the local community places on native vegetation has also been recognised by excluding all areas of rainforest within the Nightcap Range from consideration of possible route alignments. Remnant stands of rainforest and undisturbed native vegetation (primary constraints) within the study area have also been avoided by the preferred alignment. Intrusion into areas of disturbed native vegetation (a secondary constraint) has been minimised.

Affected landowners will be consulted prior to determination of the final route alignment and landowner requests will be taken into account before finalisation of the alignment. Design safeguards will ensure the safety of residents adjoining the line and the electric and magnetic fields generated by the line will comply with the recommendations of Australian and overseas Health Authorities. The process of easement acquisition and compensation would be undertaken in such a way as to safeguard the interests of affected landowners.

Other safeguards that have been adopted into the route selection process will allow the continuation of current land use activities, minimise the potential for soil erosion and water quality impacts and maintain heritage and archaeological values. Local Government plans have also been considered in the selection of the preferred route alignment, as have local reforestation initiatives.

ENVIRONMENTAL IMPACTS

Construction of the proposed development would result in the following environmental impacts:

- Visual Impacts - the line would pass in proximity to residential areas at South Lismore, Tullera, Numulgi, Federal and Goonengerry, and several rural dwelling clusters. A number of ridgelines and areas of dense vegetation would also be crossed. Visual amenity would not be significantly impaired at any of these locations and, bearing in mind the density of rural settlement in the region, and its topography, the impacts are assessed as being acceptable.
- Agricultural Impacts - the route avoids existing horticultural plantations and construction of the line would not have significant adverse effects on dairying, grazing or cropping activities.
- Vegetation and Wildlife Impacts - the line has been sited to avoid undisturbed stands of remnant rainforest and to minimise intrusion into disturbed stands. Potential effects on rare and endangered species, riparian vegetation and wildlife conservation would not be significant.
- Residential Amenity - design and construction safeguards would ensure that the impact on residential amenity would be minimised along the length of the proposed line. While some limitations would be placed on allowable activities within the easement, residential amenity would not be substantially impaired.

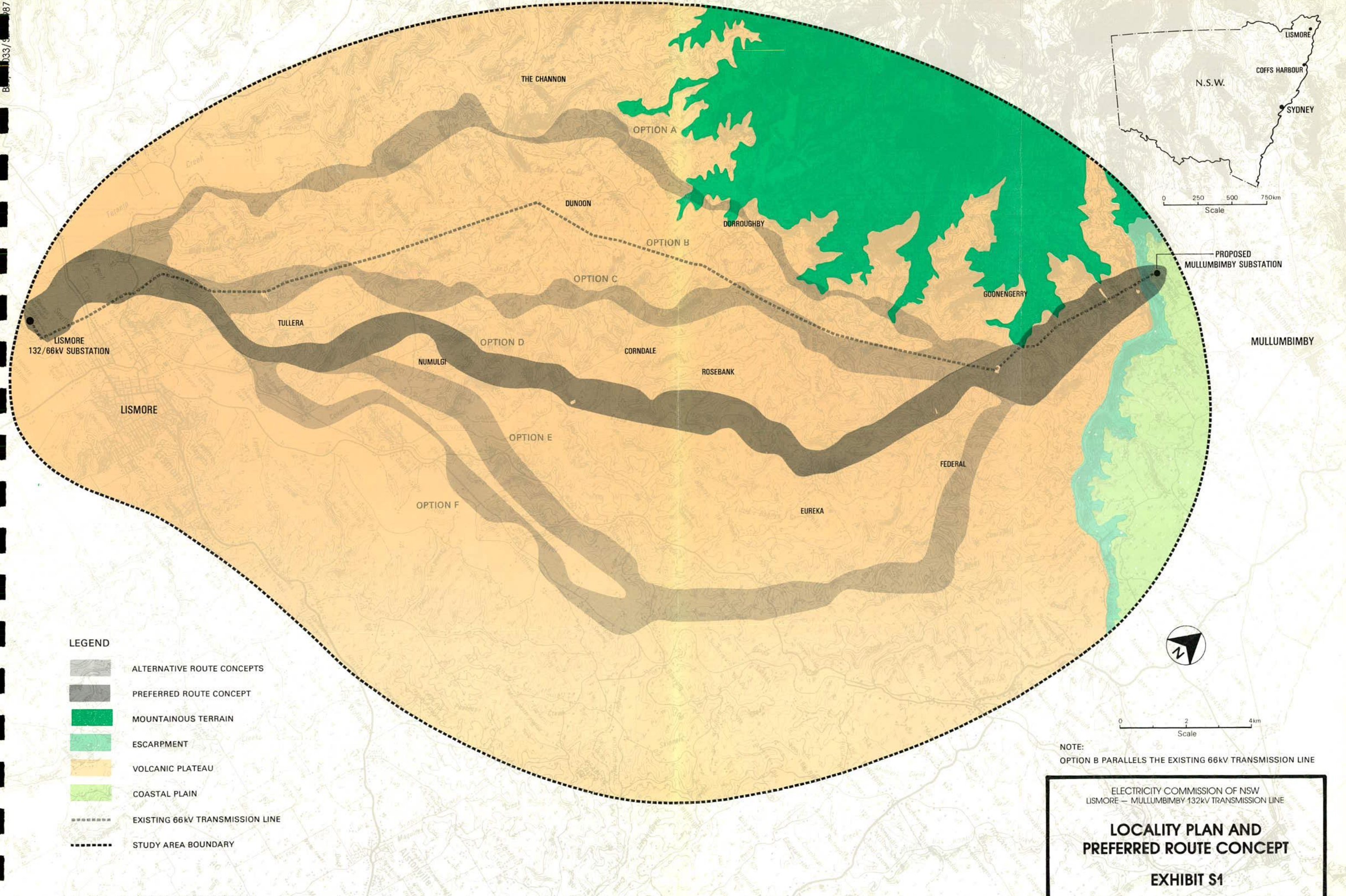
Impacts were assessed under a wide range of other categories including flooding, soil erosion, water quality, heritage and archaeology, Council planning initiatives and equity considerations. It was concluded that the impact potential of the proposed development is low in all these categories.

The safeguards incorporated into the planning and construction of the proposed transmission line would ensure that it would minimise adverse environmental impacts in the region. Impacts identified would generally represent marginal changes in the existing situation rather than the introduction of a significant new and inconsistent element.

As discussed in Part A, the proposed development is best suited to providing for the power needs of the Far North Coast Region, and its implementation would have beneficial implications for future growth and development in the region.

In this context, and provided the recommended environmental safeguards are observed, a basis is provided for approval of the proposed development.

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Part A

Selection of the Proposed Scheme

1. The Need for Augmentation of the Power Supply

1.1 EXISTING SUPPLY ARRANGEMENTS

The Electricity Commission of New South Wales is responsible for the generation of electricity and its bulk transmission to supply points throughout the State of New South Wales. Distribution Authorities (Northern Rivers Electricity in this case) are responsible for sub-transmission and the retail distribution of electricity from the Commission's supply points to customers within their respective county or franchise areas.

As shown on Exhibit 1.1, the Commission's State power grid presently extends to its Lismore 132/66 kV Substation, which is fed from the south via three transmission lines operating at 132 kV. One of these lines is designed and constructed for 330 kV operation and is planned to be operated at that voltage when connected to a future 330/132 kV Substation on the south-western outskirts of Lismore.

At Lismore Substation, the Commission provides supply at 66 kV to Northern Rivers Electricity (N.R.E) which in turn distributes electricity to the Richmond River, Kyogle, Ballina and Byron Shires, the Municipality of Casino and the City of Lismore via a number of zone substations forming part of a 66 kV and 33 kV sub-transmission system. Lismore Substation and this N.R.E system service a resident population in excess of 100,000.

The Commission's 132 kV transmission system supplying the Lismore Substation and the N.R.E sub-transmission system emanating from it are also shown in Exhibit 1.1. Single 66 kV sub-transmission lines currently supply each of Ballina and Ewingsdale (Byron) Zone Substations. These are old transmission lines, having a limited power-carrying capacity which cannot be readily increased. Reconstruction of these transmission lines would require them to be disconnected for prolonged periods, with a consequent total interruption to supply because at present there are no alternate means of power supply. The 66 kV sub-transmission lines to Lismore South, Lismore East and Alstonville Zone Substations are of newer design and their conductors (the wires carrying the power) are of higher capacity.

1.2 INCREASING POWER DEMANDS

Recent trends and predictions by Commonwealth, State and local authorities indicate that there will be continued high population growth in the Far North Coast region of New South Wales. Trends also indicate that the maximum consumption of electricity (or "demand") per head of population will continue to increase, although the rate of increase is expected to decline.

The region, including both the Lismore district and coastal areas, has experienced a very high degree of development in recent years. There are more people, industries and commercial ventures in the region needing electricity. Over the last ten years the total area supplied from Lismore Substation has experienced a population growth of about 3.2% per annum. However, the corresponding increase in electricity demand has been about 7%

per annum, more than twice the population growth rate. This trend is fairly typical throughout the State where population growth is occurring.

The average annual growth in electricity demand over the last ten years in each local government area supplied from the Lismore Substation is shown in Exhibit 1.1.

The growth in demand for electricity in the Lismore, Ballina and Byron local government areas is expected to remain relatively high into the future, though moderating to a slightly lower rate of about 5-6% per annum. Many factors such as land developments, population trends and industrial developments are considered in the preparation of this forecast.

The average annual consumption of electricity per head of population in this area is relatively low. The existing transmission and sub-transmission systems in the area would not have future limitations if there were to be no further growth in electricity consumption, particularly at times of highest needs (referred to as "on peak" periods). It is currently approximately 60% of the State average. Northern Rivers Electricity has actively and very successfully encouraged extensive conversion of electricity consumption to "off-peak" periods, particularly for water heaters. Various active energy conservation measures in the form of Government programs and tariff incentives are being employed and these will be further expanded in the future. However, savings achieved by such conservation measures will be more than offset by increases in electricity consumption caused by the expected population growth in the area of at least 3% per annum. It is the expected growth in the community's maximum needs (demand) that will cause the existing power system to soon become deficient.

Any significant changes in the expected growth in electricity demand over the next few years may only affect the required timing of the proposed line by a few years. Before any capital is committed to the construction of the proposed line, the Commission will take every opportunity that arises from revisions of forecasts, to defer or advance construction, or re-evaluate the project if necessary, to meet the community's needs.

1.3 HOW AN ELECTRICAL SYSTEM CAN BECOME DEFICIENT

Three basic problems can cause a power system to become deficient: transmission line (wires) overheating, low voltage at the receiving end and substation overload. These problems may be explained as follows:

1. Every transmission line has a heating limit which restricts the amount of power it can carry. Above this limit the conductors (wires) would sag to below the minimum safety clearances to ground as set down in Statutory Regulations.
2. If transmission lines are required to carry excessive quantities of power over a long distance, the receiving end voltage level may become excessively low. If unacceptably low voltage levels are sustained the customer's electrical equipment or appliances may function either poorly or not at all and could even be damaged.

3. All substations have a power supply limit. If this limit is exceeded equipment failure may occur due to overheating and could in turn cause cascading damage to adjacent equipment. This would result in widespread and prolonged loss of electricity supply.

The onset of any of these conditions would require the imposition of restrictions on electricity usage or interruptions to supply at times of highest community need.

1.4 IMMINENT NORTHERN RIVERS ELECTRICITY WORKS

As outlined in Section 1.1, the two existing N.R.E. 66 kV sub-transmission lines that supply each of the Ballina and Ewingsdale (Byron) Zone Substations are old and of limited power carrying capacity. Operation of these lines with power flows in excess of designed limits would overload them, causing the conductors to sag below minimum safety clearances to ground as set down in Statutory Regulations. If no action were taken the growth in demand for electricity would be expected to cause such situations to arise within the next year or two on the existing system.

To avoid these overloads and the necessity for electricity restrictions or interruptions at times of highest community need in each of the Ballina and Byron Shires, it is essential that alternate supplies are provided to the Ballina and Ewingsdale Zone Substations. As soon as possible within the next two years, N.R.E. plans to complete two new high capacity 66 kV lines:

- one from Alstonville to Ballina as an alternative supply to the existing line, and
- the other from Ballina to Ewingsdale, to become the normal supply to Ewingsdale. This line will also cater for likely future developments along this coastal strip by allowing the connection of future new zone substations.

A new N.R.E. zone substation (66/11 kV) is required at Dunoon by 1989 to service the low but growing electricity usage in the Dunoon and surrounding areas. The source of supply is planned to be the existing N.R.E. Lismore-Ewingsdale 66 kV transmission line which runs adjacent to the substation site, thus avoiding the need for any new 66 kV lines in the area.

These proposed developments are illustrated on Exhibit 1.1.

1.5 FUTURE LIMITATIONS

1.5.1 The 66 kV System

Even with the new N.R.E. 66 kV lines expected to be completed shortly, the resulting 66 kV "ring" system from Lismore encompassing the East Lismore, Alstonville, Ballina, Ewingsdale (Byron) and future Dunoon zone substations (shown in Exhibit 1.1) will not be fully adequate to reliably supply the forecast demands for electricity in all these areas beyond 1989. Factors affecting reliability of supply are explained as follows.

Transmission lines may be forced to be out of service at any time for a number of reasons such as:

- damage caused by lightning, high wind, travelling bushfires, flooding, earth movement, vandalism or accident;
- the urgent need for repair or maintenance to remove hazardous conditions;
- failure or incorrect operation of transmission line or terminal equipment.

From about 1989, should the new Alstonville - Ballina 66 kV line be removed from service at times of highest electricity needs, supply restrictions or interruptions would be necessary in both the Ballina and Byron Shires, to avoid overloading the in-service lines. However, until 1991 the probability of such supply restrictions being necessary is acceptably low. In 1991 the probability of supply restrictions or interruptions increases substantially.

From about 1991, the Lismore - Dunoon - Ewingsdale 66 kV sub-transmission line is expected to become overloaded at times of highest electricity needs under normal conditions (ie. with all other system elements in operation). If the line were taken out of service between Dunoon and Ewingsdale to mitigate this overloading, low voltage would occur at Ewingsdale Substation and necessitate supply restrictions or interruptions. In addition, removal from service of any one of the Lismore - Alstonville, South Lismore - East Lismore or East Lismore - Alstonville 66 kV lines could cause low voltage and/or other line overloading at times of high electricity needs, again necessitating supply restrictions or interruptions.

It can be seen that from 1991 there is a substantial and increasing risk of supply interruptions becoming necessary, at times of high electricity needs. Such interruptions would affect one or more of the East Lismore, Alstonville, Ballina, Dunoon or Ewingsdale supply areas.

1.5.2 Lismore 132/66 kV Substation Capacity

By the mid 1990's it is expected that if no action were taken the electrical loading on The Electricity Commission's Lismore 132/66 kV Substation will exceed the capacity of the substation. If this occurred, supply interruptions would need to be shared around all the areas supplied from Lismore Substation at times of highest community needs. Increasing the capacity of this Substation by replacing the existing 60 MVA transformers with larger units would require major and costly reconstruction work and would eventually lead to a proliferation of 66 kV sub-transmission lines, as many 66 kV lines would become necessary to export power to service the more distant centres.

To offload Lismore 132/66 kV Substation and to provide a new bulk supply power source, it is necessary to establish a new 132/66 kV substation, appropriately sited to meet localised needs in the mid 1990's. All areas currently supplied from Lismore Substation would then continue to receive adequate bulk supply from Lismore without the risk of exceeding the capacity of the Substation.

A 132/66 kV Substation in the Mullumbimby area will permit the satisfactory long term supply to the Lismore, Ballina and Byron local government areas with a minimum number of new transmission lines. The Mullumbimby location makes fullest use of the capacity available on pre-existing 66 kV lines between Lismore and Ewingsdale via the Ballina area. Such ties between Lismore and

Mullumbimby will permit the maximum usage of existing 66 kV transmission line capacity by enabling power flow from either substation (existing flow is in one direction). Mullumbimby Substation will also facilitate possible future provision of supply north into Tweed Shire if and when required.

1.5.3 Supply to Tweed Shire

Northern Rivers Electricity supplies power within the Tweed Shire which is currently sourced from the Queensland power system. This electricity is transmitted to New South Wales via a 110 kV double circuit transmission line and is supplied under an agreement between the two states.

Towards the end of the 1990's the increasing demand for electricity in Tweed Shire is expected to reach the capacity of the existing supply system from Queensland. It is considered prudent for New South Wales to be in a position to augment supply to the Tweed at that time so that an adequate and reliable electricity supply can continue to be guaranteed to this rapidly developing corner of the state.

While there are no current proposals to augment supply to Tweed Shire from the New South Wales system, the potential for such future works is considered in this document when examining the various planning options for increasing the capacity of supply to the Byron and Ballina Shires.

1.6 JOINT ELECTRICITY COMMISSION / NORTHERN RIVERS ELECTRICITY PLANNING

A program of regular liaison is maintained between the Electricity Commission and Northern Rivers Electricity in order to better understand each others needs and examine each others proposals. This ongoing programme of joint co-ordination evolves and considers many alternatives for ensuring that the power system will continue to provide a safe, adequate, reliable and economic electricity supply with least overall impact on the community.

Recent joint studies by staff of the Commission and Northern Rivers Electricity indicate that the future 132/66 kV supply point (substation) near Mullumbimby provides the optimum solution both economically and in terms of minimising the number of transmission lines to meet both the short and long term requirements of all those areas currently supplied from Lismore Substation. To also cater for 66 kV system limitations the optimum strategy is to construct a new 132 kV line between Lismore and Mullumbimby by 1991, for initial operation at 66 kV until the Mullumbimby Substation is required. Alternative development options are considered in Section 1.8.

It was found that the appropriate solution was not to rebuild the existing 66 kV line between Lismore and Mullumbimby, but to provide a new high capacity line, and continue to use the existing line as a source of supply to the Dunoon 66/11 kV zone substation. This course of action eliminates the high risk of interruptions to supply which would occur during such reconstruction and is the most economic solution, especially when it is considered that a second 132 kV line is expected to be required by the mid to late 1990's.

In joint recognition that a second 132 kV line between Lismore and Mullumbimby could be required by the mid to late 1990's, the Dunoon Substation is being designed to enable its later conversion to 132/11 kV. This would become necessary if the optimum solution for the second line is found to be a reconstruction of the existing 66 kV line. No more than two 132 kV lines are required between Lismore and Mullumbimby to meet optimistic 40-50 year forecasts, even allowing for the possible future supply of Tweed Shire from Mullumbimby.

The overall joint long term strategy for augmenting electricity supply to this northerly part of the far north coast of the State, provides for electric power to be transmitted from Lismore to the Mullumbimby area at 132 kV. Electricity would then continue to be supplied to growing local areas from these bulk supply points via the existing 66 kV sub-transmission lines, including the N.R.E. lines expected to be completed within the next two years. This strategy offers maximum utilisation of existing and future community assets.

Forecasts of future electricity needs are updated at least annually resulting in regular reviews of the timing and need for developments. The Commission and N.R.E. will defer (or advance) construction of new transmission works where necessary if altered forecasts suggest such action is justified. The Commission in consultation with N.R.E. will undertake only those steps, within the above strategy, that are necessary and at the time of need, to maintain adequate electricity supply to all areas on the Far North Coast.

1.7 THE PROPOSED SCHEME AND PLANNING FOR THE REGION

From its inception, the Commission has responded to community requirements. During the 1950's, early demands focused on the elimination of electricity shortages in a quick yet economic fashion. More recent community expectations have placed increased emphasis on environmental considerations. The Commission has adopted a planning methodology which is responsive to these needs. Expansion of the power system is planned in such a way as to meet both present and future electricity requirements of the community and at the same time accommodate environmental considerations.

Development of the transmission system in stages to this part of the Far North Coast is considered to be the preferred option at this time. This will avoid the degradation of currently accepted standards of supply quality and reliability.

The proposed 132 kV link between Lismore and Mullumbimby would ensure that supply problems, which otherwise would cause electricity restrictions to be imposed in the Lismore, Ballina and Byron areas by about 1991, do not arise. It is planned to initially operate the new transmission line at 66 kV and reconnect it later for operation at its design voltage, when required (expected by the mid 1990's), so that the expenditure for the associated new 132/66 kV Substation at Mullumbimby can be deferred as long as possible. The future 132/66 kV substation in the Mullumbimby area would ensure that consumers in all districts currently supplied from Lismore Substation continue to have an adequate electricity supply.

Implementation of a programme covering the planned long term augmentation of the electricity supply system is expected to start at the end of the decade and continue until the late 1990's - early 2000's. The programme to provide 132 kV supply to this northerly part of the Far North Coast (as distinct from the 7-stage programme proposed for the entire Far North Coast region), may be summarised as follows:

Stage 1: Lismore - Mullumbimby 132 kV Transmission Line (the proposal)

This line is the subject of this document. The line is required to be in service by about mid 1991 and is planned to operate initially at 66 kV. This action is necessary to ensure that the loading on the existing older Lismore - (Dunoon) - Ewingsdale 66 kV sub-transmission line does not exceed its designed rating.

The new transmission line will also provide for further growth in community demand for electricity in the area, by increasing the capacity of the supply system to the East Lismore, Alstonville, Ballina and Mullumbimby districts. This line will ensure that problems which would cause electricity restrictions to be imposed from about 1991 do not arise.

Stage 2: Mullumbimby 132/66 kV Substation (not part of the current proposal)

This substation would be required when the limit of Lismore Substation capacity is reached. This need will arise as the loads in all areas currently supplied from Lismore Substation continue to grow. This development is expected to be required by the mid 1990's.

Stage 3: Second Lismore - Mullumbimby 132 kV Transmission Line (not part of the current proposal)

Expected continuing growth in the Far North Coast could require a second 132 kV transmission line to Mullumbimby within a few years after the establishment of the Mullumbimby Substation (by about mid to late 1990's).

If this transmission line is not built as required, an unacceptable and rapidly increasing risk of supply interruption or restrictions would arise during periods of moderate to high electricity consumption. Also, essential maintenance of a lone 132 kV transmission line would become increasingly difficult to be carried out, without the necessity for imposing electricity restrictions over widespread areas. Reconstruction of the existing N.R.E. 66 kV transmission line between Lismore and Mullumbimby will be carefully considered for this second 132 kV line, along with other options which may be available at the time.

Further Stages (not part of the current proposal)

The two 132 kV transmission lines to Mullumbimby will be adequate to meet the expected foreseeable long term bulk electricity demands of Ballina, Byron and, if necessary, Tweed Shires.

The electricity requirements for the maximum expected further development of the coastal strip between Ballina and Ewingsdale can be supplied from Mullumbimby at 66 kV. N.R.E. is planning a second 66 kV (single pole) sub-transmission line between Mullumbimby and the Ballina area (on a route west of the Pacific Highway). This line would be built so that it can be readily converted to a double circuit 66 kV line if and when necessary.

New developments to the north of Mullumbimby (such as Ocean Shores) and up to the Tweed Shire, if necessary, could be accommodated by supply at 132 kV or 66 kV. These factors have been considered in the choice of the proposed scheme.

This strategy would mean that no electricity restrictions or interruptions over widespread areas would need be applied throughout the 1990's in the Richmond River, Casino, Lismore, Kyogle, Ballina and Byron local government areas, due to bulk transmission system limitations, except in the most unlikely emergencies involving removal from service of many transmission system components simultaneously.

The Electricity Commission (and N.R.E.) consider these planned system augmentations to the area to be the most appropriate solution, in terms of potential environmental impact and cost, to the problems associated with the continued provision of an adequate and reliable supply of electricity. These works will meet this growing community's forecast electricity consumption requirements in both the short and long term.

The construction of each future Commission transmission line indicated in the programme will be the subject of the appropriate environmental impact assessment as required at the time.

Alternatives to the current proposals are discussed in Section 1.8, 1.9 and 1.10.

1.8 ALTERNATIVE SYSTEM DEVELOPMENT OPTIONS

1.8.1 Introduction

As discussed in Section 1.5, it is necessary to augment the 66 kV electricity supply system encompassing East Lismore, Alstonville, Ballina, Byron and Dunoon areas by about 1991, to meet its growing demand and to avoid an increasing risk of overloading transmission lines and/or the occurrence of undervoltage conditions which may necessitate electricity supply restrictions or interruptions. By the mid 1990's it is also necessary to relieve the loading on the Lismore 132/66 kV Substation so that adequate supply can be maintained to all areas supplied from it.

In this Section, various practicable options for achieving a suitable augmentation are evaluated. They are compared on the basis of effectiveness in meeting expected needs, environmental impact in terms of minimising the number and length of transmission lines, and compatibility with an overall long term strategy for ensuring adequate supplies to this part of the Far North Coast region.

In addition, a number of conceivable solutions, such as using underground cables or alternative sources of energy, have been examined. As outlined in Sections 1.9 and 1.10, these solutions are not considered practicable.

The preferred development scheme is nominated and its advantages are discussed. The consequences of not proceeding with the development are also discussed.

1.8.2 Feasible Alternative Supply Arrangements

Several tactical steps towards the strategic strengthening and development of the existing power supply system to the Lismore, Byron and Ballina areas have been examined and are discussed below:

The expected long term outcomes of each option are shown schematically in Exhibit 1.2. It is considered prudent to include provisions for possible future supply to Tweed Shire from the New South Wales system. This would require the construction of additional 132 kV transmission lines north from Mullumbimby. However, these works are not included in the economic costing of these options.

Option 1: Construct a new transmission line from Lismore Substation to Mullumbimby (the proposed scheme)

A new 132 kV transmission line (to be operated initially at 66 kV) from Lismore Substation to the Mullumbimby area would relieve the limitations of the existing supply system described in Section 1.5. This proposed transmission line would ensure that line overloads or low voltage conditions which would cause electricity restrictions to be imposed in the Lismore, Ballina and Byron areas by about 1991, do not arise.

However, as consumption of electricity in this area continues to grow, the 66 kV system, even with this extra support, would reach its capacity limit by about the mid 1990's, around the same time that the Lismore 132/66 kV Substation reaches its loading limit. The transmission line is the first tactical step to enable the establishment of a future 132/66 kV bulk supply point in the Mullumbimby area. This will ensure that consumers in all districts currently supplied from the Lismore Substation, continue to have adequate bulk supply of electricity. Some time after the establishment of a 132/66 kV bulk supply point in the Mullumbimby area, a second 132 kV line will be required to ensure that these developing communities have a reliable supply of electricity. Reconstruction of part, or all, of the existing Lismore - (Dunoon) - Ewingsdale 66 kV line would be given consideration in conjunction with an examination of other available options for this line to form the second 132 kV circuit.

In environmental terms, Option 1 would produce impacts associated with the construction of a two pole-type transmission line for a length of approximately 40 km. This option also produces the least number of new transmission lines in the long term and has the lowest costs of the practicable options.

The construction of a 132 kV transmission line, as required by Option 1, would cost approximately \$2.0 million (based on latest prices). The line would initially operate at 66 kV to defer expenditure on the 132 kV substation works at Mullumbimby, until absolutely necessary.

Option 2: Reconstruction of the (existing) Lismore - Ewingsdale 66 kV transmission line to 132 kV

The option to reconstruct the existing 66 kV transmission line to 132 kV has been considered. Once in service (initially at 66 kV) the rebuilt line would satisfy part of the short term requirements. As foreshadowed in Section 1.4, Northern Rivers Electricity plans to establish a 66/11 kV Zone Substation, near Dunoon, required for operation by about 1989. This zone substation will need to be supplied from Lismore Substation through the existing 66 kV

sub-transmission line. However, if Option 2 is adopted, the existing line would have to be reconstructed either prior to the commissioning of Dunoon Zone Substation or, if after the Substation is established, during restricted period of low electricity usage (i.e when the Dunoon area can be supported on existing 11 kV lines, but with substantially increased risk of interruptions). Reconstruction of existing lines takes longer than the construction of new lines, involves higher costs, (particularly, if work is restricted to periods of low electricity usage) and in this case would cause substantial risk of widespread interruptions in the Ballina, Byron and Dunoon areas during the reconstruction period (expected to last 12 to 18 months).

This option would also necessitate conversion of Dunoon Substation to a 132/11 kV Substation when Mullumbimby 132/66 kV Substation is established in the mid 1990's. This conversion would cost approximately \$1.5 million (based on latest prices) and would take place several years earlier than might otherwise required under Option 1. As mentioned in Section 1.6, a second 132 kV transmission line to Mullumbimby is expected to be required from Lismore by the mid-late 1990's, not long after the establishment of a 132/66 kV bulk supply point at Mullumbimby. A new route for a 132 kV line would then be required.

In planning terms the net result of adopting Option 2 would be to create a substantial risk of supply restrictions or interruptions to consumers for a prolonged period. Also, as a result of not having a 66 kV sub-transmission backup (as under Option 1) the system would become less reliable. The net result in the long term is likely to be only an alteration in the sequence of works in the area.

In terms of environmental impact, this option does not avoid the need for a second 132 kV line, which would eventually be required by about the mid to late 1990's. It also involves higher overall costs than Option 1 (about \$1-2 million extra at present day valuation).

Option 3: Transmission lines via the Coastal Strip

Provision of a new 132 kV transmission line to the Mullumbimby/Byron area via the coast, was considered using some sections of existing 66 kV sub-transmission line reconstructed to 132 kV, where possible.

However, this route would be approximately 20 kilometres longer than a direct Lismore - Mullumbimby line route. This could cost the State's electricity users about \$1 million more than Option 1, with no offsetting technical or environmental benefit.

Since this transmission line is considerably longer and would be expected to traverse more heavily populated areas than that proposed in Option 1, its presence would probably affect a greater number of property owners and have a greater potential for environmental impact.

If such an option were to be adopted, the substations already built along the route (Alstonville, Ballina, Ewingsdale) would need to undergo major redevelopment and refitting to 132/11 kV to meet the new requirements (at an estimated cost of approximately \$2 million per substation). This would also incur significant risks of supply interruptions during such redevelopments. To maintain supplies during these reconstruction works, a minor upgrading of the Lismore - Dunoon - Ewingsdale 66 kV line would be required by about 1991.

This would increase its capacity while still being only needed as a 66 kV line, and could be done in multiple stages. This upgrading would become possible after completion of the 132 kV works from Lismore to Ballina.

In technical terms such a 132 kV line would have a lower power capacity limit because of its extra length (about 50% longer than the line in Option 1), and therefore it would be expected to necessitate further 132 kV transmission line(s) to be required in the area in the long term.

Option 3 incurs extra costs of about \$3 million, at present valuation compared to Option 1. In technical terms Option 3 would result in increased risks of widespread interruptions or restrictions over many years (during times of substation and transmission line reconstruction works).

A variation of Option 3 would be to reconstruct the nearly completed new 66 kV transmission lines via the coast to form initially a 66 kV circuit and to be convertible later to double circuit 132 kV transmission lines. However, in order to provide the required long term power capacity the structures would have to be either steel towers or closely spaced large concrete or steel poles with three line conductors supported on each side of the structure. This would have a double effect: (a) environmentally, there is likely to be a greater impact, and (b) economically, it would cost three to four times as much as Option 1. The provision of two vital circuits on one set of structures also reduces the reliability of supply to the area, as a single event, for example a lightning strike, could simultaneously remove both circuits from service.

In economic terms this variation would have a very high overall cost and would thus place an unnecessary economic burden on New South Wales electricity users.

Option 4: Establish a 132/66 kV Substation near Ballina

To cater for the expected load growth in the Ballina and Byron areas, an option to construct a 132/66 kV substation near Ballina rather than near Mullumbimby was considered. A 132 kV transmission line would need to be constructed from the Lismore area to supply this substation. To meet the short term supply requirements from 1991, this line would initially operate at 66 kV, and an additional 66 kV sub-transmission line would be required from Ballina to Ewingsdale. Later a second 132 kV transmission line would be required from Lismore to Ballina to ensure continued reliability of bulk supplies. This Option, neglecting possible future supply of Tweed Shire from the New South Wales system, has similar costs to Option 1.

However, in planning terms, this 132 kV substation and associated transmission line would be in a location that would not facilitate the future supply of Tweed Shire from the N.S.W. system. Hence in addition to this development it may eventually be necessary to construct additional 132 kV lines northward from Lismore and Ballina and possibly establish a substation or switching station at Mullumbimby to cater for the possible supply of Tweed.

Under such circumstances, this Option would be expected to lead to a greater number of transmission lines between Lismore and Ballina and northwards and greater costs in the long term compared to Option 1.

Option 4 therefore has both environmental and economic disadvantages when compared to Option 1.

1.8.3 No Build Option

One option is not to undertake any further development of the Commission's transmission system.

The consequences of the "do nothing" option on the availability of bulk supply and likely effects on customers in the area have been examined, assuming the growth in electricity requirements follows established trends.

If the proposed transmission line is not built by about 1991, localised supply restrictions would become necessary in the Alstonville, Ballina and Ewingsdale areas. This would take place if a colder than average winter occurs, even when all system elements are in service. In the event of having any one of the several 66 kV Council sub-transmission lines out of service, at times of moderate to high demands, restrictions or interruptions in the mentioned areas are also highly probable.

Furthermore, if a new 132/66 kV bulk supply point cannot be served by such a transmission line, by the mid 1990's, broader restrictions on the supply of electricity have to be imposed. These restrictions would be shared at times of highest needs by all customers currently supplied by Lismore Substation (i.e. approximately 100 000 people). With further expected development of the area the severity and duration of these interruptions would rapidly increase to intolerable levels. Also, no capacity would become available for bulk supply of the Tweed Shire area from the New South Wales power system if this were later required.

The construction of the proposed transmission line, by Winter 1991, would generate a saving of approximately \$1 million in the period up to 1995 from a reduction in system losses (i.e. the energy lost in the form of heat radiating from the system's transmission line while carrying power). It would also avoid risks of widespread interruptions (estimated to cost the community on the balance of probabilities, about \$0.3 million up to 1995).

If the construction of a transmission line as presented in the preferred option, were to be delayed until the mid 1990's (i.e. until the new Bulk Supply Point at Mullumbimby is essential) a net benefit to the community would be lost.

Such real economic benefits to the community would commence in 1991 if Option 1 is adopted.

1.8.4 Conclusion

In this assessment the various practicable options for upgrading the power supply to the Byron - Ballina area have been examined and it is considered that Option 1, the construction of a new 132 kV transmission line from Lismore to the Mullumbimby area by 1991, is the most suitable course to follow. This will allow the best use to be made of existing and future assets, and provides net economic benefits to the community.

Option 1 satisfies both short and long term objectives and is consistent with the overall strategy for augmentation of the supply system to the Far North Coast of New South Wales.

The cost of this option is acceptable and it is believed the transmission line can be constructed with an acceptable environmental impact, as assessed in the following sections of this document.

Economics dictate that the proposed Lismore to Mullumbimby 132 kV transmission line should be initially operated at 66 kV to defer for as long as possible the need to establish a 132 kV substation at Mullumbimby, and obviate N.R.E. from carrying out potentially redundant 66 kV sub-transmission works in the system supplying the coastal area. Near Mullumbimby, this line will connect onto an existing line section to Ewingsdale Substation.

1.9 ALTERNATIVE ENERGY SOURCES

The Electricity Commission and the New South Wales Department of Energy are actively involved in the investigation of alternative sources of energy and have co-operated in the establishment of a number of pilot projects. These alternatives have also been reviewed in examining options to improve the electricity supply to the Far North Coast Region. These alternatives and the reasons they are considered impractical are summarised as follows:

1.9.1. Solar Energy

The Commission has participated in the development of an experimental solar generation plant at White Cliffs in western New South Wales and has a number of solar-powered radio installations at remote locations throughout the state.

The conversion of solar energy to electrical energy is only possible during the daytime and under fine conditions.

Should such an installation be established, an alternative electricity supply system would still be required to ensure that an adequate supply of electricity could be maintained during periods when solar generation was not available. A solar plant of sufficient size and adequate backup facilities to meet the needs of this part of the Far North Coast area would be prohibitively costly.

1.9.2 Hydro-Electric Energy

The Commission has extensive experience in the planning and operation of hydro electric power stations of all sizes since its formation in 1950. The Commission owns and operates (throughout the State) hydro power stations with a total capacity of some 360 Megawatts and shares the resources of the Snowy Hydro Scheme with the State Electricity Commission of Victoria.

Also within the Far North Coast area, N.R.E. owns and operates conventional hydro-electric power stations, one of them being at Lavertys Gap near Mullumbimby. Its capacity is 250 kW.

This generating capacity is far too small to affect the need or timing of the proposed transmission line. Expansion of this hydro-electric station would require major hydro infrastructure changes, including dams, at very large capital cost and with major environmental impacts.

Small scale (less than 20,000 kilowatts) hydro-electric developments are possible and under investigation, but again capital costs are high and system connections (transmission lines) would also be required. The overall environmental impact could be very significant.

Both large or small scale hydro-electric developments in the area would incur net overall costs far greater than the preferred transmission works option.

1.9.3 Fuel Cells

The Commission continuously reviews developments occurring in fuel cell technology. The Department of Energy also reviews, co-ordinates and encourages research into such areas of new technology.

Currently, the technology and production facilities do not exist for ready application of fuel cells of any significant scale, in the available time or at reasonable cost.

1.9.4 Wind Energy

The generation of electricity by wind is susceptible to weather conditions. Hence, as for solar power, an alternative supply system would still be necessary to cover periods when generation was not possible on the scale which would be required for supply to this part of the far north coast area. A large number of such generation units would be required. These would cover a substantial area of high exposed ground in order to capture sufficient wind energy and would be extremely costly. The power generators would also require connections to the power system and occupy much space at exposed and visually prominent sites. While reducing the consumption of fossil fuel elsewhere, wind power generation would have significant cost, environmental, visual and noise impact disadvantages.

1.9.5 Ocean Energy

The Commission has for many years reviewed the development of systems to harness the wave and tidal energy with a view to its use in isolated locations. However, the small mean difference between tidal level and lack of vigorous wave action along the New South Wales coast may not be suitable for existing tidal or wave energy devices.

The Electricity Commission and other Australian power authorities are keeping developing technology in this area under review. However, at this time excessive cost, low reliability, and inadequacy preclude this option as an alternative means of electricity supply.

1.9.6 Geothermal Energy

There are no known locations in New South Wales where geothermal energy can be used for the production of electricity.

1.9.7 Nuclear Energy

In a policy statement dated 20th May, 1986 by the Minister for Energy, the Hon. P. Cox, the New South Wales Government indicated that the generation of electricity by the use of nuclear reactors would not be an alternative considered by the Government.

1.9.8 Other Sources of Energy

Other forms of energy conversion such as Coal Gassification, Fluidised Bed Combustion (which are alternative methods of extracting the energy contained in coal), Biomass energy, (or the extraction of heat from biological waste) and Ocean Thermal Gradients are not sufficiently technologically developed and/or economically viable as alternate means of electricity generation. They are therefore considered unsuitable for application to this area of the north coast.

1.10 NON-PRACTICABLE OPTIONS

For completeness, a discussion of various other conceptual solutions to the problem of augmenting this power supply system is presented. Some of these possibilities are often suggested as preferable alternatives to transmission line construction but are impracticable for either technical or financial reasons.

1.10.1 66kV Upgrading of the Existing Lismore - Ewingsdale (66 kV) Transmission Line

Some years ago when lower electricity usage was forecast, N.R.E. was proposing to upgrade (at 66 kV) the existing Lismore - Ewingsdale 66 kV transmission line up to near Mullumbimby, following completion of the planned Alstonville - Ballina - Ewingsdale 66 kV lines. A strong 66 kV "ring" system would thus have been formed between Lismore, Ballina and Mullumbimby areas. Without upgrading, the existing line could not be part of such a ring because of its low power carrying capacity.

Continued high growth in population and electricity demand in this area in recent years, together with predictions of further rapid development, mean that the proposed 66 kV "ring" system after reinforcement would only have the capability of supplying the electricity requirements of the Ballina to Mullumbimby area until about the early 1990's. After this time, additional 66 kV lines would be required (many more than for the 132 kV option) leading to a proliferation of 66 kV lines. Also, continuing high population growth and increasing community demand for electricity throughout the Richmond River, Casino, Kyogle, Lismore, Ballina and Byron areas mean that the Commission's 132/66 kV Substation at Lismore would be unable to cope with the highest electricity needs of all these areas beyond the mid 1990's.

The Commission and N.R.E. have jointly assessed the future needs of the area for electricity supply. The preferred option in terms of minimising the number of new lines in the long term and costs to the community, is to provide for the future establishment of a 132/66 kV Substation near Mullumbimby (about mid 1990's). Rather than a wasteful reconstruction of the existing line at 66 kV, a Lismore - Mullumbimby 132 kV line is planned for about 1990/1991 for initial use by N.R.E. at 66 kV. The existing 66 kV line to Ewingsdale will be used to supply a zone substation near Dunoon (necessary to cater for growth in electricity demand in the Lismore and Dunoon areas) by about 1991; the low power carrying capacity of the line is adequate for this purpose.

1.10.2 Obtain Supply from Queensland

As previously outlined, the Tweed Shire is supplied from the Queensland power system. This is achieved via a double circuit 110 kV transmission line that terminates in New South Wales at Terranora. Hence, there exists a possibility of supplying the Far North Coast from Queensland. However, the provision of supply to the Byron and Ballina Shires from Queensland via Terranora would necessitate the construction of a line at least 10 kilometres longer than the line now proposed under Option 1. Furthermore two lines from this location would eventually be required.

As different voltage level systems are used in the Tweed Shire, voltage conversion equipment would also be required.

The capacity of the supply to Tweed from Queensland is very limited. In the short term after the above connection was established, there would be a need to provide additional 132 kV circuits from Lismore to the Byron/Ballina areas or substantial and costly higher voltage reinforcement of the Queensland system.

Thus, in planning terms, such an option does not discard the need for two 132 kV transmission lines between Lismore and Mullumbimby, which would still be required about the mid to late 1990's.

Should it be necessary to eventually supply the Tweed Shire from the N.S.W. system, then this option only serves to alter the sequence of works involved in the long term strategy of this development.

In economic terms this option would be more costly than Option 1 as it requires the construction of longer lines, earlier than would otherwise be required, as well as substantial additional substation works at Terranora.

1.10.3 Upgrade Lismore 132/66 kV Substation

The upgrading or extending of the existing Lismore 132/66 kV Substation does not overcome all the limitations outlined in section 1.5. The substation requires significant upgrading, which would need an expensive staged programme of reconstruction works. During such works, the risk of widespread interruptions or restrictions would be high. Also, this option would not overcome the future limitations of the 66 kV sub-transmission system supplying the coastal areas.

Hence, such an option would in the short term necessitate increasing the number of 66 kV sub-transmission lines towards the Ballina and Mullumbimby areas, in order to supply the expected loads over the distance from Lismore. Associated with this option, therefore, is the increased environmental impact and costs due to the need to construct additional 66 kV lines. Eventually, 132 kV lines to the coast would also be required to overcome the limitations associated with the transmission distance.

1.10.4 Underground Cables

A conceptual alternative to the construction of a 132 kV overhead transmission line would be to install underground cables. This option has been and is being used by The Electricity Commission and other electricity authorities over short distances in high density urban areas, where cables are laid in roadways.

The cost of installing either a.c. (alternating current) or d.c. (direct current) underground cables is many times greater than for overhead transmission lines. Furthermore, a.c. cables (which are usually of the oil filled type) are not technically suitable for the transmission of electric power over long distances, unless additional costly voltage regulating equipment is provided along the cable route. Such an installation also requires maintenance pits at 500-600 metres intervals and buried oil tanks (to maintain adequate oil pressure in the cable at all times).

The use of d.c. underground cables, although not requiring voltage controlling stations along the route, necessitates conversion stations at the two ends. The cost of providing this type of equipment would be very high.

The possibility of using underground cables for the entire length of the line would not provide adequate electrical support to the transmission system and is therefore not considered practicable.

The adoption of short cable sections in selected areas, coupled to an overhead transmission line is feasible but would incur the penalty of substantially higher costs than if overhead transmission lines were used throughout. In addition it would be necessary to acquire land at each end of the cable route to erect a high voltage enclosure in order that a transition could be made from underground to overhead transmission.

In rural areas, if cables are not laid in ready made roadways, cleared easements with vehicle access directly above the entire cable route would be necessary. This could create considerable disturbance. Underground cables for 132 kV transmission would cost approximately 15 to 20 times the cost of a conventional transmission line. (In this particular case the cost would be approximately \$30 million; this does not include the additional cost of the voltage regulating equipment).

The cost of maintenance for underground cables is also significantly greater than for overhead lines. In the event of a cable failure, the time taken to locate and repair the fault is often many weeks, compared to overhead transmission line faults which are usually rectified within hours.

The installation of underground cables would result in protracted inconvenience on roadways or on properties during the excavation, cable laying and backfilling procedures. After installation, access to the entire easement would have to be maintained resulting in the easement area being available for a more limited range of uses than would occur with an overhead transmission line. These impacts would be significantly greater than those associated with the construction of an overhead transmission line. At no location in rural New South Wales has the Electricity Commission found the benefit of inserting an underground section in a major transmission line to be worth the significant penalties that such an installation would incur.

1.10.5 Installation of Combustion Turbine Generators

Another means of supplying electricity at times of high loading is the installation of strategically located generation. Combustion turbines have relatively low capital cost compared with the large coal fired steam turbo-generators which supply the majority of the State's electricity needs. However, due to their extremely high fuel costs and their poor efficiency at less than full output, the combustion turbines are best suited as a means to

cover temporary shortfalls in supply (i.e. during emergency conditions) rather than for the continuous generation of electricity.

The use of combustion turbines could also present significant air and noise pollution problems. For practical and space considerations, these units would need to be installed near the site of the proposed Mullumbimby 132/66 kV Substation. This would involve the establishment of the switching station portion of this proposed substation to connect the turbines and transmission lines. Significant site costs would be incurred.

It should be noted that no suitable natural gas supplies are known to exist sufficiently close to the Mullumbimby area, to achieve cheaper fuel costs by the gas-firing of combustion turbines.

For the above reasons the option to provide Combustion Turbine generation is considered unpracticable.

1033/1987

LEGEND

- SHIRE BOUNDARY
- AREA SERVICED BY PROPOSAL

ELECTRICITY COMMISSION OF NSW SYSTEM

- SUBSTATION
- FUTURE SUBSTATION
- 132kV TRANSMISSION LINE
- PROPOSED 132kV TRANSMISSION LINE
- 330kV TRANSMISSION LINE OPERATING AT 132kV

NORTHERN RIVERS ELECTRICITY SYSTEM

- SUBSTATION
- FUTURE SUBSTATION
- 33kV TRANSMISSION LINE
- 66kV TRANSMISSION LINE
- 66kV TRANSMISSION LINE UNDER CONSTRUCTION

SUPPLY SYSTEM TO NORTH-EAST CORNER OF NSW

LOCAL GOVT. AREA	* NORTHERN RIVERS ELEC. SUBSTATIONS		'77 - '86 AVERAGE ANNUAL DEMAND GROWTH
LISMORE	(SL) - SOUTH LISMORE,	(EL) - EAST LISMORE	6.7%
BALLINA	(A) - ALSTONVILLE,	(B) - BALLINA	9.1%
BYRON	(E) - EWINGSDALE		6.8%
KYOGLE	(K) - KYOGLE,	(M) - MALLANGANEE,	3.7%
	(Bo) - BONALBO,	(U) - URBENVILLE	
CASINO	(C) - CASINO		5.6%
RICHMOND R	(W) - WOODBURN		4.3%

* NOTE:
SOME NRE SUBSTATIONS SUPPLY ELECTRICITY TO MORE THAN ONE LOCAL GOVERNMENT AREA
SOURCE:
NORTHERN RIVERS ELECTRICITY RECORDS

LEGEND

- POWER STATION
- SUBSTATION
- 132kV TRANSMISSION CIRCUIT
- 330kV TRANSMISSION CIRCUIT
- 330kV TRANSMISSION CIRCUIT OPERATED AT 132kV
- PROPOSED 132kV TRANSMISSION LINE TO BE OPERATED INITIALLY AT 66kV
- BOUNDARY OF NRE DISTRIBUTION AREA

NSW FAR NORTH COAST SUPPLY SYSTEM

ELECTRICITY COMMISSION OF NSW
LISMORE - MULLUMBIMBY 132kV TRANSMISSION LINE

EXISTING SUPPLY ARRANGEMENTS

EXHIBIT 1.1

2. Features of the Study Area

2.1 INTRODUCTION

Section 1 outlined the need for increased power supplies to the Far North Coast region and described possible supply augmentation options. An examination of the advantages and disadvantages of a number of options indicated that a 132kV transmission line running from the existing Lismore substation to a new substation in the vicinity of Lavertys Gap, near Mullumbimby, provided the most feasible option on a number of operational, environmental and economic grounds.

Having established a preferred supply arrangement, the question of a preferred route location needs to be addressed. In this section, an appropriate study area is defined and analysed for features relevant to transmission line location. Descriptions of natural and man-made environments provide a data base for the identification of areas of constraint to assist in route selection (Section 3), project description (Section 4) and impact assessment (Section 5).

In Sections 2.3 and 2.4, the physical and biological environments are described in sufficient detail to provide an overview of relevant ecological and geographical aspects of the region. In Section 2.5, the man-made environment is analysed, including State and Local Government planning controls, existing and planned agricultural and residential uses, as well as a discussion of scenic and recreational values of the area.

2.2 STUDY AREA OVERVIEW

The area of land which is the subject of detailed investigations (the study area) is that shown in Exhibit 2.1. It represents the area within which feasible route alternatives are considered likely to lie. Features considered as absolute constraints to route location which led to the delineation of the study area shown are:

- . the southerly starting point of the line at the Lismore Substation, approximately three kilometres west of Lismore
- . the northerly termination point at the site of the proposed Mullumbimby Substation at Lavertys Gap, approximately five kilometres south west of Mullumbimby
- . forested areas of the Nightcap Range to the north west and
- . the coastal escarpment and plain to the south east.

The forests of the Nightcap Range were considered as an absolute constraint to route selection because of their ecological significance and the high value placed on them by the community. The escarpment and coastal plain were similarly considered because of the population density and likely visual impacts, as well as indirectness of route.

The study area is located in the Far North Coast region of New South Wales, and includes a portion of a locality commonly referred to as the 'Rainbow Region'. The scenic quality, temperate climate and proximity to the coast combine to create an extremely attractive environment. This has encouraged the migration of large numbers of retiring urban dwellers and 'new settlers' to the area in the past twenty years. The traditional agricultural base of dairying and grazing has been expanded in recent years with the widespread introduction of horticultural plantations.

Dominant natural features in the region include the Mt. Warning caldera, the southern perimeter of which forms the Nightcap Range, the coastal escarpment and incised plateau areas. Major peaks are Jerusalem Mountain (800m), Peach Mountain (600m) and Mount Chincogan (307m). The area is also characterised by remnant stands of the 'Big Scrub' native forests. The natural features of the region and the recreation opportunities provided by such areas as the Nightcap Range National Park, Minyon Falls Flora Reserve, Whian Whian State Forest and the Rocky Creek Dam Recreation Area have made it a popular tourist destination.

2.3 PHYSICAL ENVIRONMENT

2.3.1 Landform

Principal landform elements comprise the steep footslopes of the Nightcap Range in the north west portion of the study area, and the steep to rolling hills of the volcanic plateau over the remainder. The plateau is heavily dissected and is well drained by streams from the Nightcap Range including Mullumbimby Creek, Wilsons River, Coopers Creek, Boomerang Creek, Leicester Creek and Terania Creek. A feature is the broad floodplain of the Wilsons River between Booyong and Lismore. Elevations vary between 50 and 150 metres above sea level (A.S.L.), with slopes generally ranging from 0-5% in the river valleys, to 15-20% on the hillslopes and ridges. Some slopes are in excess of 25%.

The eastern boundary of the plateau is defined by the coastal escarpment. The elevation of the escarpment varies from approximately 100 to 250 metres A.S.L. and has resulted from weathering forces and fluctuating sea levels in past geological eras. The substation site at Lavertys Gap is situated at the footslopes of the escarpment, to the southwest of Mullumbimby. Mullumbimby is situated on the coastal plain. Principal landform elements in the area are shown in Exhibit 2.1.

The study area falls within a 'notified catchment' for the purposes of the Soil Conservation Act and as such, all land sloped 18 degrees or greater is classified as 'Protected Land' to which certain controls on tree clearing apply for the prevention of soil erosion. For any route located within protected lands, it would be necessary to make application to the Catchment Areas Protection Board under Section 21c of the Soil Conservation Act for a permit to clear timber. Protected Lands within the study area are shown on Exhibit 2.1.

2.3.2 Geology and Soils

Geology

The most recent rock formation took place about 21-23 million years ago as a result of lava flows from the Mount Warning volcano. These flows covered earlier formations such as the Bundamba and Neranleigh Fernvale Groups which formed between 135 to 430 million years ago. The lava flows formed the Lismore Basalt, the Nimbin Rhyolite and most recently the Blue Knob Basalt.

Differential uplift occurred after the cessation of volcanic activity followed by Quaternary erosion and subsequent alluvial deposition partially filling valleys and forming flood plains.

Soils

The Krasnozem soil group, which form from the basaltic rocks of the region, are the most common soils of the volcanic plateau. These rich soils have formed under an extremely wet climate, and are generally located where present annual rainfall exceeds 1180mm. They are well structured, subplastic red loams. They have good water translocation properties and a stable structure when wet resulting in only a moderate sheet and gully erosion risk. Mass movement can be a problem where profiles are deep on steep slopes.

Other soils within the study area include the Chocolate soils. These soils also formed on basalt, but under present climatic conditions. They are located in the dryer regions and hillslopes of the plateau and are well structured but shallower and less fertile than the Krasnozems. Brown podzolic soils have formed on the more acidic rhyolite flows which occupy areas associated with the Nightcap Range. Topsoils are highly organic while the subsoils are usually poorly structured. The Chocolate soils, along with hard setting podzolic soils and soils of poor structure with podzolic dispersible subsoils, pose some constraint on transmission line location where they occur in steep terrain where timber has been removed.

The remaining soils occur on alluvial deposits along the Wilsons River, its tributaries and the coastal plain. Soil types include Black Earths and Weisenbodens, which form largely from the eroding basalt capping. Although their erodibility is high the erosion hazard is low and generally will not present a constraint.

None of the soils likely to be encountered in the study area constitute a significant constraint on route selection. However, since mass movement in steep areas could be a problem, particular care would be required to minimize ground disturbance during construction of the line. Where clearing is necessary, suitable grasses would need to be established to maintain the stability of the transmission line easement and associated access tracks, as well as to protect adjacent lands and streams from degradation by sedimentation.

2.3.3 Drainage and Flooding

Principal drainage patterns are shown in Exhibit 2.1. Streams in the plateau area generally flow in a southerly direction from the Nightcap Range in the north, to the Richmond River south of Lismore. The main watercourse is the Wilsons River, which drains in a southwesterly direction, and whose main tributaries include Coopers Creek, Boomerang Creek, Numulgi Creek, Terania Creek and Leycester Creek.

A second catchment lies to the north-east of the coastal escarpment and drains in an easterly direction to the sea. The major watercourse is the Brunswick River, which flows through Mullumbimby. Tributaries include Mullumbimby Creek, Kings Creek and Pipeclay Creek. South of this area are a number of smaller catchments formed by the coastal ridges, all of which drain to the sea.

The main points of interest in relation to transmission line location are the depth and velocities of 1 in 100 year floodwaters for streams in the Wilsons River catchment which are crossed by the route concepts outlined in Section 3.5.

- . Leycester Creek - the floodplain associated with this creek passes immediately to the north of the Lismore Substation. The maximum recorded flood height occurred in 1974 when the water level reached 13 metres AHD at the creek bank, constituting a one to two metres depth of water over the floodplain. A worst possible event would cause an additional one metre in flood height, resulting in a depth over the floodplain of two to three metres. The estimated flow rate would be in the order of one metre per second.
- . Coopers Creek - the highest flood recorded at the Water Resources Commission gauging station at Ewings Bridge, south of Corndale was in 1976 when the water level reached 1.78 metres over the bridge, 0.8 metres over the bank and 2.74 metres over the surrounding fields. The flow rates at Ewings Bridge were 0.56 metres/sec. during the 1976 floods, and have been as high as 0.88 metres/sec. during other floods.
- . Wilsons River - the Richmond River County Council have advised that the highest flood level recorded was in 1976 when flood waters rose to a height exceeding three metres over the roads near Eltham. Further downstream near Bexhill a depth of 1.5 metres over the road at the railway viaduct was recorded in 1976. Water velocity during the floods in the Eltham area has been measured at 1.3 metres per second.

Areas liable to flooding are defined in Exhibit 2.1. The floodwaters of both Coopers Creek and Wilsons River form a constraint to route location because of the potential damage and inaccessibility of the line that a 1 in 100 year flood could cause. Routes which have the least intrusion onto flood plains are generally favoured, all other things being equal.

2.3.4 Agricultural Land Quality

The Department of Agriculture defines Agricultural Suitability in five classes, taking into account biophysical parameters (climate, topography, soils), social factors (labour availability, land tenure, farmers' personal preferences) and economic considerations (production potential, long-term viability, return on capital and present land-use). Areas of Class 1, 2 and 3 agricultural suitability are considered to constitute prime quality agricultural land.

Prime quality agricultural lands within the study area are shown on Exhibit 2.2. They comprise both high quality grazing and horticultural lands, suitable for intensive agricultural uses. In the main, Classes 1,2 and 3 incorporate most of the lands which can be prepared for pasture improvement or planted to fruit or nut trees.

Within both Lismore City and Byron Shire areas, Class 1 lands are confined to very limited areas on the volcanic plateau (on krasnozems soils) and highest alluvial levees. Class 1 land comprises land suitable for regular cultivation or intensive horticulture. Class 2 areas occur on the higher, well drained alluvials (ie floodplains) and many small areas on the plateau, again confined to krasnozems soils. Class 2 lands are suitable for vegetable and other crop production, but not continuous cropping. Class 3 land suitable for grazing is found in moderately sloping krasnozems areas on the plateau, and moderately to gently sloping land derived from sedimentary rocks. Extensive areas of moderate to steep hill country are classified as Class 4. Class 4 lands are suitable for grazing, but not suitable for cultivation, while Class 5 land is suitable for only rough grazing, or land not suited to agriculture. Class 5 lands are confined to steep mountainous country.

Some land within the study area is regarded by the Department of Agriculture as unique horticultural land, worthy of protection. The deep, rich krasnozems soils typical of the Clunes and Tregeagle areas combine with the climate to give this area the capacity to produce the widest range of subtropical fruits and nuts and out-of-season vegetable crops of any part of the State. In addition, the Department considers that the high density of tree cover, with its associated shading and mulching of the ground surface, is a desirable form of land use for the area, more desirable than both regular cultivation or grazing enterprises. The Department therefore places a very high priority on the protection of these lands.

Lismore City and Byron Shire Councils have both responded to the Department's concern by designating specific Agricultural Protection Zones corresponding to these good quality agricultural lands. Designated horticultural areas within these zones form the highest constraint to transmission line location with respect to agricultural uses due to the reduced production capabilities that would result from restrictions to activities within transmission line easements. Trees are required to be maintained below a certain height to ensure adequate clearance to high voltage conductors. In many locations trees would not be allowed to exceed four metres. This would entail continual lopping of trees such as macadamias and avocados, which can grow up to 10/12 metres and 8/10 metres respectively, with consequent reduction in the productivity of mature trees. Areas of existing and proposed horticulture are shown on Exhibits 2.3 and 2.4.

Other forms of agriculture suitable within the Agricultural Protection Zones would not be significantly affected by transmission line location. Easements are not fenced so that grazing patterns would not be affected. Usual crops in the area are grown to less than 4 metres in height. However, since power line supports and related infrastructure could cause a minor reduction in the area of arable land (see Section 2.5.3), location of a transmission line in these areas represents a minor constraint to agricultural uses.

2.3.5 Climate

The climate of the area is of interest chiefly as it may influence rehabilitation works to be carried out during and after completion of the transmission line or may contribute to the likelihood of soil erosion.

The Far North Coast region possesses a temperate climate of warm to hot summers and mild winters. Rainfall is regular, though extremes of droughts and storms associated with tropical cyclonic depressions can occur. Much of the area may be classified as humid sub-tropical. Its suitability to human habitation has attracted settlers since the early days of European colonisation in Australia. There is also considerable evidence of prior Aboriginal occupation. Generally, the climate is highly favourable to plant growth, and this has encouraged agricultural development over a significant portion of the district. The climate allows the widest range of tropical, sub-tropical and warm-temperate crops to be grown of any area in New South Wales. The potential exists for growth of an extensive range of fruits, vegetables, cereal and energy crops.

Climatic regimes within the study area vary according to topography and distance from the coast, from warm to humid temperate in the south, to sub-tropical in the north and east. Many sub-tropical micro-climates are scattered throughout the study area and often support remnant sub-tropical rainforest and sclerophyll forest in lower rainfall areas.

Annual rainfall declines from east to west, with Byron Bay averaging 1840mm, Federal 1694mm and Lismore 1270mm. Rainfall is distinctly seasonal with the majority falling in late summer-autumn. Intense rainfall events derived from easterly winds of tropical cyclones may cause short term flooding.

Cool westerly winds occur in winter, and north easterly sea breezes predominate during the summer. High winds are usually associated with tropical cyclones, and have required the formation of windbreaks on horticultural farms.

While the climate allows adequate vegetation cover to be maintained throughout the year, the rainfall intensity limits the degree of slope which can be classified as arable. The worst erosion risk is from December to April when heavy falls of rain are normally experienced. This is also a period of high soil moisture and the probability of run-off is therefore high. The erosion risk is very high if vegetation cover is removed during this period.

Climate is not considered to be a constraint to route location.

2.4 BIOLOGICAL ENVIRONMENT

2.4.1 Vegetation

The vegetation of the majority of the study area has been extensively modified since European settlement. The entire plateau, of which Lismore and Mullumbimby are on opposite sides, once supported the 'Big Scrub', an almost continuous stand of sub-tropical and temperate rainforest. Examples of rainforest exist at Booyong, to the east of Lismore, and within the Nightcap Range, to the north west of the study area.

While the native forests of the Nightcap Range are generally intact due to the rugged terrain and relatively poor soils, extensive clearing has resulted in only small areas of remnant native vegetation remaining on the plateau, largely restricted to steep slopes unsuitable for most agricultural pursuits. The bulk of the plateau now comprises grasslands of improved pasture species with scattered remnants of disturbed and undisturbed forest communities. Considerable weed invasion is occurring through the spread of camphor laurel

and lantana. Scattered shrubland and heath communities occur on the coastal plain and dune systems, east of the study area.

Vegetation communities have been grouped in four broad communities, as shown on Exhibit 2.3, and described below:

Rainforest Communities

Sub-tropical rainforests generally occur in the Nightcap Range area and include the White Booyong and Black Bean associations. Warm temperate rainforest dominated by coachwood (Ceratopetalum apetalum) occurs in the north-west of the study area around the vicinity of the Rocky Creek dam. These rainforests occur on rhyolite derived soils which are of lower fertility compared to the soils derived from basalt which can support sub-tropical rainforest.

Remnant stands of rainforest occur on the plateau area as shown on Exhibit 2.3. These stands are isolated and small being usually surrounded by grazing land or disturbed forests. Rainforests are relic communities formed during the tertiary period when climatic conditions were significantly hotter and wetter.

They therefore do not regenerate readily under the present climatic regime and hence are highly susceptible to permanent degradation if disturbed.

Rainforests possess a high species diversity of both flora and fauna. Even small isolated remnants provide habitat for a high number of rare and endangered plant species. Rainforest communities generally are of particular ecological significance due to their very restricted distribution on a state and national basis. Their conservation is of prime importance. For the purposes of this study, rainforest communities have been classified as Category 1 vegetation.

Undisturbed Vegetation

Sclerophyll forest communities are located on sites which are too infertile, dry or exposed to support rainforest communities. They occur in large areas within the Nightcap Range as well as further south through to the central part of the study area. The extent of these communities has been affected by clearing.

Undisturbed forests that occur in moist gullies generally support forests dominated by Flooded Gum (Eucalyptus grandis) and Brush Box (Lophostemon confertus). Open forests dominated by Blackbutt (E. pilularis), Tallcwwood (E. microcorys), White Mahogany (E. acmenoides) and Grey Gum (E. punctata) are more common and cover much of the area taken up by sclerophyll forests in the study area.

Drainage lines and valley floors with sandy alluvial deposits generally support open forests dominated by Forest Red Gum (E. tereticornis) and River Oak (Casuarina cunninghamiana). In the south-west of the study area, poorer, drier sites support open forests dominated by Spotted Gum (E. maculata) and Scribbly Gum (E. signata).

Undisturbed forests are uncommon in the study area though constituent communities are reasonably well represented on the north coast. It is reasonable to presume that these forests will contain rare or endangered species. These forests therefore are of conservation significance, and have been accorded a Category 2 classification in this study.

Disturbed Vegetation

Disturbed forest comprise areas which have been partially cleared or where exotic plants are evident. The degree of disturbance varies widely and the capacity for regeneration is variable. Least disturbed areas have the greatest potential for regeneration and long-term viability.

Various primary vegetation types are included within this category. Vegetation stands include partially cleared sclerophyll forests and degraded rainforest remnants. The latter are characterised by extensive invasion by exotic plants such as Camphor Laurel and Lantana and often by high populations of the indigenous palm, Lawyer Cane (*Calamus muelleri*).

Disturbed vegetation is referred to as Category 3 vegetation in this study. As shown on Exhibit 2.3 this category occurs in scattered stands throughout the plateau area. Due to their disturbed nature these areas are not of ecological significance. However, they should be avoided where possible in situations where their density would allow successful regeneration under proper management. There is also the possibility that these areas may contain rare or endangered species.

Cleared Lands

The bulk of the study area is taken up by grasslands of improved pasture species. Also included within this category are horticultural plantations and associated wind breaks. Cleared lands have been classified as Category 4 in this study.

For the purposes of constraint identification and route selection the four vegetation categories have been ranked according to their ecological importance in Table 2.1.

TABLE 2.1- SENSITIVITY OF VEGETATION CATEGORIES

Vegetation Type	Category	Sensitivity
Rainforest	1	High
Undisturbed forest	2	High
Disturbed forest	3	Moderate
Cleared land/Horticulture	4	Low

With respect to vegetation factors, rainforest and undisturbed forests constitute areas with the highest sensitivity to transmission line location. Rainforest areas in particular have a high conservation value due to their ecological significance, and the high value placed on them by the community, and pose an absolute constraint to route selection. Forest areas and other undisturbed vegetation stands offer a high constraint due to their relative scarcity in the region, compared to cleared land. Disturbed areas are considered to be moderately sensitive as they may contain populations of rare and endangered plant species.

From an ecological perspective, cleared grazing land, improved pasture or horticultural practices do not pose a constraint to route selection.

2.4.2 Wildlife

The wide range of vegetation types within the study area give rise to a variety of habitats comprising rainforest, dry forest and woodland, cleared land, escarpment and wetlands. These habitats support a diverse range of wildlife species.

Although dry forest supports the widest range of faunal species, it does not have many species of conservation importance associated with it. Conversely, the rainforest and wetland habitats support a limited number of species, but a high proportion of animals of conservation importance.

The habitats may be ranked in their order of importance as rainforest (highest), wetlands, sclerophyll forest and cleared (least). Bird species of conservation importance in the rainforest include the Eastern Bristle Bird, Paradise Riflebird, Topknot Pigeon and Rufous Scrubbird. There are many invertebrate species endemic to rainforests, as well as some vertebrates. Rainforest habitat is limited in area and constitutes a high constraint to transmission line location.

Other areas forming important habitats include the escarpment and riparian vegetation corridors. The escarpment vegetation is limited and is used as a wildlife corridor. Similarly, removal of vegetation from along streams may result in the creation of barriers to wildlife movement along streamside corridors. Identified riparian vegetation corridors occurring in the vicinity of the route concepts are shown on Exhibit 2.3.

2.4.3 Reafforestation Potential

Local community groups have indicated that reafforestation potential of cleared land within the study area should be considered in transmission line location.

Areas of highest reafforestation potential in terms of benefits gained (eg erosion control) and minimised opportunity cost in foregoing agricultural production are the steeper lands near the forested slopes of the Nightcap Range and steep hills in riverine areas.

2.5 SOCIAL ENVIRONMENT

2.5.1 Settlement Patterns

The region's natural resources, and its scenic quality, climate and proximity to the coast have combined to make it attractive to human habitation, and there is a long history of Aboriginal and European settlement in the study area.

Rainforest logging operations constituted the first form of agricultural activity in the area, and led to the development of settlements along river banks and coastal shipping ports. As forestry operations diminished, cleared areas were either put under pasture and grazed by dairy cattle, or developed for cropping. Several small dairy factories in the area provided impetus in the development of rural villages such as Bexhill, Clunes and Dunoon. In the past 15 years substantial subdivision of rural land has taken place with the decline of the dairy industry and the increasing demands for a rural lifestyle from urban

dwellers migrating to the region. The region is now relatively densely populated in comparison to other areas of rural New South Wales. New settlers in the region have expanded its traditional agricultural base with the widespread introduction of horticultural plantations.

Settlement patterns in the study area can be considered under the following categories:

- . urban residential
- . rural villages
- . rural residential
- . recreational and part-time commercial farms
- . full-time commercial farms

The general pattern of existing land uses is shown in Exhibit 2.1 and Exhibit 2.3.

Urban Residential

The major urban settlement in the study area is the City of Lismore, situated in the south west corner of the study area. In June 1985, the population of Lismore was estimated (ref. 2) at 26 519, with an annual growth rate of 1.9%. The urban areas are expected to grow, in the short term, to a population of 30 000 and, in the long term, to a population of 36 000. The pattern of land use that has evolved reflects the city's topography - the broad floodplain used predominantly for housing, but now increasingly being converted to commercial and industrial uses, ringed by elevated areas, featuring recent housing development.

Rural Villages

The study area contains many rural villages and clustered settlements including Dunoon, The Channon, Clunes, Bexhill, Rosebank, Eltham, Tullera, Modanville, Numulgi, Corndale, Eureka and Federal. At one time, the villages were largely dependent on employment in surrounding rural areas and the service trade of those areas. In recent times, this role has declined and they have taken on a new role in providing alternative residential locations for city commuters and retired people. Many villages have experienced considerable growth in recent years.

Rural Residential

A feature of the area is the extent of rural settlement that has occurred in the past twenty years. The area is now relatively densely populated in comparison to most areas of rural New South Wales. Since 1973, most rural settlement occurred under the 'concessional allotment' subdivision controls introduced in State Planning Authority Circular No. 67. A proliferation of small lot residential type subdivision has occurred, many of which have taken the form of ribbon development along local roads.

The demand for rural accommodation is likely to continue in the future. As discussed in Section 2.5.2, a major attraction for people migrating to the area is its natural aesthetic qualities. Lismore City and Byron Shire Councils have responded to the need to maintain the visual environment (as well as the area's agricultural resources) by adopting rural subdivision and settlement strategies to create a more ordered development pattern. Locations for possible future rural subdivision have been identified by both Councils in their respective draft LEP's.

Rural residential holdings are normally in the range of 4 000 to 8 000 square metres, which are essentially for rural living with little potential for commercial agricultural production.

Recreational and part-time Commercial Farms

This classification refers to any allotment used for agricultural or forestry that is not purely commercial in nature. It included existing holdings over 20 hectares, small allotments and large rural residential blocks. As for rural residential holdings, the continuing demand for recreational (also known as 'hobby') farms is primarily the result of urban to rural decentralisation and, in some case, involves the rejection of city life and a desire for a more natural rural lifestyle.

Many recreational farmers do have commercial farming aspirations although it may take many years to achieve. In many instances outside employment permits the pursuit of farming on a part-time basis. Beef grazing, cropping and horticulture are the main part-time commercial farming enterprises. While such farms tend to have lower production per unit capital and labour input than full time commercial farming, they may be quite productive per unit area through more intensive capital and labour inputs.

Full-time Commercial Farms

The main forms of full-time Commercial Farming in the study area comprise dairying, beef cattle grazing, cropping and horticulture. Commercial farms are distributed throughout the region and generally occur on holdings of 40 hectares or more for dairying and beef cattle grazing, and 20 hectares or more for cropping and horticulture.

State and Local Governments have been concerned at the random rural settlement in recent years that has resulted in the fragmentation of high quality agricultural land into unviable units. The Department of Agriculture is anxious that rural subdivision be diverted away from the better quality agricultural lands and that rural holdings be maintained as efficient operating units.

The implications of each of these settlement patterns with respect to transmission line location are discussed in succeeding sections. Basically, the Electricity Commission prefers not to locate transmission lines through residential areas where suitable alternatives exist. Similarly, lines are generally located so as to minimise agricultural impacts.

2.5.2 Planning Controls

State Government Planning Policy

New South Wales Government landuse planning policy is administered through the Department of Environment and Planning (DEP). The D.E.P. supervises local planning initiatives and undertakes regional planning through State Environmental Planning Policies (SEPP's), directives under Section 117 of the EPA Act and Departmental Planning Circulars. Policy objectives of relevance to transmission line location include:

- . protection of better quality agricultural land
- . protection of environmental resources such as scenic areas, escarpments, wildlife refuges, national parks and nature reserves through appropriate zoning and controls on adjoining land-use

- . minimisation of land-use conflicts
- . management of land on the urban fringes to facilitate future expansion of urban areas in suitable locations and
- . consideration of topographical suitability, accessibility and proximity to existing settlements or any proposed developments.

The North Coast Draft Regional Environmental Plan (R.E.P.) has recently been publicly exhibited by the D.E.P. The draft R.E.P. reiterates the above objectives, and recommends:

- . the introduction of statutory provisions to prevent large scale vegetation clearance
- . the retention of visually important landscape features such as elevated ridgelines, steep slopes, travel routes, waterbodies, significant stands of vegetation and wild and scenic rivers and
- . development of the concept of 'natural tourism'.

These objectives require that the transmission line be sensitively sited, particularly with respect to visually prominent locations, areas of native vegetation, existing and proposed urban and rural residential zones, and horticultural areas.

Local Government Planning Controls

The study area is administered by two local government councils, namely Lismore City and Byron Shire. Both Councils are currently preparing Local Environmental Plans (LEP's) for their respective Municipality. The Byron Shire draft LEP was placed on public display in mid-1986, and a public inquiry has been undertaken. Lismore City Council's draft LEP was publicly displayed in April and May 1987 and a public inquiry is planned. The objectives of State Government policy are reflected in the aims of both Council LEP's. Policies have been developed for the preservation and enhancement of natural and man-made resources, the provision of a variety of settlement options, and protection of agricultural resources.

Transmission lines are permissible developments in all potentially affected zones, and as discussed in the Introduction to this document, State Environmental Planning Policy No 4 means that Council consent is not required. The zonings proposed in both draft L.E.P.'s are of interest principally in that they indicate areas where possible future land use changes may occur, and allow an assessment of whether the possible future land use would represent a constraint to transmission line location. Areas where the proposed zoning constitutes an alteration to an existing land use have been mapped on Exhibit 2.4.

Possible future land uses which form a constraint to transmission line location are outlined in the following sections.

Lismore City

Preparation of the Lismore City draft L.E.P. was initiated in response to a recognition of the inadequacies of the current planning instrument, Interim Development Order (I.D.O.) No. 40. A feature of IDO 40 was that, while it functioned as a vehicle for enabling rural resettlement on a large scale, it also

allowed high quality agricultural land to be fragmented into non-viable units and promoted speculative subdivision. Population growth in rural areas occurred randomly, resulting in a dispersed demand for additional services and facilities such as roads, schools, and community facilities.

As a first step in the formulation of the draft LEP, Lismore City Council produced a discussion paper, 'Rural Strategies', as a component of a Local Environmental Study. The study aimed to identify management policies which maximise the potential agricultural productivity of the land, while at the same time stimulating a balanced provision of other rural land uses such as hobby farms, rural homesites, multiple occupancy and tourist uses.

The study recognized that the existing natural beauty of Lismore's rural areas and the rural living environment was one of the major attracting forces for people migrating into the region. It concluded that to maintain this attractiveness, planning controls were required to:

- . stop degradation of rural scenery
- . protect natural systems
- . encourage retention of native vegetation
- . avoid sterilization of extractive resources

A preferred strategy was developed which accommodated village expansion at Nimbin and Clunes and a new village at Rosebank, establishment of rural residential areas at Nimbin, Clunes, Rosebank and Wyrallah, and hobby farms and multiple occupancy areas near Nimbin, Rosebank, The Channon, Dunoon, Numulgi and Boorie Creek. Proposed new land use zones included a unique horticultural zone, a hobby farm/multiple occupancy zone, a rural residential zone, environmental protection zones, and new zonings for National Parks and State Forests.

With regard to rural landscape policies, the study recommended that 'houses and other structures should not be located on hilltops or ridgelines to lessen the impact on the environment. This is to apply to major and clearly defined hills and ridges, particularly those defining a part of the viewing catchment from main roads.'

Zonings proposed in the draft L.E.P. that could result in future land-use changes are mapped on Exhibit 2.4 and described as follows:

- . Agricultural Protection Zone 1(b) - this zone aims to protect identified prime horticultural land from fragmentation and to ensure that any development maintains the rural character of the locality and minimises disturbance to the landscape. Minimum allotment size is 20 ha. It represents a constraint to route selection because of the loss of productivity that a transmission line would impose on horticultural plantations (as discussed previously in Section 2.3.4). This zone has been mapped as possible future horticulture.
- . Small Agricultural Lots Zone 1(c) - this zone has the dual objective of ensuring an adequate supply of small agricultural lots and encouraging the development of intensive agriculture. Minimum allotment size in this zone is 10 ha. This zone constitutes a constraint to route selection principally for reasons of agricultural productivity (as discussed in Section 2.3.4) and visual amenity (as discussed in Section 2.5.4.), and has been mapped as possible future rural residential for the purposes of this study.

- . Investigation Zone 1(d) - this zone identifies land in the vicinity of Lismore which has a strategic locational advantage for future population growth. Since sitings of a transmission line in such areas could be incompatible with residential usage, this zone forms a constraint to route selection principally for reasons of visual amenity (as discussed in Section 2.5.4). It has been mapped as possible future urban residential and possible future rural residential.
- . Rural Residential Zone 2(b) - this zone is sited to provide land to meet the demand for residential housing in rural surrounds, and to ensure that the development of this land does not adversely affect the rural environment of the area. Minimum allotment size is 5,000 m². As discussed in Section 2.5.4., siting of a transmission line in such areas could constitute an unwanted intrusion into the landscape. This zone has been mapped as possible future rural residential.
- . Residential Village Zone 2(c) - this zone aims to retain the character of rural villages, and forms a constraint to route location principally for reasons of visual amenity (as discussed in Section 2.5.4). It has been mapped as possible future urban residential.
- . Special Uses Zone 5 - a possible future extension to a quarry situated north west of Lismore forms a constraint to transmission line location and has been mapped as possible future extractive resources.

Other proposed zonings that constitute constraints to transmission line location, and which have also been taken into account in route selection, include:

- . Environmental Protection 7 (a) - Scenic/Escarpment Protection Zone- this zone aims for the preservation, conservation and enhancement of major landscape features, including prominent hillslopes and ridgelines.
- . River Lands Protection Zone 7(b) - this zone seeks to allow for the continual beautification of the river corridor in the city.
- . Water Catchment Protection Zone 7(c) - this zone aims to prevent development which would have a significant detrimental effect on the urban water supply.
- . National Parks, Nature Reserves and Forests Zone 8 - this zone identifies lands included in National Parks, nature reserves and aboriginal areas as advised by the Director of the National Parks and Wildlife Service.

Byron Shire

Byron Shire draft L.E.P. zonings that could result in future land-use changes are also mapped in Exhibit 2.4 and described as follows:

- . Agricultural Protection Zone 1(b) - this zone identifies land units of prime agricultural quality, and aims to preserve this land for agricultural purposes and to prevent fragmentation of rural holdings. Sub-zone 1(b2) consists of land identified as suitable for horticultural crops or bananas (min. permissible lot size of 20 ha). The 1(b2) zone represents a constraint to route selection because of the loss of productivity that a transmission line would impose on horticultural plantations (as discussed previously in Section 2.3.4). It has been mapped as possible future horticulture.

Small Holdings Zone 1(c) - land within this zone has the capability for closer rural settlement and is suitably located in relation to Council's road hierarchy system. Sub-zone 1(c1) provides for low density 'farm character' style lots set in the rural hinterland (min. permissible lot size of 1 hectare), and sub-zone 1(c2) provides for 'urban periphery' lots adjacent to urban centres (min. permissible lot size of 0.4 hectares). The 1(c) zone represents a constraint to route selection due to the potential incompatibility that could result from siting a transmission line in a future rural residential area. As discussed in Section 2.5.4., it is likely that a transmission line would represent an unwanted intrusion into the landscape in such areas. The 1(c) zone has been mapped as possible future rural residential.

Investigation Zone 1 (d) - this zone identifies land which may be suitable for rezoning for such future uses as urban development, rural small holdings development and tourist development. Its key objective is to ensure that any development that may prejudice the long term use of the land is avoided. Since siting of a transmission line in these areas could be incompatible with this objective, land with this zoning forms a constraint to route selection. It has been mapped as possible future urban residential.

Extractive Resources Zone 1 (e) - major sites of extractive resources are identified in this zone, to avoid conflicting uses that may prejudice any existing or potential quarry operation. It has been mapped as possible future extractive resources.

Village Zone 2 (v) - this zone is specifically for proposed small rural village development, and, within the study area, applies at Federal. It has been mapped as possible future urban residential.

Other proposed zonings that constitute constraints to transmission line location, and which have also been taken into account in route selection, include:

Water Catchment Zone 7 (c) - this zone aims to prevent development within the catchment of existing or future water supply systems which would have a significant detrimental effect on the quality or quantity of the water supply. The zone is used to designate the part of the Wilson's Creek water catchment located upstream from the proposed regional dam site at Keyes Bridge, Federal and that part of the catchment located upstream from the existing Mullumbimby water supply weir at Laverty's Gap.

Scenic/Escarpment Zone 7 (d) - the major objective of this zone is to protect and enhance areas of major scenic quality in the Shire. It identifies land of high scenic significance, including the distinctive escarpment in the Shire which separates the red soil plateau and the coastal lowlands. Only a limited range of uses is permissible within the zone. These include utility installations.

Habitat Zone 7 (k) - identifies and provides for the protection of significant vegetation and wildlife habitats. Only a restricted range of compatible uses are permitted within the zone, including utility installations.

. National Parks and Nature Reserve Zone 8 (a) - land within this zone comprises public lands reserved under the National Parks and Wildlife Act, 1974. Utility installations are permissible.

2.5.3 Agriculture

The Far North Coast region is one of the most productive and diverse agricultural areas in Australia. The traditional agricultural base of dairying and beef grazing has been expanded in recent years with the introduction of a wide range of tropical fruit and horticultural plantations. Horticulture in the area is flourishing due to a combination of the uniquely suited krasnozems soils of the plateau and the high rainfall and sub-tropical climate.

Dairying and Beef Cattle Grazing

Dairying, once the major industry has undergone a long decline and beef cattle are now grazed on many former dairy farms, as well as the less fertile off-river land. However, it remains a significant contributor to the local economy and there has been some resurgence of the industry in recent years with improved controls and the rapidly expanding local and near northern market.

Beef cattle grazing is an important industry as a source of income, and constitutes the most extensive form of land use in the rural areas of the study area. The hillslopes of the upper valleys provide extensive grazing opportunities, although the erosion hazard potential of such areas requires retention of sizeable holdings.

Dairying and beef cattle grazing do not constitute a constraint to transmission line location since

- . the transmission line easement would not be fenced and dairying and grazing activities could continue to be undertaken within the easement
- . the area occupied by the bases of the supporting structures is less than 1% of land within the easement
- . vehicles up to 4.3 metres high can operate under the line
- . there are no adverse effects on livestock, as is confirmed by the behaviour of animals under or near existing lines, and
- . vehicular access is only infrequently required after the erection of the line.

Horticulture

The deep, rich krasnozems soils of the district constitute one of New South Wales' most unique agricultural resources. The soils and climate combine to give the area the capacity to produce the widest range of sub-tropical fruits and nuts and out-of-season vegetable crops of any part of the state. The tropical horticultural industry has expanded rapidly in the last ten years to over 2 000 hectares, and is now a prominent part of the landscape and economy of the Lismore district. It has been estimated (Reference 2) that the industry has the potential to generate \$19 million annually in the near future, with the possibility of further expansion in the future.

Horticulture currently being undertaken include macadamia nut trees, avocados, custard apples, lychees, kiwifruit, tropical peaches and nectarines. Macadamias, a native rainforest tree, have attracted considerable outside capital, and large plantations are to be found in the Lismore area. Many plantations are owned by businessmen for long term investment purposes, often managed by consultants. Guavas and avocados are also grown on this basis. Of the major crops grown, all but guavas are in keen demand in the fresh fruit markets in southern Australia.

The horticultural plantings of the area are generally designed to give a high density of tree cover with associated shading and mulching of the ground surface. The Department of Agriculture considers that, apart from bananas, this form of land use is most desirable in that it assists in the maintenance of the stability and fertility of the volcanic soils. However, Lismore City Council has noted (Reference 2) that, from a planning perspective, there are considerable risks in portraying horticulture as the legitimate basis for subdivision of good agricultural land into small holdings. Council recommends that until the tree crops realise their potential, horticulture should be viewed as a component in a mixed enterprise to ensure that farmers can diversify into other forms of production should markets render any of the tree crops unprofitable.

The banana industry is restricted in the main to frost free areas with sheltered aspects. While some plantations maintain high standards of soil conservation, the production of bananas on escarpments is considered to be a very feasible form of land use and the loss of topsoil through erosion a very real problem.

Horticulture forms a constraint to transmission line location due to the height that trees can grow to. The principal horticultural plantations grown in the area comprise macadamia nut trees and avocados, both of which grow to a mature height of between 8 and 12 metres or more. This height can substantially exceed the minimum clearance requirement for the safe operation of 132 kV lines. Normally the maximum permitted height of vegetation within easements is four metres although taller vegetation can often be retained in gullies under the line. Location of a transmission line in a horticultural plantation in such areas is likely to require continual lopping of trees with a consequent reduction in their productivity.

Existing horticultural plantations have been mapped on Exhibit 2.3, and areas designated for potential future horticulture are shown on Exhibit 2.4.

Cropping

Intensive cropping is generally undertaken on the fertile alluvial soils of floodplains throughout the study areas. A transmission line would not preclude broad acre cropping, and with a minimum clearance of 7.5 metres between the conductors and the ground (see Table 4.1) it would be possible to drive farm machinery beneath the lines. The only form of cropping with which the proposed transmission line could significantly interfere is spray irrigation. Restrictions of the use of gun-type sprays would be required within the easement for safety reasons. The supporting poles would also restrict the usage of centre pivot and lateral move type spray irrigation equipment.

In view of these potential restrictions, irrigation areas were considered to be a constraint to route location. Other cropping areas were considered by way of minimizing the length of prime quality agricultural land traversed.

2.5.4 Landscape and Visual Sensitivity

The Far North Coast region is renowned for its coastal and rural scenic beauty. Within the study area, the forested, mountainous slopes of the Nightcap Range provide an appealing backdrop to the settled valleys of the plateau. The likely visual impact of a transmission line in this locality has been assessed by analysing the landscape's ability to visually absorb the line, that is its visual sensitivity. As shown in Table 2.2, the principal determinants of visual sensitivity are topography, vegetation cover and visibility.

Components of topography are ridges (areas of high elevation that visually divide the landscape), hillslopes (areas of moderate elevation located between ridges and valley floors) and valley floors (areas incorporating rivers and drainage lines and extending to the edge of the valley). Ridges constitute areas of highest visual sensitivity due to their prominence. Valley floors are of moderate sensitivity due to their lack of variation in elevation, while hillslopes offer low visual sensitivity by avoiding silhouetting of the supporting structures against the sky.

Dense vegetation has a high visual sensitivity due to its uniformity of texture and colour. Open pasture and perennial cropping constitute areas of moderate visual sensitivity, while scattered vegetation has a low sensitivity due to its variation in form and texture and its ability to partially screen the supporting structures.

Topographic and vegetation cover factors that constitute areas of high visual sensitivity (i.e. ridges and areas of dense vegetation) have been mapped on Exhibit 2.6.

Visual sensitivity also depends on the locations from which the transmission line would be viewed and the view lengths. Locations have been selected on the basis of frequency and duration of views combined with the likely purpose of views. Priority has been given to the consideration of possible effects on 'static' views (i.e. views from residential and recreational areas) as opposed to 'transitory' impacts (i.e. views from transport arteries, either road or rail). Static views have been divided into views from towns and villages, rural dwelling clusters and lookouts. Identified view catchments from towns, villages and rural dwelling clusters are shown on Exhibit 2.7. The scenic quality of the area has also been recognized by identifying view catchments from lookouts, roads with major scenic destinations and the scenic preserve area nominated by the National Trust. These features have been mapped on Exhibit 2.5 and Exhibit 2.7.

View lengths have been divided into foreground (0 to 500 metres), within which the transmission line would form a prominent feature in the landscape, middleground (500 metres to 2 kilometres), within which the transmission line would be perceived, but would not be prominent and background (two to three kilometres), within which the transmission line would be difficult to perceive. In the middleground zone, the transmission line would cease to be a substantial feature, and would appear as a minor element in the wider landscape.

TABLE 2.2 - VISUAL SENSITIVITY

Landscape Components	Degree of Visual Sensitivity		
	High	Moderate	Low
Topography	Ridgelines	Valley Floor	Hillslopes
Vegetation Cover	Dense (>70% cover)	Open Pasture (20% cover)	Scattered Vegetation (20 - 70% cover)
Visibility	Foreground views from towns and villages	Middleground views from rural dwelling clusters	Background views from towns and villages
	Foreground views from rural dwelling clusters	Middleground views from lookouts and scenic drives	Background views from rural dwelling clusters
	Foreground views from lookouts and roads with major scenic destinations	Middleground views from towns and villages	Background views from lookouts and scenic drives
		Foreground views from main roads and local roads	Middleground views from main roads and local roads

Landscape zones within the study area are shown in Exhibit 2.5. Six zones may be distinguished as follows:

- . Zone 1 - this zone comprises the Lismore floodplain, and extends from Lismore up the wide valley floors of the Wilsons River, Coopers Creek and Terania Creek. It has low relief, comprises predominantly open pasture and is highly visible from parts of Lismore, Eltham and Bexhill. Foreground views from these areas may be considered as highly sensitive, together with foreground views from the Open Air Cathedral at Bexhill and the Scenic Preserve nominated by the National Trust between Bangalow and Lismore. Remaining areas are moderately sensitive due to the combination of valley floor and cleared pasture. Foreground views occurring from Bangalow Road between Lismore and Bexhill, and Wyrallah Road, south of Lismore may also be considered as moderately sensitive.
- . Zone 2 - located to the northwest and southeast of Lismore, this zone is higher in elevation than the floodplain. Prominent locations include the ridgeline running approximately north/south from Modanville to the Lismore floodplain, and the ridge running east from Goonellabah to Wollongbar. The area is predominantly open pasture, with small pockets of dense vegetation occurring to the south-west of Modanville. Areas of high visual sensitivity are foreground view catchments from Modanville, Keerong and Goonellabah and rural dwelling clusters adjoining Dunoon Road south of Modanville and in the Boerrie Creek Valley. Ridgelines and area of dense vegetation shown on Exhibit 2.5 also constitute high sensitivity.

Moderately sensitive areas occur at middleground view catchments of the aforementioned residential precincts and in valley floors and open pastures. Low sensitivity areas are located to the south of Goonellabah and amongst the scattered vegetation to the west of the existing 66kV transmission line.

- . Zone 3 - this zone contains more steeply undulating terrain at higher elevations than Zones 1 and 2. It is the largest zone within the study area and extends from Wollongbar in the south, Numulgi in the west, and Federal in the north. Two sub-zones are identified in Exhibit 2.5:
 - (i) Zone 3(a) - topography is gently undulating in this zone with few prominent ridgelines and medium width valley floors and hillslopes. Vegetation cover consists predominantly of open pasture. Highly visually sensitive areas comprise foreground views from Bangalow, Booyong, Newrybar, Clunes, Pearce's Creek and Wollongbar, foreground view catchments from rural dwelling clusters adjoining Bangalow Road, the ridgeline running east-west from Booyong, and the Scenic Preserve nominated by the National Trust.
 - (ii) Zone 3(b) - land in this sub-zone is undulating to steep, ridges are common and hillslopes are extensive. Large areas of scattered vegetation occur to the southeast of Repentance Creek, while the northern portion is characterised by small areas of dense vegetation. Highly visually sensitive areas include foreground views from Numulgi, Eureka and Federal, ridges between Eureka, Federal and Goonengerry, north of Bangalow to Byron View and between Corndale and Diamond Springs, and areas of dense vegetation.

The remainder of the zone generally comprises moderately sensitive areas, with some areas of low sensitivity occurring where scattered vegetation combines with hillslopes.

Zone 4 - this zone is situated between the Nightcap Range and Zone 3. It is characterised by its high elevation, ridges and steep hillslopes. Vegetation consists of large areas of dense vegetation. Highly sensitive areas include the ridges, dense vegetation areas, areas within foreground views of Dunoon, The Channon and Dorroughby rural dwelling clusters and foreground views from Rocky Creek Dam Road, Nightcap Range Road and Upper Coopers Creek Road.

Zone 5 - this zone includes the Nightcap Range in the north west of the study area. Topography consists of dominant ridges, steep hillslopes and dense vegetation. This area is highly visually sensitive, with long views available to the vegetated ridgelines from surrounding zones.

Zone 6 - this zone included the coastal escarpment at the northeastern edge of the study area. Vegetation cover is predominantly open pasture and visibility from and to the area is high. Coolamon Scenic Drive traverses the ridge along most of its length and has long views to the coast. The escarpment is a prominent topographic feature of regional significance and constitutes a landscape element of high visual sensitivity.

Areas of high visual sensitivity constitute a constraint to transmission line location and it is desirable to minimise intrusion into such areas. As outlined previously, these areas have been mapped on Exhibit 2.6 and Exhibit 2.7.

2.5.5 Recreation and Tourism

The far North Coast region is well endowed with recreation opportunities and it is New South Wales' most popular tourist destination outside Sydney. Within the study area recreation facilities include picnic areas and walking trails at Rocky Creek Dam, Mt Nardi, Minyon Falls, Nightcap Range National Park, Whlan Whlan State Forest, Dorroughby State Forest, Goonengerry State Forest, and a number of flora reserves such as Big Scrub and Boomerang Falls.

A trail to comprise a series of walking and horseriding routes to link the coast with the Nightcap Range, to be known as the Byron Shire Trail, is also planned for the area.

The natural attributes of these areas, together with their associated scenic drives and lookouts and the charm of villages such as The Channon, Eltham and Bangalow have combined to make the area a popular tourist destination. The macadamia plantations of the Dunoon area are also growing in importance as a tourist destination.

Maintenance of the high level of scenic quality of the area is of most importance to the well-being of residents and tourists alike and areas of particular visual sensitivity have been identified as a constraint to route selection in Section 2.5.4. Apart from their visual importance, the National Parks, Flora Reserves and State Forests in the study area provide a unique diversity of flora and fauna of significant conservation value (see Section 2.4.1 and Appendix E) and were excluded from possible transmission line alignment considerations.

2.5.6 Archaeology and Heritage

Archaeology

The National Parks and Wildlife Service has carried out preliminary surveys of the Byron Shire as well as providing lists of known sites of aboriginal significance for the Lismore area. Further sites are under investigation by the North Coast Aboriginal Elders Council.

It has been shown in previous surveys that aboriginal activity was primarily centred around permanent water courses. In general terms this suggests that archaeological sites should be concentrated along the major river courses as well as the coastal plain.

A detailed archaeological survey will be carried out prior to any construction activity and all recorded sites represent a significant constraint on route selection. As discussed in Section 5.11.2, archaeology does not form a determinant of route corridor selection since it is normally possible to avoid interfering with archaeological sites wherever they occur by a variety of strategies, including protective safeguards during construction, careful selection of sites for supporting structures or, where necessary, by making minor variations in the route alignment.

Heritage

There are many buildings and structures of heritage or cultural significance that have been listed by either the Register of the National Estate, the Heritage Council of NSW, the National Trust of Australia, the Royal Australian Institute of Architects and in the Heritage Study discussion paper for Byron Shire Council. All such items are shown on Exhibit 4.2 which indicates that the majority are associated with the towns of Lismore, Bexhill, Clunes, Dunoon, Nimbin, Eltham, The Channon, Bangalow, Federal and Mullumbimby. There are also a number of cemeteries located in urban areas. Since the transmission line route will be sited to avoid towns and villages, other heritage sites do not represent a constraint to route location.

The Mullumbimby Power Station, which is located near the site of the proposed Mullumbimby Substation, is also classified by the National Trust. It is part of a water and power complex, constructed in the 1920's, consisting of a weir on the Willsons River, from which a flume and tunnel lead to a water treatment works and the power generation plant.

The power station was originally built as a hydro-electric plant and contains two identical water turbines (Pelton Wheel) by Boving of London. The plant was augmented with diesel generation in 1951 when it was unable to meet increased demand, and the building extended to two storeys. The power station acts as a strong physical reminder of the earlier power generation system and represents a substantial improvement in the standard of living dating from the 1920's. The power station is considered as a constraint to transmission line location insofar as the line should not impinge on the classified elements of the existing installation, if at all possible.

The National Trust has also identified several potential Scenic Preserves in the study area. The first of these consists of a strip of land about 5 kilometres wide extending south westerly from Bangalow about 22 kilometres almost to Lismore. The area comprises a succession of gently rolling hills and valleys used for dairying or grazing. Tree lined creeks dividing the green fields and scattered farmhouses provide a particularly tranquil and picturesque rural scene. An additional point of interest is the Open Air Cathedral situated on a hilltop overlooking a broad rural valley at Bexhill. The Cathedral has panoramic views over the valley and is valued highly by the local community. The designated scenic preserve and Open Air Cathedral are shown on Exhibit 2.5.

The second scenic preserve in the study area is located to the east of the Coolamon Drive. It is also shown on Exhibit 2.5.

2.5.7 Mineral and Extractive Resources

There are a number of known mineral resources within the area, including construction materials (blue metal, aggregate, sand and gravels and general fill) as well as mineral deposits such as opal, perlite, diatomite and coal. Exhibit shows the location of known deposits, existing operations and disused sites.

Quarries and large scale sand extraction poses a minor constraint to route selection.

2.5.8 Services

Local Electricity Supply

Northern Rivers Electricity is the supply and distribution authority for the region. The bulk of electricity is supplied by the state grid via a 66kV transmission line running from Lismore to Ewingsdale. From Mullumbimby supply is fed north to the Tweed region and south-east to Byron Bay, Suffolk Park, Ballina and the remainder of Byron Shire via 11kV reticulation. This main supply line also serves the north eastern sector of Lismore City.

In addition to this supply, a small hydro-electric plant located at Lavertys Gap near Mullumbimby, supplements the supply when sufficient water is available for generation.

Transportation

The Bruxner Highway and the Pacific Highway form the two main transportation links in the region. The Bruxner Highway provides an east-west link from Tenterfield to the coast and the Pacific Highway runs up the coast through Bangalow, past Mullumbimby, and on to Brunswick Heads.

Major roads within the study area include the Bangalow Road, the principal link between Lismore, Bangalow and Byron Bay, Terania Street, linking Lismore with The Channon and Nimbin, and Dunoon Road, connecting Lismore with Dunoon.

There are also a number of scenic drives which are used extensively by tourists, such as the Coolamon Scenic Drive and roads used to provide access to the Nightcap Range, such as Nightcap Range Road, Rocky Creek Dam Road and Upper Coopers Creek Road. These scenic drives and their visual catchment were identified as constraints to route location in the visual analysis in Section 2.5.4.

Many local roads radiate from towns and villages throughout the area. These are unsealed and subject to flooding, following creek lines and low lying areas.

The regional rail network comprises the main Sydney to Brisbane line running through Casino to the southwest of Lismore, with a branch line running from Casino through Lismore to Byron Bay then north through Mullumbimby to terminate at Murwillumbah. This line provides two daily passenger services to Byron Bay and once daily goods service. Most rail freight destined for Byron Bay is transferred for road delivery at Casino. As a general rule, it is considered undesirable for high voltage transmission lines to closely parallel rail lines as interference can be caused to the signalling system. The often winding nature of railway tracks and nearby development makes it difficult to construct a transmission line in close parallel. In addition, adverse visual impacts can be registered for rail passengers.

Water Supply

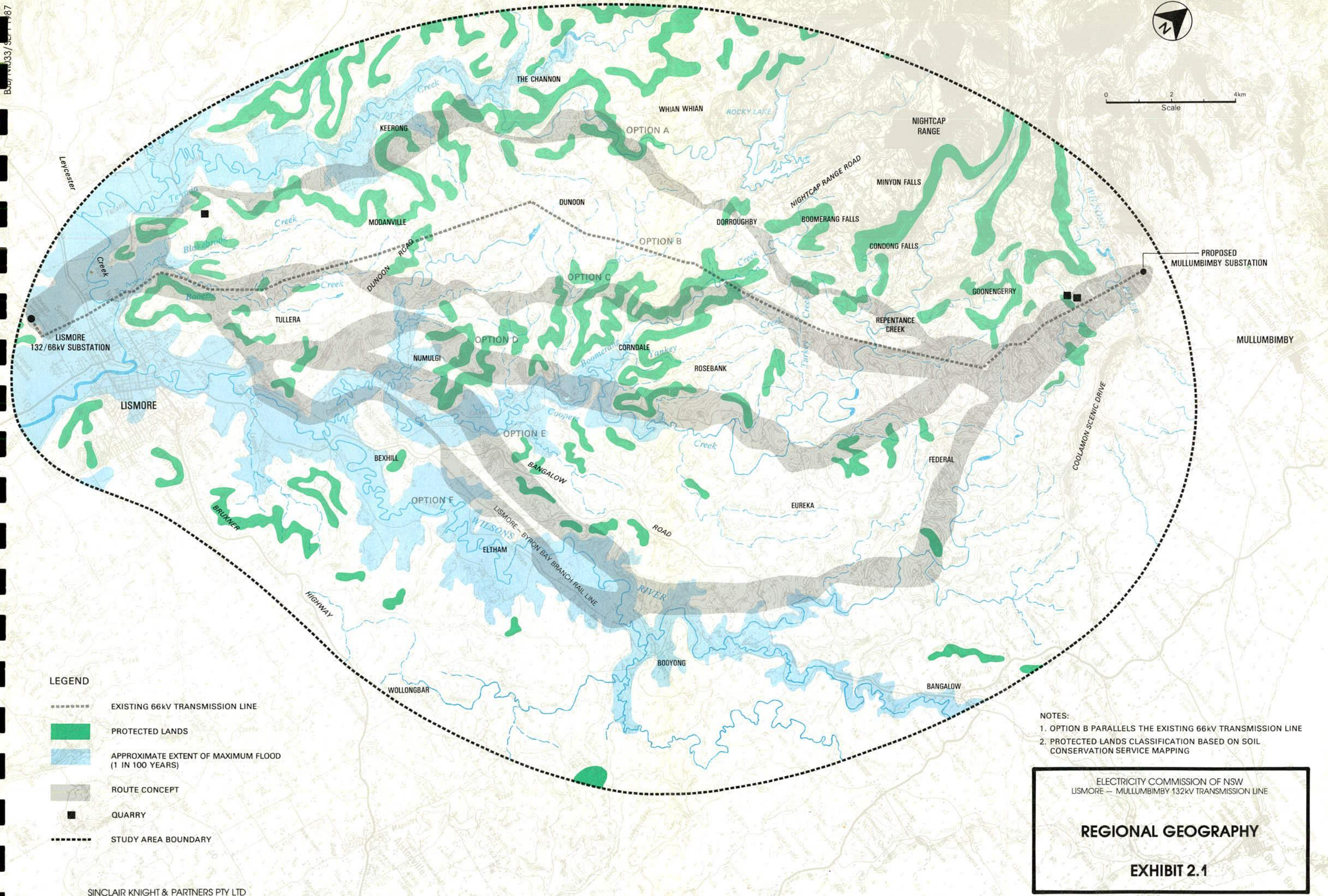
The majority of domestic reticulated water supply for the area is drawn from Rous County Council's bulk supply reticulation from Rocky Creek Dam. This is supplemented by the Mulgum Creek weir and Lavertys Gap weir. To cater for future growth in the region a regional water supply dam is required, the possible location of which is shown on Exhibit 2.4.

Large scale dams although not totally restrictive to transmission line developments, especially near their upper reaches, do pose some constraint on route selection.

BB/11033/SLT 1187



0 2 4km
Scale



- LEGEND**
- EXISTING 66kV TRANSMISSION LINE
 - PROTECTED LANDS
 - APPROXIMATE EXTENT OF MAXIMUM FLOOD (1 IN 100 YEARS)
 - ROUTE CONCEPT
 - QUARRY
 - STUDY AREA BOUNDARY

- NOTES:**
1. OPTION B PARALLELS THE EXISTING 66kV TRANSMISSION LINE
 2. PROTECTED LANDS CLASSIFICATION BASED ON SOIL CONSERVATION SERVICE MAPPING

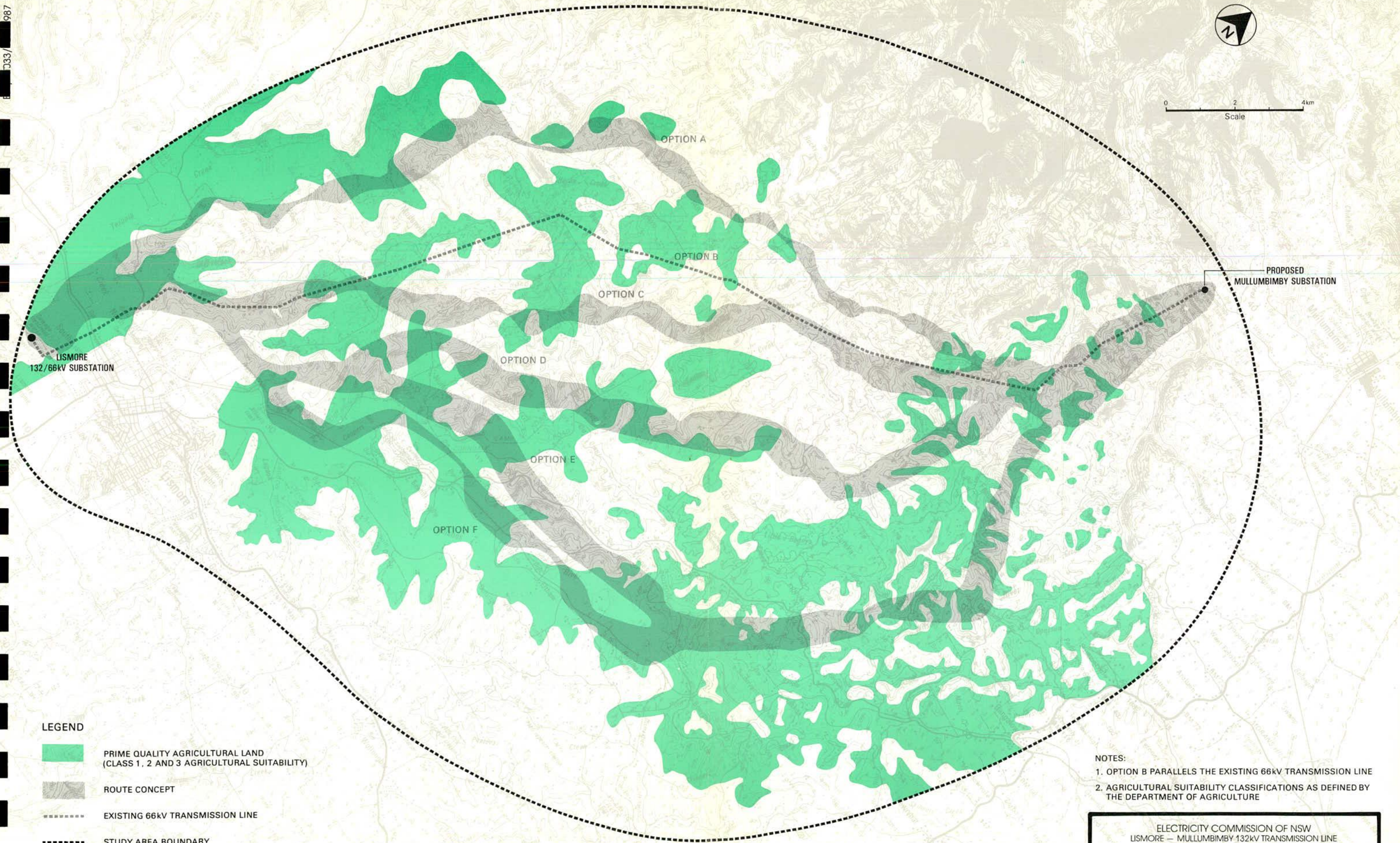
ELECTRICITY COMMISSION OF NSW
LISMORE — MULLUMBIMBY 132kV TRANSMISSION LINE

REGIONAL GEOGRAPHY

EXHIBIT 2.1



0 2 4km
Scale



LEGEND

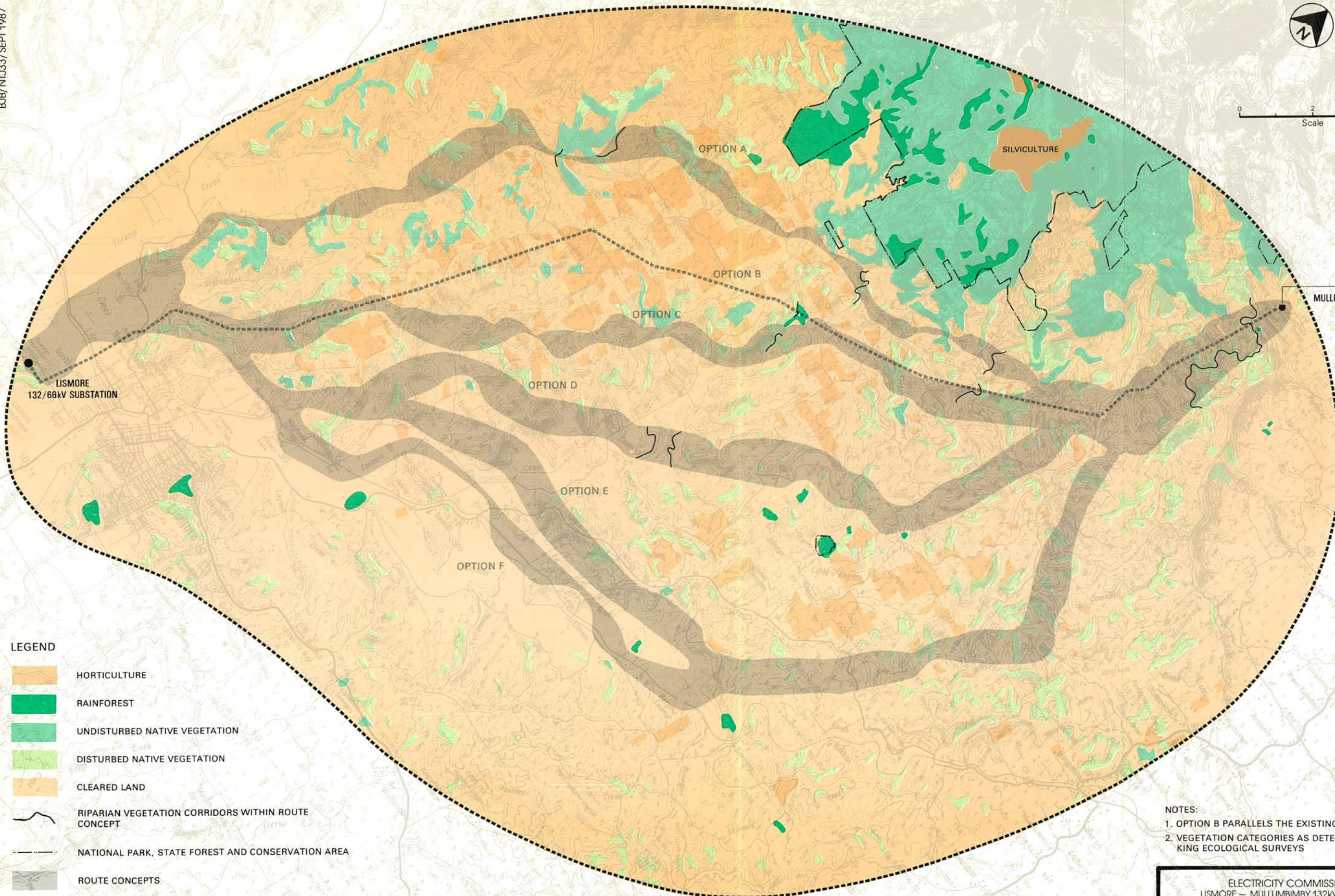
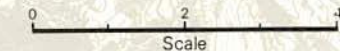
- PRIME QUALITY AGRICULTURAL LAND
(CLASS 1, 2 AND 3 AGRICULTURAL SUITABILITY)
- ROUTE CONCEPT
- EXISTING 66kV TRANSMISSION LINE
- STUDY AREA BOUNDARY

- NOTES:
- 1. OPTION B PARALLELS THE EXISTING 66kV TRANSMISSION LINE
 - 2. AGRICULTURAL SUITABILITY CLASSIFICATIONS AS DEFINED BY THE DEPARTMENT OF AGRICULTURE

ELECTRICITY COMMISSION OF NSW
LISMORE — MULLUMBIMBY 132kV TRANSMISSION LINE

AGRICULTURAL LAND QUALITY

EXHIBIT 2.2



LEGEND

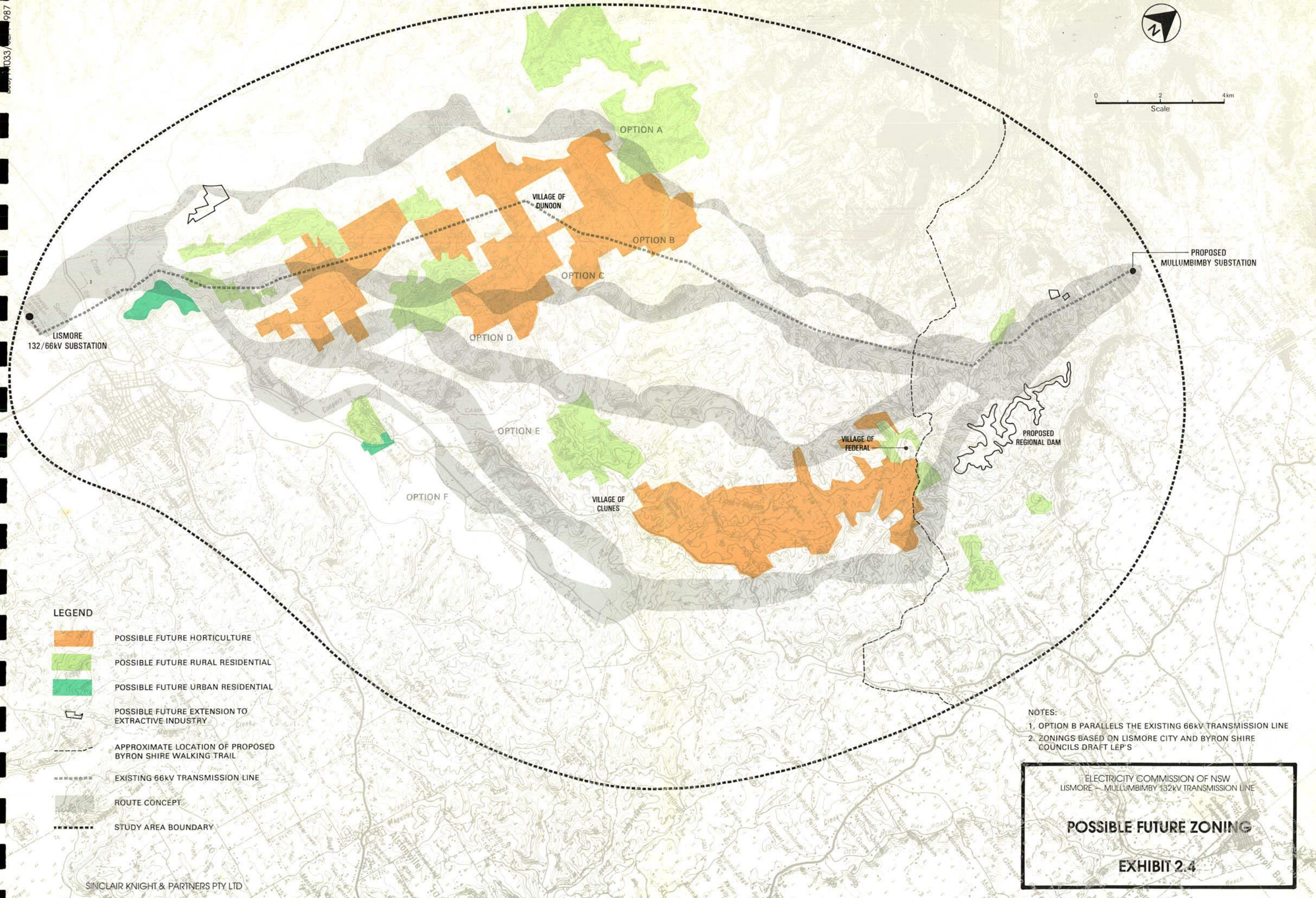
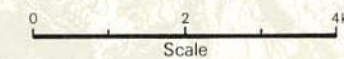
- HORTICULTURE
- RAINFOREST
- UNDISTURBED NATIVE VEGETATION
- DISTURBED NATIVE VEGETATION
- CLEARED LAND
- RIPARIAN VEGETATION CORRIDORS WITHIN ROUTE CONCEPT
- NATIONAL PARK, STATE FOREST AND CONSERVATION AREA
- ROUTE CONCEPTS
- EXISTING 66kV TRANSMISSION LINE
- STUDY AREA BOUNDARY

- NOTES:
1. OPTION B PARALLELS THE EXISTING 66kV TRANSMISSION LINE
 2. VEGETATION CATEGORIES AS DETERMINED BY MOUNT KING ECOLOGICAL SURVEYS

ELECTRICITY COMMISSION OF NSW
LISMORE — MULLUMBIMBY 132kV TRANSMISSION LINE

LAND COVER

EXHIBIT 2.3



- LEGEND**
- POSSIBLE FUTURE HORTICULTURE
 - POSSIBLE FUTURE RURAL RESIDENTIAL
 - POSSIBLE FUTURE URBAN RESIDENTIAL
 - POSSIBLE FUTURE EXTENSION TO EXTRACTIVE INDUSTRY
 - APPROXIMATE LOCATION OF PROPOSED BYRON SHIRE WALKING TRAIL
 - EXISTING 66kV TRANSMISSION LINE
 - ROUTE CONCEPT
 - STUDY AREA BOUNDARY

- NOTES:**
- 1. OPTION B PARALLELS THE EXISTING 66kV TRANSMISSION LINE
 - 2. ZONINGS BASED ON LISMORE CITY AND BYRON SHIRE COUNCILS DRAFT LEP'S

ELECTRICITY COMMISSION OF NSW
LISMORE - MULLUMBIMBY 132kV TRANSMISSION LINE

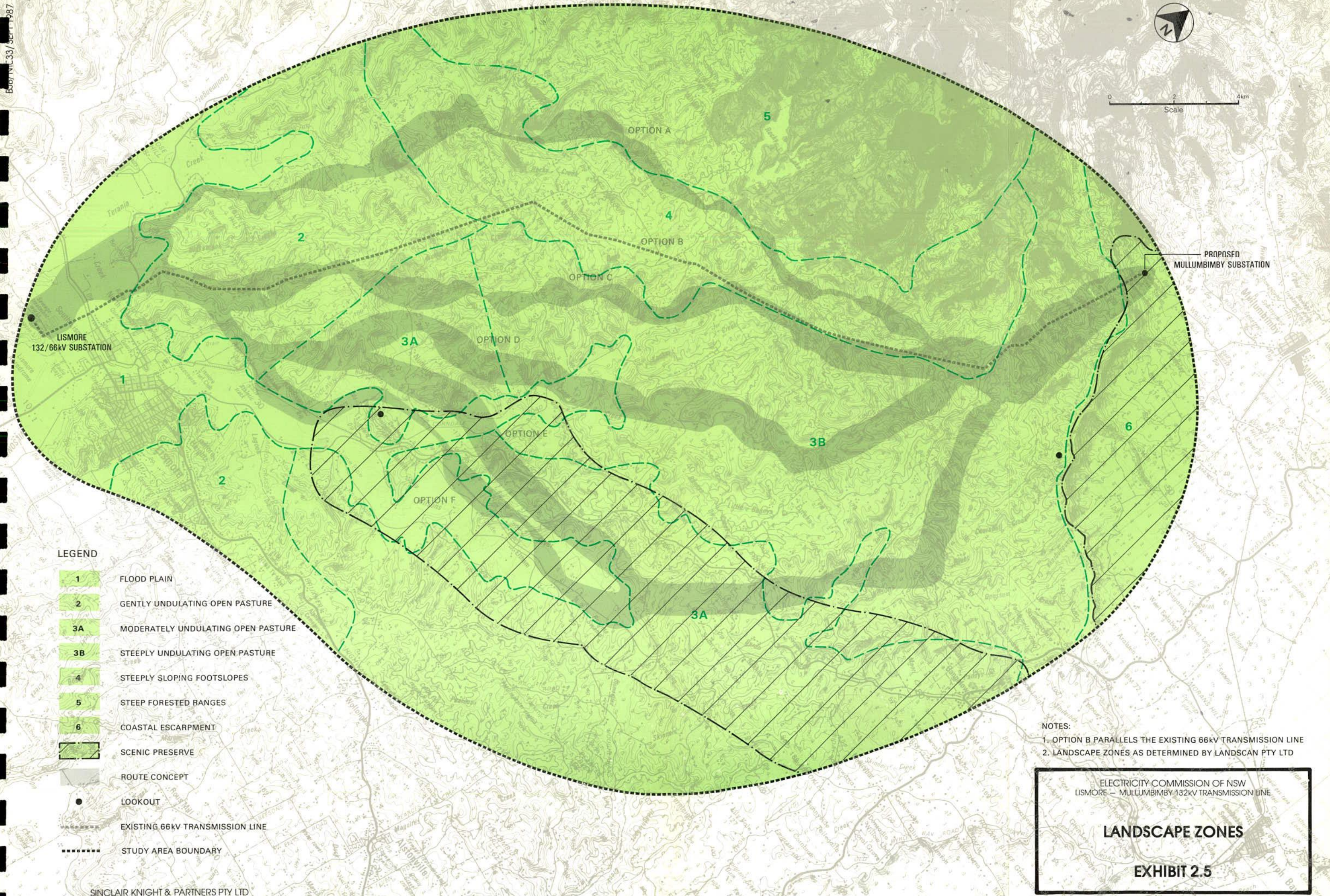
POSSIBLE FUTURE ZONING

EXHIBIT 2.4

606/NL33/SEPT1987



0 2 4km
Scale



LEGEND

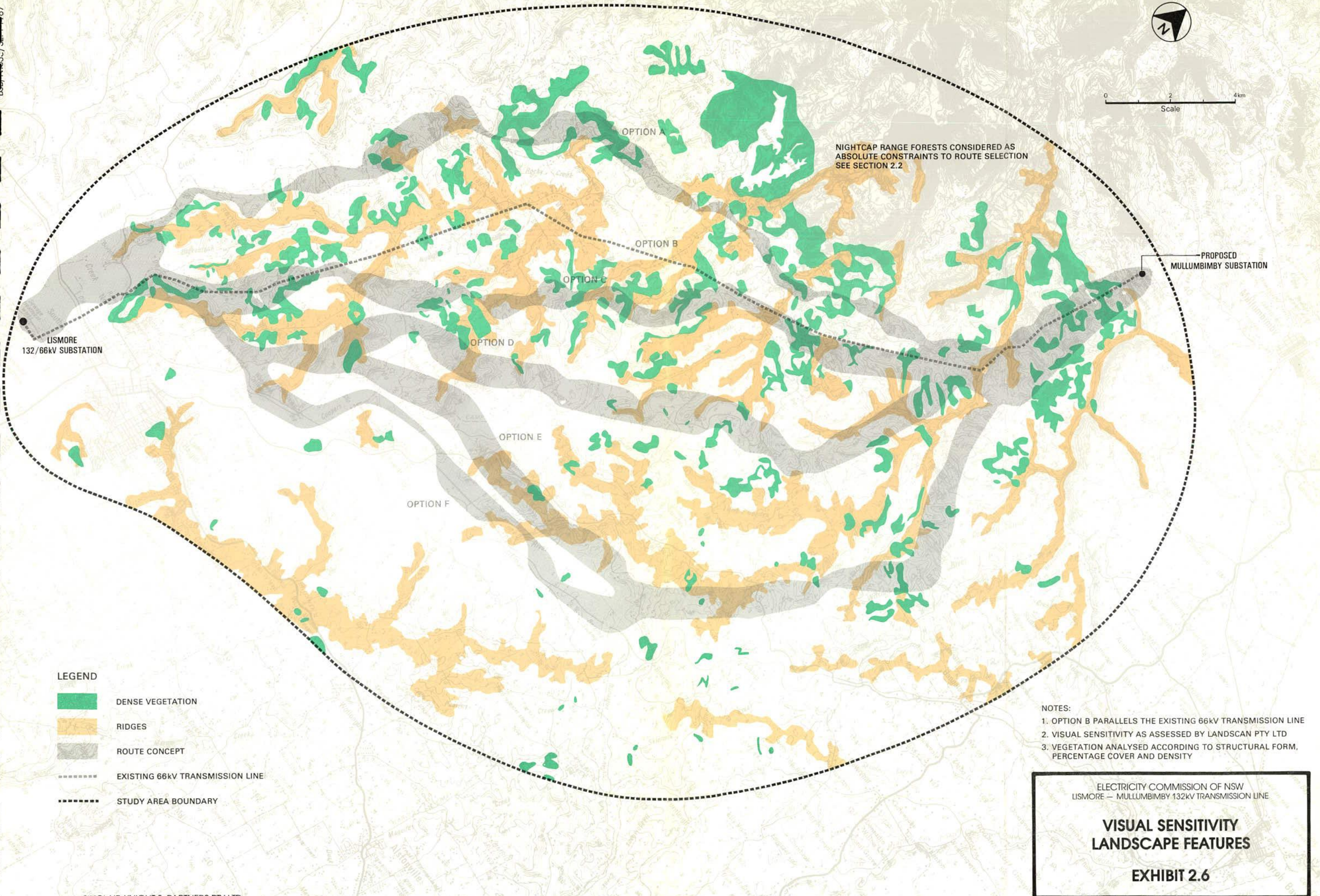
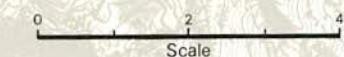
- 1 FLOOD PLAIN
- 2 GENTLY UNDULATING OPEN PASTURE
- 3A MODERATELY UNDULATING OPEN PASTURE
- 3B STEEPLY UNDULATING OPEN PASTURE
- 4 STEEPLY SLOPING FOOTSLOPES
- 5 STEEP FORESTED RANGES
- 6 COASTAL ESCARPMENT
- SCENIC PRESERVE
- ROUTE CONCEPT
- LOOKOUT
- EXISTING 66kV TRANSMISSION LINE
- STUDY AREA BOUNDARY

- NOTES:
- 1. OPTION B PARALLELS THE EXISTING 66kV TRANSMISSION LINE
 - 2. LANDSCAPE ZONES AS DETERMINED BY LANDSCAN PTY LTD

ELECTRICITY COMMISSION OF NSW
LISMORE - MULLUMBIMBY 132kV TRANSMISSION LINE

LANDSCAPE ZONES

EXHIBIT 2.5



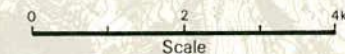
- LEGEND**
- DENSE VEGETATION
 - RIDGES
 - ROUTE CONCEPT
 - EXISTING 66kV TRANSMISSION LINE
 - STUDY AREA BOUNDARY

- NOTES:**
1. OPTION B PARALLELS THE EXISTING 66kV TRANSMISSION LINE
 2. VISUAL SENSITIVITY AS ASSESSED BY LANDSCAN PTY LTD
 3. VEGETATION ANALYSED ACCORDING TO STRUCTURAL FORM, PERCENTAGE COVER AND DENSITY

ELECTRICITY COMMISSION OF NSW
LISMORE – MULLUMBIMBY 132kV TRANSMISSION LINE

**VISUAL SENSITIVITY
LANDSCAPE FEATURES**

EXHIBIT 2.6



LEGEND

- FOREGROUND VIEW CATCHMENTS FROM TOWNS AND VILLAGES
- FOREGROUND VIEW CATCHMENTS FROM RURAL DWELLING CLUSTERS
- VIEWS FROM ROADS WITH SCENIC DESTINATIONS
- ROUTE CONCEPT
- STUDY AREA BOUNDARY
- EXISTING 66kV TRANSMISSION LINE

- NOTES:
- 1. OPTION B PARALLELS THE EXISTING 66kV TRANSMISSION LINE
 - 2. VISUAL SENSITIVITY AS ASSESSED BY LANDSCAN PTY LTD

ELECTRICITY COMMISSION OF NSW
LISMORE — MULLUMBIMBY 132kV TRANSMISSION LINE

VISUAL SENSITIVITY
VIEW CATCHMENTS

EXHIBIT 2.7

3. Route Corridor Options

3.1 INTRODUCTION

Section 2 has identified features of the study area relevant to transmission line location. This section describes the methods used to develop a number of route options and to select a preferred route alignment for detailed impact assessment. The role of community consultation in the establishment of a constraint hierarchy is explained, and the route options compared on the basis of a set of route selection criteria.

3.2 ROUTE SELECTION PROCESS

The approach to route selection has been to firstly, identify factors offering possible constraint to the location of a transmission line (from the examination of the study area in Section 2) and secondly, to rank these factors into a framework of primary and secondary constraints. This framework was used to develop and analyse a number of route concepts and assist in the selection of a preferred route.

The route selection process is shown schematically in Exhibit 3.1. It involved the following principal elements:

- . identification of major community concerns through early consultation with local groups and Council representatives
- . analysis of the physical, biological and social environments of the study area, taking into account community priorities
- . mapping of zones within the study area offering constraint to transmission line location
- . generation of a number of route concepts from areas generally outside these constrained zones
- . distribution of a brochure to the local community and relevant government authorities which outlined the route concepts and which invited comments on the options and the criteria used in their development
- . establishment of a hierarchy of primary and secondary constraints from a review of comments received in response to the brochure
- . analysis of the route concepts with respect to the primary and secondary constraints and selection of a preferred route.

Each of these steps is explained in succeeding sections, together with a resume of community involvement in the planning process.

3.3 COMMUNITY CONSULTATION

3.3.1 Introduction

The region between Lismore and Mullumbimby is a relatively densely populated and scenic rural area, with unusually high and diverse environmental characteristics. The local population has a heightened awareness of environmental issues, a concern to maintain existing environmental quality, and a keen desire to participate in public authority decision-making. Local groups identified as being likely to be interested in the proposal included town and village residents, graziers, horticulturists, recreational and part-time farmers and 'new settlers'.

A consultation program was devised which involved the community in the planning process prior to the selection of a route alignment for the proposed transmission line, and before preparation of this document had begun. The aims of the program were to inform the community of the proposal, its planning justification and the planning process, as well as to gain an appreciation of community concerns relating to transmission line location. Concerns expressed formed the basis for the establishment of a hierarchy of constraints which were subsequently used to analyse a number of route concepts and which led to the selection of a preferred route alignment. Other issues raised during the consultation program were noted as requiring detailed coverage in this document.

Principal components of the program were a series of workshops held with local community groups, exhibition of a Route Concepts brochure and provision of background planning information, release of a number of press statements, attendance at public meetings and demonstration measurements of existing electric and magnetic fields in the area.

3.3.2 Community Group Workshops

The consultation program began with a series of workshops with local community groups and meetings with representatives of Lismore City and Byron Shire Councils. The workshops involved an initial brief explanation of the planning process for the project, the opportunity for community involvement, and reasons why the line was being proposed. Discussions were then held to identify issues of community concern.

Workshop held at Wollongbar Agricultural Research Station on 20.10.86

This workshop was attended by representatives of the Department of Agriculture, Banana Growers Federation, NSW Farmers Association, the Macadamia Growers Association and the Exotic Fruit Growers Association. The major constraint to route location was identified as existing horticultural plantations, while it was suggested that land potentially suitable for horticulture should also be avoided. Compensation procedures were also discussed.

Workshop held at Lismore on 20.10.86

This workshop was attended by representatives of the Big Scrub Environment Centre, Richmond Valley Reafforestation Association, Rainforest Information Centre, Treeworks Association, Ballina Environmental Society and several individuals.

Nine major issues of concern were identified at the workshop. The issues were generally in relation to the need to maintain the environmental quality of the area in terms of its rare species of plants and animals, wildlife habitats, vegetated corridors, remnant rainforest stands and visual amenity. It was considered important that the current state of the land should not be assessed in isolation, but that possible future uses also be considered, particularly in relation to the potential for the re-establishment of sustainable land uses such as horticulture and land rehabilitation. Concern was also expressed at the potential for the colonisation of the transmission line easement by exotic species, and accelerated soil erosion through disturbance of steep slopes. Other issues discussed included perceived health effects of the line and the possibilities for an underground line.

A consensus was reached amongst those present that rainforest and undisturbed native forests constituted the most important constraint to route location. Visual amenity also rated very highly. Most participants agreed that trade-offs would probably be necessary in some situations.

Workshop held at Byron Bay on 21.10.86

This workshop was attended by representatives of 'BEACON' and several individuals. Participants noted the significance of the local area with respect to its vegetation and scenic quality, and its importance to tourism. Suggestions were made on techniques that could be adopted to minimise the construction impact of the line such as 'slashing' of easements, rather than uprooting of vegetation, the planting of native trees adjacent to supporting structures and replanting of cleared easements with low growing native shrubs. A suggestion was made that paralleling of the existing line would minimise impacts by confining effects to a single service corridor.

Native vegetation and visual amenity were considered to form the highest constraint to route selection.

Meetings with Lismore City Council (20.10.86) and Byron Shire Council representatives (21.10.86)

Discussion at these meetings centred on explanations of both Council's draft Local Environmental Plans and the need to take into account proposed zonings for scenic protection areas, urban and rural residential/hobby farm areas and horticultural plantations. The scenic amenity of the Wilsons River valley between Lismore and Bangalow was stressed.

Conclusions drawn from these initial meetings were that firstly environmental groups place a very high value on the protection of remnant stands of native vegetation, with the next most important consideration being maintenance of visual quality. Secondly, agricultural groups placed highest priority on the avoidance of existing horticultural plantations. A third point to emerge from the discussions was that, in the opinion of local groups and Council representatives, transmission line location should take potential future landuses into account.

These identified issues were taken into account in the generation of a number of route concepts subsequently exhibited in the Route Concepts brochure.

3.3.3 Route Concepts Brochure

The community group workshops and Council meetings were followed by specialist studies of the physical, biological and social environments, mapping of zones within the study area offering constraint to route location, and generation of a number of route concepts.

A brochure was then prepared, advertised and distributed to towns throughout the region. The brochure, reproduced in Appendix A, explained the increasing power demands in the North Coast region, the proposed development, the role of the community in the planning process and identified constraints to route location. Five alternative route concepts were shown and described. A questionnaire included in the brochure invited comments on the concepts and asked respondent's to rank the importance of a number of identified constraints. The route concepts shown in Exhibit 3.2 are based on the concepts shown in the brochure. Options A to E have been modified following detailed investigations and a sixth option, Option F, added following a request received at one of the public meetings (see later).

Supplementary information, including a detailed plan of the route concepts, a background planning information paper and a brochure outlining electricity supply plans for the region, was also made available on request at the time the brochure was on display.

Due to public interest and response, the public exhibition period of the brochure was extended to three months and replies were received over five months. All comments were analysed to determine:

- . what issues the community considered to be most important with respect to transmission line location
- . the reasons given for either favouring or opposing each of the route concepts, and
- . other issues that needed to be addressed in detail in the EIS.

Resident Responses

The brochure stimulated considerable community interest and 345 questionnaire responses, 77 letters and two petitions were received. Seventy-six of the questionnaire responses were submitted as a form letter from members of the Federal Action Group (F.A.G.) and ten of the letters were submitted by the Farmers' Association. A resume of all resident responses received is included in Appendix A.

A review of the responses received revealed that issues of most importance to route selection were, in order of decreasing priority:

- . views from existing rural dwellings
- . proximity to planned rural residential areas
- . proximity to towns and villages
- . disturbance to intense agricultural uses
- . proximity to planned horticultural developments
- . disturbance to native vegetation

Issues rated as having relatively minor importance were:

- . views from main roads and
- . views from tourist roads and lookouts

Other issues of concern, not directly related to route selection, were perceived health effects, property devaluation and project justification. Another perception was that the line was being provided for the benefit of coastal tourist resorts, at the expense of the local community. Suggestions included alternative sites for the Mullumbimby Substation and future supply of the Tweed region from Queensland. All routes were both supported and opposed, although Option A was most favoured. The principal reason given in its support was that it was the option most removed from population centres.

A feature of the replies received was the divergence of opinion as to what issues were considered to be of most importance. Replies may be generally divided into the following groupings within the community, as summarised in Table 3.1:

- . Traditional farmers/graziers - respondents from this group were mainly concerned with possible effects on grazing land, aerial spraying of crops, compensation procedures and reduction in property values and potential health effects.
- . Small acreage rural dwellers/horticultural farmers - this group considered that views from rural residential dwellings, disturbance to native vegetation and effects on horticulture plantations rated most highly. Other issues raised were perceived health effects, the need to avoid disturbance to reafforestation programmes in steeply-sloping areas in proximity to the forests of the Nightcap Range, possible impact on tourist destinations in the Nightcap Range and potential landform instability problems. The importance of vegetation surrounding rainforests was also stressed.
- . Town and village residents - proximity to towns and villages, views from rural residential dwellings and proximity to planned rural residential areas were all rated highly by this group. Disturbance to native vegetation rated relatively lowly, as did views from lookouts, scenic drives and main roads. A strong desire was expressed for the line to be removed from population concentrations and that people be given priority over vegetation and agriculture.

Another specific issue raised was the question of equity. This was raised by residents owning properties in the vicinity of the existing Northern Rivers Electricity 66 kV Lismore to Mullumbimby line. These residents opposed Option B and expressed the view that the burden associated with services infrastructure should be shared amongst the community. Flooding of the Wilson River floodplain, perceived railway signalling hazards and effect on tourism were also considered as important constraints by several respondents.

Community Group Responses

Community Group responses were received from the Big Scrub Environment Centre, B.E.A.C.O.N., the Federal Action Group, the Farmer's Association and the NSW Dairy Farmers Association.

- . Big Scrub Environment Centre - this group declined to offer detailed comments on the route concepts or to indicate a preferred option. Concern was expressed at the potential disturbance to native vegetation if the transmission line easement were to pass through forested areas. Route location should also consider possible future uses of land such as reafforestation of erosion prone Class 4 and 5 agricultural quality land

(as defined by Soil Conservation Service). 'Big Scrub' considers that potential forest could occupy the area between the Nightcap Range and the Wilson River valley, and, as such, 'Options A,B,C and D, and to a less extent E, all have the potential for major impact by incising many valley side slope forested corridors.' It was noted that reafforestation initiatives are actively promoted by many Government Departments and community groups concerned about sustainable land use and rational resource utilization.

B.E.A.C.O.N. - this group felt it was inappropriate to comment on the route concepts before exhibition of the Environmental Impact Statement. Criteria that will be used by the organisation at that time will be that the preferred option should render minimal impact upon established native vegetation and faunal communities, archaeological sites, environmental protection zones and visual amenity and consider land uses planned for sites surrounding the proposed route. BEACON also suggested that native vegetation should be retained in the vicinity of power lines wherever possible, and that if clearing within the easement is required, replanting of native vegetation should be undertaken.

Additional information to substantiate the need for a 45 metre wide easement was requested. Other matters of concern noted were an alleged insufficiency of information provided in relation to project justification, health effects and compensation procedures.

Federal Action Group - replies generally followed a set format and indicated a strong concern that local residents be given priority over visitors and non-residents. None of the route concepts were preferred, with Options C, D and E being most disliked. Advantages were seen in locating the line along either an existing road or railway corridor. Concern was expressed concerning potential health effects, visual amenity, disturbance to horticulture and native vegetation, property devaluation and interference with appliances.

NSW Farmers' Association - the Association supplied a submission comprising 10 replies from individual landholders who were potentially affected by one or more of the route concepts. Objections were received for each of the route concepts for a variety of reasons including perceived health effects to humans and cattle, disturbance to existing and planned agricultural and reafforestation pursuits, property devaluation and visual impacts. Many respondents felt that priority should be given to minimizing effects on residents, and that the line should be located in forested areas of the Night Cap Range.

NSW Dairy Farmers' Association - the submission indicated strong objection to Option E on the grounds that up to five members' farms would be traversed. Option C was considered to represent the most feasible option.

Authority Responses

Replies were received from the following Government Authorities: the Soil Conservation Service of NSW, the State Pollution Control Commission, the Department of Agriculture, Telecom Australia, the State Rail Authority of N.S.W., Department of Aboriginal Affairs, Forestry Commission of N.S.W., the National Trust of Australia (NSW), Water Resources Commission, Department of Education, Catchment Areas Protection Board, and the Department of

Environment and Planning. A summary of these submissions is included in Appendix H. Submissions of particular relevance to route location were:

- . Department of Environment and Planning - Reference was made to the draft Local Environmental Plans of Lismore City and Byron Shire Councils and the need to ensure that the agricultural potential of lands designated for inclusion in Agricultural Protection Zones are not compromised by any construction or use which would reduce their value to agriculture.
- . Department of Agriculture - the Department supplied a map of Class 1, 2 and 3 lands, representing high quality grazing and horticultural lands suitable for pasture improvement or planting fruit and nut trees. Options B and E were regarded as the least desirable options since they traversed the most important agricultural lands. The Department considers that both existing and potential uses are important considerations in choosing a preferred route. Other relevant considerations are the importance of aerial agriculture to the expanding horticultural industry, and the local impact of tree clearing in disturbing windbreaks. It was noted that windbreaks are required to protect horticultural crops from prevailing winds.
- . State Pollution Control Commission - the Commission expressed a preference for Option C because of its location away from watercourses. Implementation of adequate erosion and sediment controls was requested during construction of the line.
- . Catchment Areas Protection Board - the Board noted that its prime function is the preservation of tree cover on steeply sloping lands and prevention of indiscriminate destruction of trees along the banks of rivers and lakes. A map prepared by the Soil Conservation Service which detailed protected lands was submitted. It indicated that there were a number of areas of protected lands and prescribed streams in the study area.
- . National Trust of Australia, NSW - the Trust submission outlined a number of historic buildings included in its Register at Bexhill, Clunes and Eltham. The Mullumbimby Power Station was noted as being classified and the Trust considers that the Commission should ensure that none of the surviving significant elements of the complex are adversely affected by the proposal.

The location of the North Lismore General Cemetery/Pioneer Park, Clunes Cemetery, Bexhill Cemetery and Dunoon Cemetery were also noted and the comment made that it would be inappropriate to locate a transmission line directly above burial grounds.

A proposal for an Urban Conservation Area for the town of Eltham was outlined. Option E would lie within the view catchment of this conservation area. Option E also traverses an area between Lismore and Bangalow identified in field surveys as being of high visual quality, worthy of classification.

The Trust suggested that existing easements be followed where possible to avoid duplication of easements and a repetitious impact on rural areas.

Soil Conservation Service of NSW - lands of special concern include those mapped as 'protected land' (lands generally having a slope greater than 18° to the horizontal) and those adjacent to streams listed as 'prescribed'. The Service noted that all routes traverse protected lands and that several prescribed streams were crossed.

A description of soil types occurring on each of the route concepts was also given and a request made that the Commission should take soil characteristics into account in the design and location of the proposed line. A number of soil erosion control measures were also outlined.

Local Government

Replies were received from both Lismore City and Byron Shire Councils.

Lismore City Council - Council declined to comment on the route concepts. However, it was felt that the transmission line should avoid populated areas and ridgelines, prime agricultural areas (especially areas already established). The line should also avoid the creation of cleared 'corridors' through vegetated areas, and have due regard to the aims and objectives of Council's draft Local Environmental Plan. There should not be any infringement on the Lismore Airport or on aircraft movements.

Council also requested that the route options be expanded to include lines following the railway line between Lismore and Bangalow, a coastal alignment and a direct line from Coffs Harbour.

Byron Shire Council - Council indicated its desire for a 'northern most route' to be investigated.

As explained previously, all comments received were analysed to determine issues that were considered to be of most importance to the general community. A hierarchy of constraints based on the relative importance accorded to each issue was subsequently used to compare each of the route concepts and to select a preferred alignment.

3.3.4 Public Meetings

Three public meetings were attended by representatives of Sinclair Knight and Partners and the Electricity Commission during the route location phase of the study. A deputation of Clunes residents was also received.

Dunoon public meeting held on 2.2.87

Approximately 160 people attended the meeting with the majority coming from the Dunoon, Dorrroughby and Rosebank areas in the north-west of the study area. Major issues of concern to emerge from the meeting were project justification (including the validity of power demand projections, the source of increased power demands), the need for the line (whether power supplies would be sufficient by replacement of the existing 66kV line with a 132kV line once the Ballina to Ewingsdale line was completed), and possible health effects. A number of power supply options were discussed including energy conservation, small-scale hydro schemes, solar energy and underground cabling.

A preference was indicated for the location of lines within floodplains where they would generally be removed from residential areas, and a motion was passed requesting consideration of a route paralleling the railway line between Lismore and Bangalow.

Techniques for screening the transmission line and allowing some vegetation growth within the easement were also discussed.

Federal public meeting held on 18.3.87

The Federal meeting was attended by approximately 80 people, predominantly from Federal, Eureka, Clunes and Goonengerry. The main areas of discussion were the need for a new line, the possibility of health effects and alternative means of providing electricity.

With regard to route location, a consensus was reached that the line should be sited to affect the least number of people, and that horticulture and trees should be considered secondary to the needs of people. This was passed as a resolution, along with the statement that 'the electricity needs of this community be met until the late 1990's by upgrading the 66kV line to 132kV, without the necessity to construct a second 132kV line'. An additional resolution was passed to reconvene the meeting following more information being provided concerning the practicality of upgrading the existing 66 kV Lismore to Mullumbimby line.

Lismore public meeting held on 19.3.87

The Lismore meeting was also attended by about 80 people, with representation from most villages in the study area. Dunoon and Dorrroughby had the highest representation. Questions again centred on the need for the line, and whether upgrading of the existing 66kV line would obviate the need to construct a new line. Doubts were raised as to how the line would benefit Lismore, and concern was expressed at possible health effects.

Discussion also included equity questions relating to paralleling of the existing line, and whether it was fairer to 'share the burden' amongst the community. The Electricity Commission was requested to investigate alternatives to power generation.

Meeting with Clunes deputation held on 19.3.87

A deputation from residents who had attended an earlier public meeting at Clunes was received in Lismore on 19.3.87. The deputation reported that the meeting had generally agreed that a new line was required, and that it should be sited to affect the least number of people. Option A had been perceived as conforming to this criteria.

The possibility of health effects on people was perceived as the highest constraint, and it was considered that there had been too much emphasis placed on horticultural impacts. Access to lines during floods was suggested as a criteria for route selection.

Opinions expressed at the public meetings were taken into account in the establishment of the hierarchy of constraints developed to analyse each of the route concepts, together with other issues that were identified as requiring detailed coverage in the E.I.S., such as project justification, perceived health effects and compensation procedures.

The meetings also provided the opportunity to explain the planning process for the project and to explain some of its more contentious aspects. A sixth route concept, Option F, was added for consideration following the Dunoon public meeting, and measurements of electric and magnetic fields were undertaken in and around residents' houses in response to requests received at the Lismore public meeting.

3.3.5 Other Features

Other components of the community consultation program were:

- . release of a series of press statements in the local papers to inform residents of the planning process. The articles provided details of increased power demands in the Far North Coast region, explained investigations for new power supply options and outlined the role of the community in the selection of an alignment for the proposed transmission line.
- . a brochure which outlined proposals for expansion of the high voltage supply system to the North Coast region over the period 1986 to 1996, and a more detailed Information Paper were made available on request during the exhibition period of the Route Location brochure.
- . explanation of electric and magnetic fields associated with transmission lines by Electricity Commission representatives at the public meetings, distribution of a brochure entitled 'What is Electromagnetic Radiation?', and measurement of electric and magnetic fields in the vicinity of the existing Lismore to Mullumbimby 66 kV transmission line were all undertaken to alleviate concerns expressed by the community in relation to perceived health effects of transmission lines. The measurement of electric and magnetic fields was undertaken in response to requests received at the public meetings. Results of the field measurements are included in Appendix G.

3.3.6 Conclusions

The community consultation program resulted in a valuable information exchange. It enabled information relating to the proposal to be disseminated to the public, including the need for power supply augmentation due to the increasing electricity demand of the region, an explanation of electric and magnetic fields associated with transmission lines and compensation procedures.

The program also provided an opportunity for the community to be involved in the planning for the project, prior to the preparation of the Environmental Impact Statement, and before a preferred route had been selected. Apart from indicating issues requiring detailed coverage in the E.I.S., it also allowed issues of community concern to be identified early in the study so that those concerns could be incorporated into the constraint hierarchy used in the selection of a preferred route.

With respect to route location considerations, there was some variation between community views expressed at the group workshops and public meetings, the responses to the Route Concepts brochure and the replies received from relevant Government authorities and Councils. Whereas environmental groups generally considered disturbance to native vegetation as constituting the highest constraint to transmission line location, agricultural groups considered horticultural areas should form the highest constraint while brochure responses indicated that views from residential areas should be accorded the highest priority.

However, general agreement was apparent at the various public meetings and deputations that the highest priority should be given to minimising the number of residents likely to be affected by the proposal. There was also agreement that while both existing and future land-uses should be considered, priority should be given to current residents.

Overall, three issues stood out as being of prime importance to the general community. They were views from towns and villages, effects on intense agricultural uses such as horticulture and disturbance to native vegetation. As discussed in Section 3.4, these factors have been considered as constituting primary constraints to transmission line location, while a number of other factors were identified as being of secondary constraint. Each of the route concepts was subsequently analysed with respect to these primary and secondary constraints.

TABLE 3.1 COMMUNITY GROUP CONCERNS

COMMUNITY GROUP	CONCERNS*
Traditional farmers and graziers	Effect on grazing land Aerial spraying of crops Compensation procedures Property values Possible health effects
Small acreage rural dwellers, horticultural farmers	Views from rural residential dwellings Effect on horticultural plantations Rainforest remnants and forest perimeters Reafforestation programs Effect on tourist destinations Possible health effects
Town and village residents	Proximity to towns and villages Project justification Need for line to affect the least number of people People to be given priority over vegetation and agriculture Possible health effects
Environmental Groups	Disturbance to native vegetation Visual amenity Reafforestation programs Possible health effects
Government Departments	
Department of Environment and Planning, Department of Agriculture	Protection of agricultural potential
Soil Conservation Service, Catchment Areas Protection Board	Intrusion into protected lands
State Pollution Control Commission	Erosion and sedimentation potential
National Trust of Australia (N.S.W.)	Preservation of scenic quality Effect on heritage items
Councils	
Lismore City and Byron Shire	Compatibility with aims and objectives of their respective draft LEP's

Note : * An appreciation of community concerns was gained through responses received during the community consultation phase of the study.

3.4 CONSTRAINTS TO ROUTE LOCATION

Consideration of principal characteristics of the study area resulted in the identification of two main constraint categories:

- social and environmental issues - visual amenity, agricultural land use, preservation of native vegetation and wildlife habitats, reafforestation potential, land use zoning compatibility, tourism, landowner compensation and questions of equity in siting the line in a services corridor parallel to the existing 66kV line.
- engineering issues - land instability and erosion potential, sterilisation of extractive resources, flooding considerations, length of the line, man-made barriers to construction.

Selection of a preferred route alignment for the transmission line required the ranking of these factors. Establishment of a hierarchy of constraints was achieved through the community consultation program outlined in the previous section, by gaining an appreciation of community opinion through the workshops, public meetings and an analysis of responses received to the Route Concepts brochure.

Comments received from individuals, community groups, government authorities and local council representatives revealed that proximity to towns and villages, effect on intensive agricultural uses and disturbance to native vegetation should form the primary constraints to route selection. Other constraints that rated highly were views from rural residential dwellings, proximity to planned rural residential areas, and proximity to planned horticultural plantations.

There was also a strong concern relating to perceived health effects of the transmission line. It should be noted that the Electricity Commission does not consider perceived health effects to be a constraint to route selection. This is consistent with the Commission's conclusion based on the bulk of scientific evidence that the electric and magnetic fields associated with the proposed transmission line would not pose a threat to public health. Electric and magnetic field effects associated with transmission lines are discussed in detail in Appendix G.

Environmental groups felt that the line should be removed from areas which were suitable for reafforestation, and should avoid soils and slopes constituting a high erosion risk. This latter concern was also expressed by several state government authorities, including the Soil Conservation Service of NSW and the Catchment Areas Protection Board. Other factors requiring consideration included the length of the line, the length of floodplain traversed, and impact on tourism in the area.

A comprehensive list of identified route selection factors is given in Table 3.2. The table also explains why each factor was chosen and how it has been mapped or measured. As shown in the table, and outlined below, constraints were categorised as being either of primary or secondary importance. The hierarchy was established from a review of all comments received during the community consultation program.

Primary Constraints

- . areas within foreground views of towns and villages
- . areas of existing horticulture
- . remnant stands of undisturbed native vegetation.

Areas of primary constraint are identified in Exhibit 3.2 and represent locations which the transmission line should avoid wherever possible.

Secondary Constraints

A. Environmental Issues

- . areas within foreground view catchments of rural dwelling clusters, lookouts and roads with major scenic destinations, proximity to visually prominent locations and areas designated as scenic preserves
- . the relative number of residences in proximity to the nominal route alignment of each of the route concepts
- . length of prime quality agricultural land traversed
- . stands of disturbed native vegetation and riparian vegetation corridors crossed
- . locations designated by the Lismore City and Byron Shire Councils for possible future urban residential, rural residential and horticultural uses
- . areas suitable for reforestation traversed.

B. Engineering Factors

- . comparative length of the nominal route alignment of each of the route concepts
- . areas susceptible to land instability and with erosion potential
- . wide floodplains subject to deep, fast-flowing floodwaters
- . extractive resources and locations of possible conflict with existing and proposed services.

Intrusion of the transmission line into areas of secondary constraint should be minimised. Secondary constraints which can be mapped are shown on Exhibits 2.1 to 2.7.

In Section 3.6, this hierarchy of constraints is used to evaluate and compare the route concepts described in Section 3.5. As explained, a nominal route alignment was selected for each of the route concepts in order to facilitate the comparison of options.

3.5 ROUTE CONCEPT OPTIONS

3.5.1 Development of the Route Concepts

A number of specialist studies were undertaken in response to issues raised at the workshops and meetings held during the inception phase of the study. The studies analysed visual sensitivity (ie landscape features and view catchments), agricultural patterns (ie areas of horticulture and prime quality agricultural land) and vegetation types (ie areas of native vegetation). From these studies, maps were prepared of view catchments from towns and villages, horticultural plantations, and stands of undisturbed native vegetation. These areas were considered to represent zones of primary constraint which should be avoided wherever possible.

Four route concepts, namely Options A, C, D and E shown in Exhibit 3.2, were developed in areas outside these highly constrained zones. Two other options, Option B and Option F are also shown in Exhibit 3.2. Option B passes within areas of primary constraint, but was considered due to community requests received at the inception phase of the community consultation program. Option B comprises a paralleling of the existing 66 kV line and was considered due to opinions expressed that adoption of such a route would have the advantage of confining transmission line impacts to a single corridor.

Option F, as shown in Exhibit 3.2, also avoids areas of primary constraint. This option was developed following a request at the Dunoon public meeting that an option be considered which paralleled the railway line between Lismore and Bangalow. While the rationale given for the request for a railway option was also to confine impacts to a single service corridor, an alignment strictly paralleling the railway line was found to be untenable because of the visual impacts that would have resulted at Lismore, Bexhill and Eltham. The so-called 'Railway Option' was consequently modified so that it avoided these residential areas and satisfied the primary constraint criteria.

3.5.2 Variations from the Brochure Route Concepts

As noted in Section 3.3.3, the Route Concepts shown in Exhibit 3.2 have been modified from the original concepts shown in the Route Concepts brochure. The modifications were made as a result of the detailed environmental investigations that were undertaken following the publication of the brochure. Possible connections between the concepts were also considered during the detailed investigations, but were generally found to be inferior on environmental grounds.

The principal modifications may be described as follows:

- . north of Lismore - the route concepts have been modified in the vicinity of Lismore to account for foreground view catchments from residences in South and North Lismore
- . near Tullera - an alternative route concept crossing of Dunoon Road to the south of Tullera has been adopted due to visual and agricultural constraints to the west and north of Tullera. Topographical features and vegetation south of Lismore will shield the line from the view of residences adjoining Dunoon Road
- . at Bexhill - the route concepts have been modified in the vicinity of Bexhill to avoid primary visual constraints
- . north of Numulgi - the route concept has been varied at this location to avoid an area of undisturbed native vegetation identified during detailed field surveys
- . south and east of Corndale - the route concept has been widened to minimise the length of the Coopers Creek floodplain traversed, and to increase separation from an agricultural air-strip near Ewing Bridge
- . between Goonengerry and Lavertys Gap - the route concepts have been widened in this section principally to increase the separation from rural residences south of Goonengerry and at Donaghys Bridge.

3.5.3 Alternative Route Concepts

A number of other alternative route concepts were also investigated. Considerable attention was paid to minimising impacts at Lismore, the largest residential concentration in the study area. Apart from Options A to F which passed to the west and north of Lismore, alternative alignments were considered passing to the south and east of Lismore, and which crossed the Bruxner Highway near Wollongbar. These options would need to head south from the Lismore Substation for approximately two kilometres to pass south of the Lismore Airport, an adjoining caravan park and residential area, and to obtain a suitable undercrossing of three existing 132 kV lines and an overcrossing of two existing 66 kV lines. These requirements meant that this option was substantially longer by at least ten kilometres than Options A to F. The route would cross a number of prominent ridgelines to the south of Lismore and ridgeline roads crossed would include Skyline Road and Rous Road. In addition, the region to the south-east of Lismore is highly constrained by horticultural plantations, rural residential dwellings, the Department of Agriculture Research Station, the Cattle Tick Research Station as well as the towns of Alstonville and Wollongbar. The line would also be required to cross the Bruxner Highway. The section between the Bruxner Highway and the railway east of Eltham passes through less constrained undulating grazing land. Overall this option involved considerable additional length without any environmental advantages and was not considered further.

As outlined in Section 1, alternative locations for the proposed Mullumbimby Substation were also considered. These options were not proceeded with for environmental, economic, or long term planning reasons.

3.5.4 Description of the Route Concepts

Features of Options A to F may be summarised as follows:

Option A

Option A passes through Landscape Zones 1,2 and 4 identified in Section 2.5.4. It traverses the Leycester Creek floodplain to the west of Lismore, approximately one kilometre west of the existing 66 kV Lismore to Mullumbimby transmission line. Further north, the alignment crosses hillslopes on the eastern side of the Terania Creek floodplain before traversing steep slopes to the south and east of the Nightcap Range.

Vegetation within the corridor varies from open pasture in the south to dense vegetation north of Dunoon. It passes to the south of the Whian Whian State Forest. This option avoids main population centres, but is located in proximity to rural dwelling clusters between Dunoon and Repentance Creek. Several scenic drives leading to the Nightcap Range are crossed north of Dunoon.

The route keeps to the west of the existing 66 kV Lismore to Mullumbimby line. It passes between it and Goonengerry and continues in a northerly direction through steeply undulating land before terminating at the site of the proposed Mullumbimby Substation.

Option B

Option B crosses Landscape Zones 1,2,3 and 4 identified in Section 2.5.4, and parallels the existing NRE line for its entire length. It follows the Leycester Creek floodplain out of Lismore before traversing the hillslopes of the Boorie Creek valley. The central portion of the route passes through undulating to

TABLE 3.2 - ROUTE SELECTION CRITERIA

1. PRIMARY CONSTRAINTS

Issue	Constraint	Measure	Selection Rationale
Visual amenity	Foreground views from towns and villages	View catchments within 500 metres of towns and villages	The local community has a heightened awareness of environmental quality and is keen to maintain existing values. Transmission line location should avoid locations frequently viewed by residents.
Agricultural productivity	Disturbance to horticulture	Areas of existing horticultural	State and Local Governments wish to protect areas of prime agricultural quality. Within the study area, horticultural plantations are being developed on the uniquely suited krasnozem soils of the plateau area. Transmission line location in these areas could affect horticulture by requiring trees to be lopped in some circumstances.
Protection of native vegetation	Effect on undisturbed native vegetation	Areas of undisturbed native vegetation (Category 1 and 2 vegetation)	Areas of undisturbed native vegetation are of ecological significance and remnant stands of the 'Big Scrub' forest are highly valued by local environmental groups. Clearing within the transmission line easement in such areas would cause some disturbance to the remnant stands.

2. SECONDARY CONSTRAINTS

Issue	Constraint	Measure	Selection Rationale
A. Environmental Issues			
Visual amenity	Views from rural dwelling	Foreground view catchments (ie 0-500 metres) of rural dwelling clusters.	The study area features many rural dwellings and small scale acreages. The consultation program revealed that these residents are highly sensitive to the possibility of a transmission line being within view of their homes. It is preferable that views of the line from rural dwelling clusters be minimised.
	Views from lookouts and roads with major scenic destinations	Foreground view catchments (ie 0-500 metres) from lookouts and scenic drives leading to the Nightcap Range National Park	The natural attributes of the region make it a popular tourist destination. State and Local Governments are seeking to promote 'natural tourism' in the area. Tourists (and residents) seeking to enjoy the beauty of the landscape are likely to consider a transmission line an undesirable element in areas in proximity to the Nightcap Range.
	Proximity to visually prominent locations and areas of particular scenic quality	Prominent ridgelines, areas of dense vegetation, and locations of particular scenic quality	The draft LEP's of Lismore City and Byron Shire Council aim to preserve and enhance landscape features, including prominent hillslopes and ridgelines. It is preferable that transmission line location in these areas be minimised. The National Trust has nominated a number of scenic preserves, representing areas of particular scenic quality.
Residential amenity	Proximity to individual residences	The number of residences within 250 metres of a nominal route alignment selected for each of the route options	The community consultation program revealed a strong desire for the transmission line to be removed from residences and population centres. Reasons cited by the community included reduction in residential amenity, property values and perceived health effects (see Note 1). The relative number of houses located within 250 metres of the line provides a basis for comparison of the route options.
Agricultural impacts	Disturbance to prime quality agricultural land	Areas of Class 1,2,3 agricultural suitability other than areas designated for existing or proposed horticulture	Prime quality agricultural land is considered to be an important community resource. Although impacts in agricultural areas, other than horticultural plantations, are minimal, it is preferable to minimise intrusion into such areas.
Protection of native vegetation	Effect on disturbed native vegetation	Areas of disturbed native vegetation (Category 3 vegetation)	While disturbed areas of native vegetation are not of particular ecological significance, it is considered that they should be avoided where possible in situations where their density would allow successful regeneration under proper management. This concept has received strong support from environmental groups.

TABLE 3.2 (Cont.)

2. SECONDARY CONSTRAINTS (Cont.)

Issue	Constraint	Measure	Selection Rationale
Protection of wildlife	Disturbance to wildlife habitats	Riparian vegetation corridors	Removal of riverside vegetation may result in the creation of barriers to wildlife movement along streamside corridors and should be avoided where possible. This sentiment was supported by environmental groups and landowners. Retention of riverside vegetation was also promoted by several Government Authorities for reasons relating to soil conservation.
Equity issues	The equity of locating transmission lines in a single service corridor	Consideration of the location of existing services	Residents owning property traversed by the existing Lismore to Mullumbimby 66 kV transmission line have expressed their view that the burden associated with services infrastructure should be shared amongst the community. Although paralleling of the existing line would confine transmission line view catchments to a single corridor, the impact on smaller properties could be substantially increased.
Compatibility with Local Government planning initiatives	Intrusion into areas designated for future urban development	Areas zoned as 1(d) and 2(c) in Lismore City draft LEP, and 1(d) and 2(v) in Byron Shire draft LEP	Lismore City and Byron Shire Councils have both identified areas suitable for future urban development. The visual amenity of such areas should be maintained. It is preferable that, where appropriate, intrusion into such areas be minimised.
	Intrusion into areas designated for future rural residential uses	Areas zoned as 1(c), 1(d) and 2(b) in Lismore City draft LEP, and 1(c1) and 1(c2) in Byron Shire draft LEP	Rural residential and small acreage blocks are in great demand in the region and there is every indication that land set aside for this purpose will be utilized in the short to medium term. The DEP, Lismore City and Byron Shire Councils and the local community felt there was a need to maintain the visual amenity of these designated areas. It is preferable that intrusion into such areas be minimised, although not at the expense of existing developed areas.
	Intrusion into areas designated for future horticultural uses	Areas zoned as 1(b) in Lismore City draft LEP and 1b(2) in Byron Shire draft LEP	It is recognised that there are locations within the study area that are uniquely suited to horticultural uses. The DEP, Department of Agriculture, Lismore City and Byron Shire Councils and the local community feel that such areas should be protected from uses that could limit horticultural productivity.
Reafforestation of cleared land	Transmission line location in areas suitable for reafforestation	Class 4 & 5 land capability areas (as defined by the Soil Conservation Service) in proximity to forest areas	Environmental groups have expressed a desire for consideration of possible future reafforestation of cleared land in steep, unstable areas, in proximity to existing forested areas. Transmission line location in such areas would inhibit the effectiveness of such a program, should it be implemented by the local community.
B. Engineering Factors			
Cost	Construction cost	Length of the line	Government Authorities are required to provide services to the community at the least practicable cost.
Erosion	Unstable land	'Protected lands' as defined by the Soil Conservation Service	Several Government Authorities, community groups and individuals were concerned that the route alignment should avoid steep slopes and unstable soils. Such lands constitute an erosion risk with the clearing required within the transmission line easement. Protected lands are those generally having a slope greater than 18° to the horizontal.
Flooding	Transmission line security	Extensive floodplains with deep floodwaters	Extensive floodplains with deep floodwaters pose an engineering constraint to route selection due to line security considerations.
Sterilisation of extractive resources	Locations that would inhibit existing and future extraction of resources	Location of existing and planned quarries	State and Local Governments have identified that options for future utilisation of extractive resources should not be inhibited.

TABLE 3.2 (Cont.)

2. SECONDARY CONSTRAINTS (Cont.)

Issue	Constraint	Measure	Selection Rationale
Services	Conflict with existing and proposed services	Location of local power distribution network. Proximity to proposed water supply dam. Local roads.	An engineering consideration noted by various Government Authorities.

NOTE:

1. A review of recent research into transmission line health effects is presented in Appendix G. The Electricity Commission does not consider perceived health effects to be a constraint to route selection. This is consistent with the Commission's conclusion based on the bulk of scientific evidence that the electric and magnetic fields associated with the proposed transmission line would not pose a threat to public health.

steep terrain in the vicinity of Modanville, Dunoon and Repentance Creek. At a point approximately 1.5 kilometres south of Goonengerry the line deviates to the north through steep terrain before terminating at the site of the proposed Mullumbimby Substation.

Vegetation within the corridor is generally open pasture to the south and scattered vegetation to the north. Some dense vegetation is crossed in the northern segment of the route, and a substantial area of horticulture is traversed in the Dunoon area. This option is located in close proximity to the population centres of Modanville and Dunoon and several rural dwelling clusters. The line would also be visible from the Lismore/Dunoon Road.

Option C

Option C crosses Landscape Zones 1,2 and 3 identified in Section 2.5.4. This option generally parallels the existing 66kV line from the Lismore Substation to the south of Modanville, and then heads in a more easterly direction through steeply undulating terrain in the centre of the study area. It rejoins the existing transmission line near Dorrroughby, and generally follows the line to the site of the proposed Mullumbimby Substation. Terrain traversed varies from undulating in the south to steep in the north.

Vegetation within the corridor is generally open pasture in the south, dense in the centre and scattered in the north. The alignment is generally removed from population centres, but is approximately one kilometre from Corndale, and in proximity to rural dwelling clusters near Rosebank and Goonengerry.

Option D

Option D crosses Landscape Zones 1, 2, 3 and 6 identified in Section 2.5.4. It crosses the Leycester Creek floodplain north of the Lismore Substation approximately 0.5 kilometres west of the existing 66 kV line, before crossing the line and traversing the eastern hillslopes of the Boorie Creek valley and crossing the Lismore/Dunoon Road near Tullera. It then passes through the central region of the study area through undulating terrain, becoming steeper in the north. Coopers Creek is crossed at several locations.

Vegetation within the corridor is predominantly open pasture. Isolated areas of scattered and dense vegetation are crossed within the centre and northern areas. The corridor is located in proximity to Tullera, Numulgi and Eureka but is generally removed from rural dwelling clusters.

Option E

This option crosses Landscape Zones 1, 2 and 3 identified in Section 2.5.4. Option E follows the same alignment as Option D from the Lismore Substation to a point approximately two kilometres north of Numulgi, where it deviates to the east. Between Numulgi and Clunes it makes three crossings of Coopers Creek, and passes through steeply undulating land. From Clunes, the corridor follows footslopes adjoining the Wilsons River floodplain before heading north through generally undulating terrain. Terrain becomes steeper in the northern segment of the corridor. Several crossings of the Wilsons River is required in this section.

Vegetation within the corridor is predominantly open pasture. The option is located in proximity to Tullera, Numulgi, Clunes and Federal, and requires two crossings of Bangalow Road.

Option F

Option F crosses Landscape Zones 1,2 and 3 identified in Section 2.5.4. While this option was originally proposed as a route which paralleled the Lismore/Bangalow railway line, it has been modified in order to satisfy the primary constraint criteria outlined previously. It follows the same alignment as Options D and E to a point south east of Tullera, from where it deviates to the east to parallel the railway line near the Woodlawn College. It also deviates from the railway line to avoid Bexhill and Eltham. In paralleling the railway line between these villages the alignment traverses the Wilson River floodplain through open pasture land.

Option F connects with the Option E corridor at a point approximately 1.5 kilometres to the west of Booyong and follows it all the way to the site of the proposed Mullumbimby Substation.

3.6 ROUTE CONCEPT ANALYSIS

In this section, each of the route concepts described in the previous section is analysed with respect to the constraints and route selection criteria identified in Section 3.4. The criteria adopted for route selection was that the transmission line should avoid areas of primary constraint, wherever possible, and minimise intrusion into areas of secondary constraint.

3.6.1 Conformity to Primary Constraints

As shown in Exhibit 3.2 and Table 3.3, Options C, D, E, and F all avoid areas of primary constraint, while Option A exhibits a minor intrusion into such areas. Option B features significant non-conformity with the primary constraint criteria. Details of the intrusion of Options A and B into areas of primary constraint are as follows:

- . Option A - detailed investigation has revealed that this option involves a minor non-conformity with a primary constraint, namely disturbance to areas of Category 2 (undisturbed native) vegetation to the west of Dunoon and east of Dorrroughby. 'Tongues' of Category 2 vegetation are crossed at these locations. Although it is expected that an alignment could be found so that the line could span most of the vegetated areas, some residual disturbance may result.
- . Option B - this option passes through a substantial length (3.5 kilometres) of existing horticulture in the Dunoon area and foreground views would result from residences in Modanville and Dunoon. The route also passes through a small rainforest remnant along Boomerang Creek, south-east of Dorrroughby.

An alignment paralleling the Lismore to Bangalow railway line was also found to exhibit significant non-conformity with the primary constraint criteria, namely intrusion into foreground view catchments at Lismore, Bexhill and Eltham. The railway option was consequently modified to avoid these areas and is shown in Exhibit 3.2 as Option F. This option is analysed further in Section 3.6.2.

3.6.2 Conformity to Secondary Constraints

The route concepts were also analysed with respect to the secondary constraints identified in Table 3.2. To enable a comparative assessment, nominal alignments were developed from within the route concepts. Results of the analysis are analysed below with reference to Section 2 Exhibits and summarised in Table 3.3.

Option A

Although the alignment is removed from population centres and would not be visible from towns or villages, the footslopes of the Nightcap Range are relatively densely populated. This has resulted in Option A having a relatively high number of residences within 250 metres of the line (i.e. 96 residences).

Prominent locations, of high visual sensitivity, crossed by Option A, include a ridgeline south east of Blakebrook (visible from rural dwelling clusters adjoining Nimbin Road), high points east of Keerong (visible from a cluster of rural residences adjoining Keerong Road) and south of The Channon (visible from a housing cluster adjoining The Channon Road), four north-south spurs north of Dorroughby (visible from a rural residential enclave near Dorroughby) a ridge north of Repentance Creek (visible from Repentance Creek residences) and two ridges south of Goonengerry (visible from a rural cluster south of Goonengerry).

Other rural dwelling clusters in proximity to the line are located at Keerong Road (west of Booerie Hill), at Dunoon Road (west of Dorroughby) and east of Repentance Creek.

Short crossings of densely vegetated areas occur at Booerie Hill, east of Keerong, south of The Channon (two crossings), north of Dunoon, three crossings between Dorroughby and Repentance Creek and two crossings between Goonengerry and Lavertys Gap. Crossings of vegetated areas at ridgetops increase the potential for adverse visual impacts. This occurs south east of Blakebrook.

Foreground views of the line from scenic drives leading to the Nightcap Range would also result at Rocky Creek Dam Road, Upper Coopers Creek Road and Nightcap Range Road. These crossings are likely to be considered an intrusion into the landscape for those seeking to enjoy the natural beauty of the area.

Option A traverses a relatively long length of prime quality agricultural land (11.2 kilometres), and crosses over five kilometres of disturbed native vegetation, requiring a substantial amount of clearing. Some of the disturbed forest traversed is in a relatively good condition. This vegetation includes a wide range of habitat types and constitutes a moderate constraint to transmission line location.

Apart from the crossing of the Lismore floodplain (common to all options), the corridor is removed from major floodplains. Riparian corridors crossed include vegetation adjoining Coopers Creek, Boomerang Creek and Wilsons River.

The northern portion of Option A traverses steep terrain in proximity to forested areas, where clearing has increased the risk of instability and erosion. In particular, over six kilometres of protected lands are crossed. These areas would be suitable for reafforestation should landowners favour such an initiative. A transmission line in these locations would limit the efficacy of such a land use policy.

Option A also intrudes into areas designated for future rural residential and horticultural uses between Dunoon and the Whian Whian State Forest.

Other secondary constraint factors identified in Table 3.3 are its moderately direct alignment (it is approximately three kilometres longer than Option A, the shortest route), and its crossing of an area of land proposed for future quarry extension east of Blakebrook.

Option B

The proximity of Option B to villages (ie. Modanville and Dunoon) and rural settlements results in it having the highest number of residences (ie. 145) within 250 metres of its alignment.

Prominent locations, of high visual sensitivity, crossed by Option B include a ridgeline which runs between Modanville and Lismore (visible from houses adjoining Dunoon Road, south of Modanville), two spurs of the Dunoon/Lismore ridgeline (visible from residences adjoining Dunoon Road north of Modanville and from residences in Dunoon), three elevated plateau areas at Dunoon (within view of residences in Dunoon), three ridgelines between Dorroughby and Repentance Creek (visible from isolated rural residences), a high point south of Repentance Creek (visible from residences at Repentance Creek), and two ridgelines running between Goonengerry and Federal (visible from a rural dwelling cluster south of Goonengerry). The option is also within view of rural dwelling clusters in the Boorie Creek valley (two), north east of Repentance Creek and west of Montecollum.

Areas of dense vegetation (also constituting areas of high visual sensitivity) are crossed at Boorie Creek, east of Modanville, at Boomerang Creek, Turkey Creek, north of Goonengerry and south of Montecollum.

The option traverses a considerable length of prime quality agricultural land (14.0 kilometres), but minimises intrusion into areas of disturbed native vegetation (1.8 kilometres), and protected lands (2.2 kilometres). The corridor is relatively well removed from forested areas, and is not particularly suited to reafforestation. As for Option A, the alignment generally traverses flood free land. Riparian vegetation corridors are crossed at Boomerang Creek and Wilsons River.

Option B intrudes into relatively large areas of land designated for future urban (7.2 kilometres) and future horticultural (8.1 kilometres) uses. Only a relatively small area of land designated for future rural residential use (0.9 kilometres) is traversed. The option constitutes the most direct route (37.5 kilometres) and avoids existing and planned extractive industries.

Several construction, operational and safety factors mitigate against its adoption as the preferred alignment, as outlined previously in Section 1. These include the possible interruption to power flow along both the existing 66 kV line and the proposed 132 kV line in the event of a lightning strike or bushfire.

Questions of equity have also been raised by residents living along the existing 66 kV line. These residents have expressed the opinion that installation of a new line paralleling the existing one would considerably amplify impacts currently being experienced and create an inequitable situation. They feel that the burden of essential service installations should be spread amongst the community.

Option C

While the deviation of this option from the existing 66kV line around Dunoon means that it avoids main population centres, it has a relatively high number (i.e. 83) of residences in its proximity due predominately to rural dwelling clusters north of Corndale and Rosebank.

Prominent locations, of high visual sensitivity, crossed by Option C include a ridgeline which runs between Modanville and Lismore (visible from houses adjoining Dunoon Road south of Modanville), an elevated plateau area between Dunoon and Numulgi (visible from isolated residences adjoining Duncan Road and Hunters Hill Road), a ridgeline west of Corndale (visible from residences adjoining Dorroughby Road and Arthur Road, west and north of Corndale), elevated areas north of Rosebank (visible from residences on Fox Road), and south of Repentance Creek (visible from residences on Emerson Road), two ridgelines running between Goonengerry and Federal (visible from a rural dwelling cluster south of Goonengerry).

Other rural dwelling clusters in proximity to the line occur in the Booerie Creek valley (two clusters) and on Arthur Road, north Corndale.

Areas of dense vegetation (also constituting areas of high visual sensitivity) are crossed at Booerie Creek, north of Numulgi, three areas south of Dorroughby, three areas south of Repentance Creek and three areas between Goonengerry and Lavertys Gap.

The option minimises intrusion into prime quality agricultural land (8.6 kilometres), but passes through approximately four kilometres of disturbed native vegetation. As for Option A, this vegetation contains stands in relatively good condition. The length of protected lands crossed (i.e. 4.8 kilometres) is considerably less than for Option A. The corridor is well removed from forested areas and therefore less suitable for reafforestation. As for Option A, the alignment generally traverses flood-free land. Riparian vegetation corridors are crossed at Coopers Creek, Boomerang Creek and Wilsons River.

A disadvantage of Option C is that it intrudes into substantial areas designated for future rural residential and horticultural uses, and exhibits considerable incompatibility with these local government planning initiatives. Planned rural residential areas are crossed west of Tullera and north of Numulgi, and intrusion into future horticultural areas occurs north of Tullera and south-east of Dunoon.

Option C constitutes the second most direct route (38 kilometres) and avoids existing and planned extractive industries.

Option D

This option is generally removed from population centres and has the least number of residences within 250 metres of its nominal alignment (i.e. 54 residences). It can therefore be seen as providing the least reduction in residential amenity, as perceived by resident response during the community consultation phase of the study. Residents were concerned not only of potential views of the line, but also of proximity of the line to their place of residence.

Elevated locations crossed by the corridor include the Modanville/Lismore ridgeline at Dunoon Road (visible from rural residences in the Boerrie Creek valley), two ridgeline spurs between Tullera and Numulgi, a high point of the Dunoon/Numulgi ridgeline north east of Numulgi, two ridgelines east of Corndale, and ridgelines south of Rosebank, south of Goonengerry and south of Lavertys Gap. Another rural dwelling cluster in proximity to the line occurs at Donaghys Bridge, west of Montecollum.

Areas of dense vegetation crossed by the line occur in the Boerrie Creek valley, north of Federal, east of Goonengerry and south of Lavertys Gap.

Option D traverses the shortest length of disturbed native vegetation and it crosses a relatively minor length of prime quality agricultural land. Slopes are generally moderate, with similar lengths of protected land traversed as for Options C and E.

While three crossings of Coopers Creek are made, flooding would not be a problem due to the moderate depths of flow likely to be encountered. Riparian vegetation would be crossed at Coopers Creek and Wilsons River.

The alignment involves minimal intrusion into areas designated for possible future urban and rural residential uses and moderate intrusion into proposed horticultural areas near Tullera and west of Federal. Option D has a relatively direct alignment, approximately three kilometres longer than the shortest route, Option B. It traverses land which is not particularly suited for reafforestation. No areas of extractive industry are traversed.

Option E

Option E passes within 250 metres of a relatively large number of residences, (i.e. 79), substantially higher than for Option D.

While the alignment generally passes through undulating terrain, six prominent locations are traversed. These comprise the Modanville/Lismore ridgeline at Dunoon Road (visible from residences in the Boerrie Creek valley), a ridgeline spur east of Tullera, an elevated area south of Clunes (visible from residences adjoining Bangalow Road, north of Eltham), and ridges south of Springvale Hill, east of Eureka, south of Goonengerry and south of Lavertys Gap. The line would also be visible from residences near Keys Bridge and west of Montecollum. Areas of dense vegetation are crossed at Boerrie Creek, south west of Numulgi, south east of Federal, and between Goonengerry and Lavertys Gap.

Other locations from which the transmission line would be visible from include residences adjoining Woodlawn Road, Corndale Road, Booyong Road and Federal Road and at Goonengerry. The alignment also passes through the scenic preserve area proposed by the National Trust between Bangalow and Lismore and would be within view of the Bexhill Open Air Cathedral.

Option E traverses the second longest length of prime quality agricultural land, almost twice the length crossed by Option D. It crosses a moderate length of disturbed vegetation and minimises intrusion into areas designated for future rural residential and horticultural uses. The generally open terrain through which it passes includes 4.8 kilometres of protected lands, similar to Options C and D. It is well removed from forested areas, not particularly suited to reafforestation.

The route also follows substantial lengths of the Wilsons River floodplain and has the potential for operational difficulties due to the deep, fast-flowing floodwaters. Riparian vegetation would be crossed at the Wilsons River, south of Mullumbimby Power Station.

Option E is indirect, and would require the second longest length of construction (approximately 44.5 kilometres).

Option F

Option F passes within 250 metres of a similar number of residences to Option E (ie. 80), substantially higher than for Option D.

Prominent locations, of high visual sensitivity, crossed by the corridor include the Modanville/Lismore ridgeline at Dunoon Road (visible from residences in the Booerie Creek valley), the southern extremity of a ridgeline at Woodlawn (visible from the Woodlawn College), ridgelines north of Eltham (visible from residences in Eltham), south of Springvale Hill, east of Eureka, south of Goonengerry and south of Lavertys Gap.

The line would also be visible from residences near Keys Bridge and west of Montecollum. Areas of dense vegetation are crossed at Booerie Creek and south east of Federal. The alignment also traverses the scenic preserve area proposed by the National Trust between Bangalow and Lismore and would be within view of the Bexhill Open Air Cathedral.

Option F traverses the longest length of prime quality agricultural land (27.2 kilometres), almost 50% more than the second longest (Option E). It crosses a moderate length of disturbed vegetation and minimises intrusion into areas designated for future rural residential and horticultural uses. As for Option E, it passes through generally open terrain, of which 3.2 kilometres comprise protected lands. It is well removed from forested areas, traversing land not particularly suited to reafforestation.

Also as for Option E, the route crosses substantial lengths of the Wilsons River floodplain and has the potential for operational difficulties due to the deep, fast-flowing floodwaters. Riparian vegetation would be crossed at the Wilsons River, south of Mullumbimby Power Station. It has the longest length of all the options (45 kilometres), approximately 7.5 kilometres longer than the shortest route, Option B.

Finally, in paralleling the railway line, the line would be within foreground views of train travellers. The National Trust has indicated the importance of maintaining scenic quality in the vicinity of the railway line.

3.6.3 Comparison of Options

Table 3.4 indicates that Option B has considerable disadvantages with respect to both primary and secondary constraints. Option A exhibits some non-conformity with a primary constraint factor, namely potential effects on undisturbed native vegetation, as well as relative disadvantages with respect to a number of secondary constraints, including the number of residences in proximity to the line, affect on disturbed vegetation, landform instability, disturbance to riparian vegetation and reafforestation potential.

Option F is the least desirable option (ie. after Option B) in terms of visual impacts. Its middleground visibility from Bexhill and Eltham constitute intrusion into areas of secondary constraint, while its location within the scenic preserve nominated by the National Trust between Bangalow and Lismore, and its visibility from the Bexhill Open Air Cathedral considerably lower its visual amenity. Other disadvantages of Option F such as its substantial intrusion into prime quality agricultural land, its length and flooding difficulties, means that it, along with Options A and B, can be discarded from further consideration as a preferred alignment.

The remaining options, Options C, D and E all have a number of advantages and disadvantages. However, the only advantages Option E has over Option D are its superior compatibility with local government planning initiatives for future horticultural uses, less potential disturbance to riparian vegetation and slightly less impact on reafforestation potential. This advantage has to be weighed against Option D's advantages in regard to the substantially fewer existing residences in proximity to the line, its avoidance of the area of scenic preserve between Bangalow and Lismore, views from fewer rural dwelling clusters, intrusion into a smaller area of disturbed native vegetation, possible flooding problems for Option E in the Wilsons River floodplain, the substantial extra length of the line, and the considerable additional length of prime quality agricultural land traversed. Option D is therefore considered to be clearly preferable to Option E.

In reviewing the relative merits of Options C and D, Option D has the advantage in relation to substantially fewer residences in proximity to the line, fewer views from planned rural residential areas, intrudes into less disturbed native vegetation and substantially less intrusion into planned residential and horticultural areas. Option C is better removed from floodplains, traverses a shorter length of prime quality agricultural land, and is shorter. On balance, Option D is considered to offer the superior alignment, especially with respect to existing land uses and potential impact on current residents. It has therefore been adopted as the preferred route concept.

3.6.4 Preferred Route Alignment

Following determination of Option D as providing the best route concept, detailed investigations were undertaken to determine its preferred alignment. In particular, various alternative alignments were considered for segments of the line between Lismore and Numulgi Hill, and between Numulgi Hill and Laverty's Gap, principally in order to minimise views from rural dwellings and to reduce potential impacts on planned rural residential and horticultural areas. The nominal route alignment shown on Exhibit 3.2 was found to be the one which minimised the number of residences within 250 metres of the line, views from rural dwelling clusters, the length of disturbed native vegetation traversed and crossings of protected lands. The preferred route concept and the nominal route alignment are described in detail in Part B of this document, together with an assessment of likely environmental impacts.

Table 3-4 Route Concept Comparison

	Ranking of Route Concepts - Primary Constraints		
Route concepts	Views from towns and villages	Disturbance to intense agricultural uses	Effect on undisturbed native vegetation
A	■ ■ ■ ■ ■ ■ ■ ■	■ ■ ■ ■ ■ ■ ■ ■	■
B	■	■	■ ■
C	■ ■ ■ ■ ■ ■ ■ ■	■ ■ ■ ■ ■ ■ ■ ■	■ ■ ■ ■ ■ ■ ■ ■
D	■ ■ ■ ■ ■ ■ ■ ■	■ ■ ■ ■ ■ ■ ■ ■	■ ■ ■ ■ ■ ■ ■ ■
E	■ ■ ■ ■ ■ ■ ■ ■	■ ■ ■ ■ ■ ■ ■ ■	■ ■ ■ ■ ■ ■ ■ ■
F	■ ■	■ ■ ■ ■ ■ ■ ■ ■	■ ■ ■ ■ ■ ■ ■ ■

	Ranking of Route Concepts - Secondary Constraints									
Route concepts	Visual amenity	Number of residences within 250 metres of the nominated line	Intrusion into prime quality agricultural land	Affect on disturbed vegetation	Disturbance to riparian vegetation	Compatibility with planning initiatives	Reafforestation potential	Length of line	Landform instability	Flooding
A	■ ■	■ ■	■ ■ ■ ■	■	■	■ ■ ■	■	■ ■ ■ ■	■	■ ■ ■ ■ ■ ■ ■ ■
B	■ ■ ■	■	■ ■ ■	■ ■ ■ ■ ■ ■ ■ ■	■ ■ ■	■	■ ■	■ ■ ■ ■ ■ ■ ■ ■	■ ■ ■ ■ ■ ■ ■ ■	■ ■ ■ ■ ■ ■ ■ ■
C	■ ■ ■ ■ ■ ■ ■ ■	■ ■ ■	■ ■ ■ ■ ■ ■ ■ ■	■ ■	■ ■	■ ■	■ ■ ■	■ ■ ■ ■ ■ ■ ■ ■	■ ■ ■	■ ■ ■ ■ ■ ■ ■ ■
D	■ ■ ■ ■ ■ ■ ■ ■	■ ■ ■ ■ ■ ■ ■ ■	■ ■ ■ ■ ■ ■ ■ ■	■ ■ ■ ■ ■ ■ ■ ■	■ ■ ■ ■ ■ ■ ■ ■	■ ■ ■ ■ ■ ■ ■ ■	■ ■ ■ ■ ■ ■ ■ ■	■ ■ ■ ■ ■ ■ ■ ■	■ ■ ■ ■ ■ ■ ■ ■	■ ■ ■ ■ ■ ■ ■ ■
E	■ ■ ■ ■ ■ ■ ■ ■	■ ■ ■ ■ ■ ■ ■ ■	■ ■	■ ■ ■ ■ ■ ■ ■ ■	■ ■ ■ ■ ■ ■ ■ ■	■ ■ ■ ■ ■ ■ ■ ■	■ ■ ■ ■ ■ ■ ■ ■	■ ■	■ ■ ■	■ ■ ■ ■ ■ ■ ■ ■
F	■	■ ■ ■ ■ ■ ■ ■ ■	■	■ ■ ■ ■ ■ ■ ■ ■	■ ■ ■ ■ ■ ■ ■ ■	■ ■ ■ ■ ■ ■ ■ ■	■ ■ ■ ■ ■ ■ ■ ■	■	■ ■ ■ ■ ■ ■ ■ ■	■ ■ ■ ■ ■ ■ ■ ■

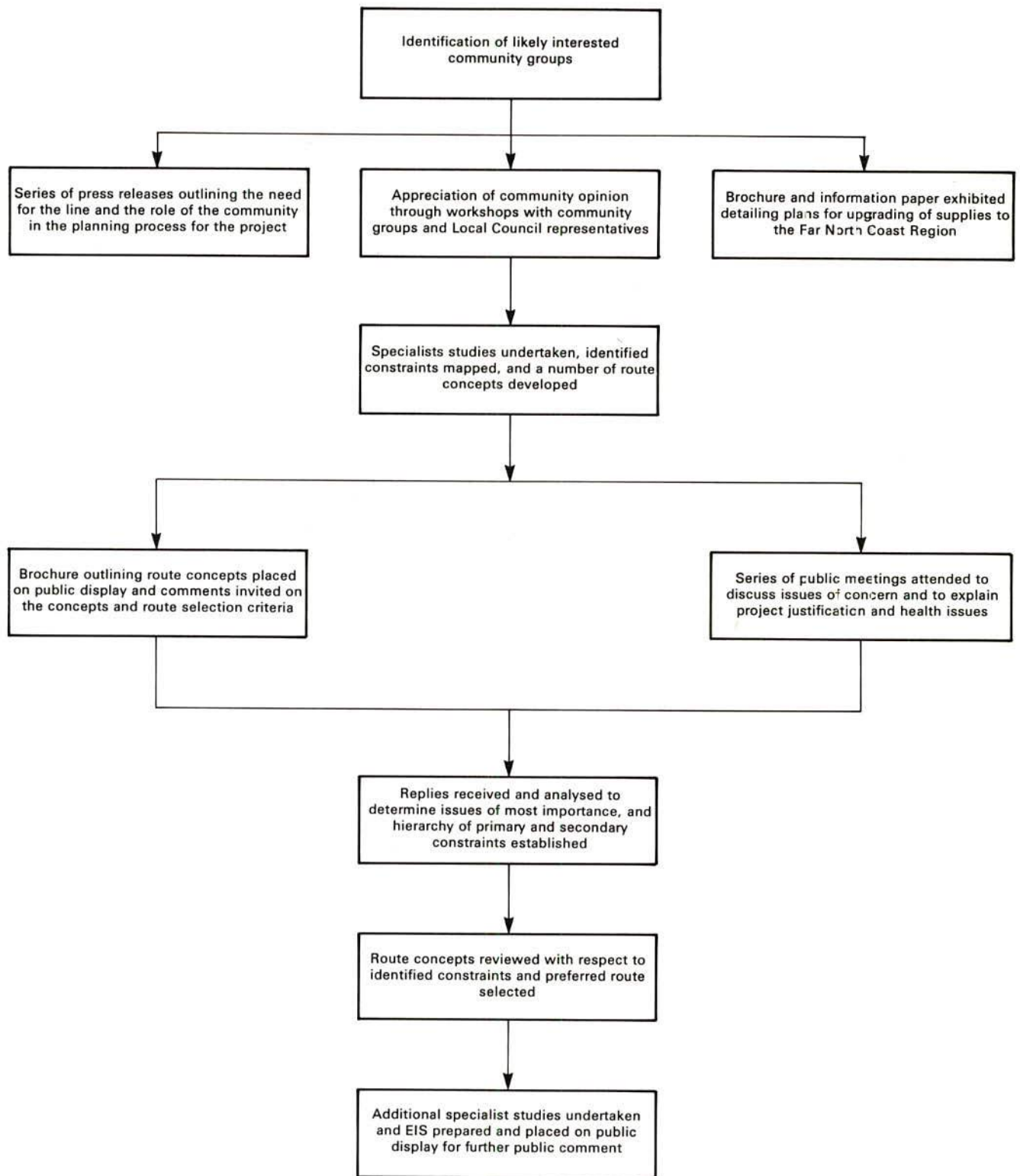
NOTE : In these tables the route concepts have been compared and ranked in relation to each of the Primary and Secondary Constraints. Rankings vary from most favoured (■ ■ ■ ■ ■ ■ ■ ■) to least favoured (■). Primary Constraint rankings have been shown in large squares (■) to indicate their relative importance when compared to the Secondary Constraint factors (■).

Table 3-4 Route Concept Comparison

Route concepts	Ranking of Route Concepts - Primary Constraints		
	Views from towns and villages	Disturbance to intense agricultural uses	Effect on undisturbed native vegetation
A	■ ■ ■ ■ ■ ■ ■ ■	■ ■ ■ ■ ■ ■ ■ ■	■
B	■	■	■ ■
C	■ ■ ■ ■ ■ ■ ■ ■	■ ■ ■ ■ ■ ■ ■ ■	■ ■ ■ ■ ■ ■ ■ ■
D	■ ■ ■ ■ ■ ■ ■ ■	■ ■ ■ ■ ■ ■ ■ ■	■ ■ ■ ■ ■ ■ ■ ■
E	■ ■ ■ ■ ■ ■ ■ ■	■ ■ ■ ■ ■ ■ ■ ■	■ ■ ■ ■ ■ ■ ■ ■
F	■ ■	■ ■ ■ ■ ■ ■ ■ ■	■ ■ ■ ■ ■ ■ ■ ■

Route concepts	Ranking of Route Concepts - Secondary Constraints									
	Visual amenity	Number of residences within 250 metres of the nominated line	Intrusion into prime quality agricultural land	Affect on disturbed vegetation	Disturbance to riparian vegetation	Compatibility with planning initiatives	Reafforestation potential	Length of line	Landform instability	Flooding
A	■ ■	■ ■	■ ■ ■ ■	■	■	■ ■ ■	■	■ ■ ■ ■	■	■ ■ ■ ■ ■ ■ ■ ■
B	■ ■ ■	■	■ ■ ■	■ ■ ■ ■ ■ ■ ■ ■	■ ■ ■	■	■ ■	■ ■ ■ ■ ■ ■ ■ ■	■ ■ ■ ■ ■ ■ ■ ■	■ ■ ■ ■ ■ ■ ■ ■
C	■ ■ ■ ■ ■ ■ ■ ■	■ ■ ■	■ ■ ■ ■ ■ ■ ■ ■	■ ■	■ ■	■ ■	■ ■ ■	■ ■ ■ ■ ■ ■ ■ ■	■ ■ ■	■ ■ ■ ■ ■ ■ ■ ■
D	■ ■ ■ ■ ■ ■ ■ ■	■ ■ ■ ■ ■ ■ ■ ■	■ ■ ■ ■ ■ ■ ■ ■	■ ■ ■ ■ ■ ■ ■ ■	■ ■ ■ ■ ■ ■ ■ ■	■ ■ ■ ■ ■ ■ ■ ■	■ ■ ■ ■ ■ ■ ■ ■	■ ■ ■ ■ ■ ■ ■ ■	■ ■ ■ ■ ■ ■ ■ ■	■ ■ ■ ■ ■ ■ ■ ■
E	■ ■ ■ ■ ■ ■ ■ ■	■ ■ ■ ■ ■ ■ ■ ■	■ ■	■ ■ ■ ■ ■ ■ ■ ■	■ ■ ■ ■ ■ ■ ■ ■	■ ■ ■ ■ ■ ■ ■ ■	■ ■ ■ ■ ■ ■ ■ ■	■ ■	■ ■ ■	■ ■ ■ ■ ■ ■ ■ ■
F	■	■ ■ ■ ■ ■ ■ ■ ■	■	■ ■ ■ ■ ■ ■ ■ ■	■ ■ ■ ■ ■ ■ ■ ■	■ ■ ■ ■ ■ ■ ■ ■	■ ■ ■ ■ ■ ■ ■ ■	■	■ ■ ■ ■ ■ ■ ■ ■	■ ■ ■ ■ ■ ■ ■ ■

NOTE : In these tables the route concepts have been compared and ranked in relation to each of the Primary and Secondary Constraints. Rankings vary from most favoured (■ ■ ■ ■ ■ ■ ■ ■) to least favoured (■). Primary Constraint rankings have been shown in large squares (■) to indicate their relative importance when compared to the Secondary Constraint factors (■).



ELECTRICITY COMMISSION OF NSW
LISMORE — MULLUMBIMBY 132kV TRANSMISSION LINE

PLANNING PROCESS

EXHIBIT 3.1



0 2 4km
Scale



LEGEND

- PRIMARY CONSTRAINTS
- PREFERRED ROUTE CONCEPT
- NOMINAL CENTRE LINE
- ALTERNATIVE ROUTE CONCEPTS
- EXISTING 66kV TRANSMISSION LINE
- STUDY AREA BOUNDARY

NOTE:
OPTION B PARALLELS THE EXISTING 66kV TRANSMISSION LINE

ELECTRICITY COMMISSION OF NSW
LISMORE — MULLUMBIMBY 132kV TRANSMISSION LINE

PRIMARY CONSTRAINTS AND
ROUTE CONCEPTS

EXHIBIT 3.2

Part B

Environmental Assessment of the Proposed Transmission Line

4. The Proposed Development

4.1 INTRODUCTION

In this part of the Environmental Impact Statement, the proposed development is described in terms of the procedures that would be used in the determination of its precise layout, its principal physical components and its route alignment (this section). Safeguards that have been incorporated into the design are described in Section 5, together with an assessment of likely environmental impacts.

4.2 DEVELOPMENT PROCEDURES

4.2.1 Determination of the Final Route Alignment

The public exhibition of this document forms the first phase of the Electricity Commission's investigation into the feasibility of the proposed development. All submissions received in response to the E.I.S. (including any advice from the Department of Environment and Planning) will be analysed and a draft report prepared. This report provides a basis for consideration by the Board of the Electricity Commission of whether or not to proceed with the development, and if so, whether to modify the proposal in any way. The report is finalised and published following the Board's decision.

Subject to a favourable decision by the Board, the final route alignment would be determined on the basis of detailed survey and landowner negotiations. Potentially affected landowners would be contacted and their preferred location for the transmission line ascertained. It is often possible to make minor variations to the route from the nominated alignment to satisfy landowner requests.

4.2.2 Easement Determination

Once the route alignment is finalised, an appropriate easement would be determined. For this development, an easement of predominantly 45 metres is required to ensure that adequate clearance is maintained between the line conductors and nearby buildings and vegetation. This width includes a consideration of the extent to which the conductors can be blown out of their normal 'still air' position by strong winds, and the increase in vertical sag of conductors that occurs on warm days, or at times when the transmission line is carrying a heavy electrical loading. However, a wider easement may be required in areas where long spans are encountered, or in other areas requiring special consideration.

Acquisition of an easement also gives the Commission the right to construct, operate and maintain the line. Access to the line and each structure may be achieved along the easement or, where practical or environmental considerations suggest it would be preferable, by right of way or other agreement, from existing roads and tracks. Lines are normally inspected for maintenance purposes some three or four times a year.

Easements are not fenced and the land within the area may be used for most farming pursuits, including grazing and cropping. However, it is necessary to restrict the erection of buildings and structures, and to ensure that all activities including the installation of any services in the vicinity of the line are carried out safely. In particular, special care is needed with cranes, harvesters, and other high machinery. Water jets produced by high pressure, cannon-type irrigation sprays can also provide a conducting path for high voltage electricity, and their usage is therefore restricted in the vicinity of the line.

4.2.3 Compensation Procedures

In acquiring easement rights the Electricity Commission pays compensation to affected landowners. Compensation for easement acquisition, and activities associated with the construction of the proposed transmission line would be assessed by a registered valuer, who would be available to discuss with landowners the basis of his or her assessment. The Commission's valuers are qualified members of the Australian Institute of Valuers and are registered to practice as valuers by the Valuers' Registration Board.

The assessment would include consideration of the highest potential use of the land, having regard to current zoning or firmly proposed future zoning. For example, if the line were to pass through an approved subdivision, compensation would reflect the value of the subdivided blocks. Similarly, if an existing horticultural plantation was to be traversed, the payment would consider the potential long-term loss of the plantation's productive capability.

Where landowners disagree with offers of compensation and wish to obtain independent valuations, they may engage a registered valuer, subject to prior approval by the Commission. Discussion will then be arranged between the two valuers and the landowner in an attempt to resolve any substantial discrepancy. When final agreement is reached the valuer's fee will be reimbursed with the settlement of compensation, provided that the Commission's policy on the payment of valuation fees is followed.

Once agreement has been reached, an advance payment of approximately 50% of the agreed compensation would generally be made when the landowner signed a consent to permit construction. Arrangements would then be made for easement survey plans to be prepared, enabling the balance of the compensation to be paid when the easement was registered on the title. The Electricity Commission would meet any reasonable legal expenses incurred by the owner in connection with the granting of the easement.

An easement would be acquired by resumption only where it proved impossible to settle the matter by negotiation, or else where complications with respect to title existed. Acquisition by resumption would not affect the owner's right to receive compensation, which in these cases would be determined by the Valuer General.

4.2.4 Easement Conditions

Transmission line safety is maintained by applying certain restrictions regarding the erection of structures or undertaking of certain activities within the easement. The following activities would normally be permitted:

- . normal agricultural pursuits, including operation of machinery not exceeding 4.3 metres in height
- . domestic recreational activities other than flying kites or model aircraft;
- . gardening activities provided vegetation did not exceed 4 metres in height (taller vegetation may be permissible on the easement in deep gullies or other specific locations)
- . parking of vehicles under 4.3 m in height
- . operation of mobile plant and equipment under 4.3 m in height
- . storage of non-flammable materials subject to a 2.5 m height limit
- . the erection of minor structures subject to a height limit of 2.5 m and the earthing of metallic parts. Minor structures would include clothes hoists, fences (excluding brick or masonry walls), barbecues, dog kennels and children's play equipment.

In situations where the transmission line conductors are significantly higher above the ground than usual (such as gullies or valleys), the height restrictions may be relaxed. Advice should be sought from the Electricity Commission if this is the case.

The following activities may be permitted subject to permission from the Electricity Commission, which might stipulate certain conditions:

- . burning off or the lighting of fires
- . operation of mobile plant or equipment exceeding 4.3 m in height
- . temporary parking of caravans and other camping vehicles
- . erection of:
 - electric fencing
 - non-electrical agricultural fencing and yards
 - metallic fencing in urban areas
 - flagpoles, weather vanes, single-post signs and outdoor lighting
 - prefabricated metal (garden) sheds under 2.5 m in height and having a floor area under 8 m²
 - outbuildings (detached garages, carports, sheds, stables, pergolas, greenhouses and tool-sheds), or unroofed verandahs and pergolas attached to residences
- . installation or use of irrigation equipment

- . installation of:
 - low voltage electricity, telephone, communications, water, sewerage or gas facilities whether overhead, underground or on the surface
 - high voltage electricity
 - swimming pools whether above or in-ground
 - tennis courts
 - sporting and recreational facilities
- . construction of:
 - roads other than access tracks
 - cycleways, walking tracks and footpaths
 - subdivisions for residential or industrial uses
- . excavation excluding ploughing
- . quarrying activities, earthworks, dam or artificial lake construction
- . mining
- . use of explosives.

The following activities are normally prohibited within the easement:

- . construction of houses or parts thereof, buildings and substantial structures other than permitted above
- . installation of fixed plant or equipment other than that permitted above
- . storage of flammable materials, corrosives or explosives
- . placing of garbage, refuse or fallen timber
- . planting of vegetation liable to grow to a height above 4 metres (in situations where this could infringe the required electrical clearances)
- . placing of obstructions other than timber boundary fences within 15 metres of any part of the transmission line structure
- . camping or permanent parking of caravans and other camping vehicles;
- . parking or storage of flammable liquid carriers or containers.

4.3 PHYSICAL COMPONENTS OF THE DEVELOPMENT

4.3.1 General

The proposed development comprises a 132 kV transmission line between the existing substation at Lismore and a new substation to be constructed at Lavertys Gap, near Mullumbimby. The transmission line would be approximately 40 kilometres long and would consist of supporting structures carrying conductors and earth wires. The supporting structures will probably use concrete poles although the economics of timber or steel poles will also be considered. As outlined in the previous section, the structures would be located within an easement predominantly 45 metres wide to permit construction, maintenance and safe operation of the transmission line.

4.3.2 Supporting Structures

Twin pole structures would be used over the majority of the line, and would support a horizontal galvanised steel crossarm. Single pole structures may be used for short sections where space is confined, where their appearance would be more compatible with the surroundings, or where the structure is sited within a floodplain. Single pole structures include two shorter galvanised steel crossarms. They result in shorter span lengths (ie distances between structures) and are less suitable in undulating terrain. Typical twin and single pole structures are shown schematically in Exhibit 4.6. A photograph of a typical concrete twin pole support structure is included as Plate 4.1. Three pole structures would be required at major changes of direction and certain other locations, and normally do not require a crossarm.

The height and spacing of structures would provide for a minimum clearance to ground of 7.5 metres from any point along the conductors when they are operating at their maximum design temperature. To achieve this requirement, the heights of pole structures above ground would vary with the terrain, but would be in the order of 16 to 21 metres, and the typical distance between structures over flat terrain would be about 280 metres. Structures at the taller end of the range would be used for the crossing of obstacles such as other power lines, telephone lines, roads, bodies of water and, where considered appropriate, to reduce the need to clear certain stands of vegetation. The Electricity Commission's specified minimum clearances, which incorporate statutory clearances, are detailed in Table 4.1.

TABLE 4.1 - SPECIFIED MINIMUM CONDUCTOR CLEARANCES

Location	Minimum Clearance (Metres)
Distance from ground in any direction	7.5
Height above 1 in 100 year flood level	6.7
Height over roads not likely to be reticulated with lower voltage power lines	
a) Main Roads	12.0
b) Council Roads and Tracks	8.0
Height over roads likely to be reticulated with lower voltage power lines	
a) Urban Roads	13.5
b) Rural Roads	12.0
Height over railway tracks	12.0
Height over existing power lines	4.0
Height over telephone lines	4.0

The poles would be guyed where the line alters direction, and in some cases to resist wind loading in long spans. Guys would normally rise at 45° to the horizontal and would be fitted with "sight sleeves" of white conduit to make them more visible near ground level. Guy anchors would normally be cast in-situ in concrete installed below ground within the easement area.

4.3.3 Conductors and Insulators

Power is transmitted through three current-carrying conductors. Each conductor would be 21 mm in diameter, comprising several layers of aluminium wire strands surrounding a core of steel wire strands.

Air provides insulation between the conductors. However, it is necessary to provide solid insulation between the current carrying conductors and their supporting structures. This is achieved by suspending each conductor from a string of about ten porcelain disc insulators, each approximately 250 mm in diameter. The insulator strings generally hang from a horizontal steel cross-arm.

Two thinner, multistrand 'earth' wires would be strung over the top of the power carrying conductors to minimise the incidence of lightning strikes reaching the power conductors and causing interruptions in power supplies. These wires are earthed by connecting them directly to the steel cross arms of the supporting structures, which are, in turn, connected to the earth by means of metal straps that penetrate deep into the ground.

4.3.4 Construction Procedures

The principal tasks that would be undertaken in the actual construction of the transmission line are provision of access, easement clearing, foundation construction, erection of support structures, stringing and tensioning the conductors, and land restoration.

Access

Access along the easement is required for clearing operations, foundation construction, structure installation and stringing the conductors, and later for maintenance requirements. Where it is necessary to construct new tracks, their location is best determined in the field during construction to take into account prevailing conditions and property owner preferences. Normal access would follow the easement or formed roads. However, where it is more convenient, and satisfactory arrangements have been made with land owners, access may be by way of existing or relocated private tracks.

Existing tracks may need some improvement to allow their use by heavy construction plant. This may involve straightening, the provision of more suitable gradients, upgraded surfacing, improved drainage and installation of appropriate erosion control measures. Trackwork may not be necessary in cleared areas on well drained and reasonably firm soils. Any work undertaken in relation to building of new access tracks, or upgrading of existing tracks, would be done in accordance with guidelines set down by the Soil Conservation Service of New South Wales. (Reference 1).

Clearing

Clearing of vegetated areas within the easement may be necessary to establish and maintain adequate electrical clearance between the transmission line conductors and earthed material (such as vegetation) and to avoid the possibility of timber falling or branches swaying close to the conductors. Another important purpose of clearing is to minimise the risk of earthing the line during the passage of wild fire when ionised gases above the burning vegetation could create a conducting path to earth.

An assessment of clearing requirements for the proposed line would be undertaken following route survey. Clearing would be kept to a minimum throughout the easement and would vary according to the type of vegetation, the terrain and landowner requests. Vegetation not infringing, and not likely to infringe on, the required electrical clearances would be retained where practicable. In flat terrain, vegetation of up to four metres in height can be retained, while in situations where the line is elevated (e.g. over valleys and gullies), trees may be able to grow to their full height without infringing required electrical clearances. In sensitive locations, such as remnant stands of native vegetation, and where the topography allows, consideration would be given to siting supporting structures to enable the stands to be spanned without clearing. In other areas, such as near residences, road crossings, prominent locations, steeply sloping land and crossing of watercourses, restricted clearing techniques would be applied, involving hand felling. In these situations, sufficient vegetation would be retained to preserve the natural appearance of the area and the soil binding benefits of vegetation. Existing identified faunal corridors would also be retained wherever possible.

Where the proposed transmission line traversed 'protected lands' and 'prescribed streams', as defined by the Soil Conservation Act, 1938 permission would be sought from the Catchment Areas Protection Board before undertaking vegetation control in accordance with the requirements of the Board. In such areas, grass or shrub cover would generally be left intact to minimize the area of exposed soil and reduce the risk of soil erosion.

Where mechanical clearing is required, it would normally be carried out by bulldozers fitted with tree pushers. This method removes the tree without leaving a stump but requires care to avoid unnecessary disturbance to the soil.

The disposal method for cleared vegetation is dependant on a range of factors including the quantities to be disposed of, seasonal conditions, and any specific landowner requirements. Where vegetation is to be disposed of by burning, it would be done in consultation with relevant local authorities and all necessary safety measures would be adopted. Rather than burning timber, the use of portable diesel-powered chippers may be considered, but their use has not in the past been found to be justified because of the cost of retaining this specialist plant on site and the additional labour required for its use.

It is likely that the amount of clearing along the proposed alignment would be quite limited. However, in sensitive areas, consideration would be given to replanting of the cleared easements with low growing native shrubs and planting native trees adjacent to supporting structures to assist in their screening. Tree and shrub planting would only be undertaken in appropriate areas and with the agreement and support of the property owner.

Foundations

Pole holes are normally excavated by boring. The depth is dependent upon the length of the pole but is in the order of 2 to 3 metres. At certain sites including termination and angle structures, preparations also include bored excavation followed by the pouring of concrete to form bases for the guy anchors. Normal excavation plant and ready-mixed concrete carriers are involved in these operations. Where hard rock is encountered, explosives are used in such a way to minimize vibration and disturbance to the surroundings. The use of explosives on the proposed development is expected to be minimal.

Track construction work will also include the levelling or benching of structure sites where this is required on steeply sloping lands. Pole structures do not require the same amount of site preparation as steel towers, but it is still necessary to provide a reasonably level pad on which a crane can work to erect poles.

Surplus excavated material from holes is spread thinly over the site. Care is taken so as not to excessively cover the topsoil as would inhibit regeneration of vegetation.

Transmission Line Erection

The poles will be delivered to the site on jinkers and erected using truck mounted lifting equipment. The crossarms and associated fittings are then bolted in place and guys attached where needed.

The overhead earthwires are strung first, as these are connected to the top of the structures. The main conductor stringing operation involves the assembly and attachment to the structure of insulator strings from which the conductors themselves are suspended. A technique known as "tension stringing" would be used. This requires that the conductor drums be mounted on braking machines and the conductor pulled out by winches using a draw wire running over sheaves hanging from the insulators. Stringing by this method results in the conductor being kept clear of the ground although a narrow strip of vegetation may be cleared through deep gullies to allow a draw wire to be raised from the ground. The stringing plant will consist of conductor delivery vehicles, braking machines and winch trucks. Stringing may be undertaken by helicopter in steep, sensitive areas.

To implement the tension stringing procedure, sites are established at intervals of about 5km along the route where conductor drums can be delivered and mounted on braking machines. Mid-way between these locations other sites are required where winching activities can be carried out.

Restoration of Disturbed Areas

During the progress of the work, areas such as embankments, structure sites, drum sites, winch sites and sections of the cleared easement, which have lost some of their natural ground cover will be treated to lessen the risk of erosion and to promote stabilising plant growth. Revegetation techniques may include loosening of ground compacted by the operation of construction plant, improving the soil quality of excavated material spread over structure sites, sowing seed and in special circumstances, planting trees and shrubs. Stabilised pre-seeded spray mulches may be used in certain steep localities. Initial sowing is carried out immediately following disturbance, preferably before the first rainfall which may seal the soil surface, as recommended by the Soil Conservation Service. There may be a need for re-seeding if vehicles or construction activities destroy the initial growth.

Revegetation procedures adopted would be in accordance with Soil Conservation Service recommendations. As mentioned previously, consideration would be given to planting cleared easements with low growing native shrubs where appropriate, and to planting suitable trees beside supporting structures for screening purposes.

As outlined earlier in this section, particular attention would be paid to the construction of access tracks to ensure adequate erosion control during and after construction. Measures to be adopted include:

- . installation of cross-banks and mitre drains on access tracks in accordance with published guidelines
- . the installation of diversion banks and drains where long slopes occur uphill of cut batters
- . where unstable drainage lines are crossed, installation of coarse gravel or rock pitched protective measures
- . installation of headwalls on culverts, and stabilisation of pipe outlet discharge points and
- . early revegetation of all disturbed areas.

4.3.5 Construction Program

Construction would be undertaken by contractors who work under the supervision of the Electricity Commission. While detailed scheduling of work would be the responsibility of the contractor, it is likely that construction would take approximately nine months in the following sequence:

- . provision of suitable access and clearing
- . laying out of pole and structure hardware along the route and 'dressing' of the poles
- . boring of the pole holes and excavation and concreting of guy anchors where required
- . erection of the poles and fitting out with hardware
- . stringing of the line.

The size of the construction workforce would be determined by the contractor but it is anticipated that the average workforce will number between five and twenty depending on what aspect of the work is being carried out. The hours of working would be the responsibility of the contractor, but could be expected to take place at any time during the hours of daylight and usually be confined to six days per week.

Accommodation for the construction workforce will be arranged by the contractor, who will probably make use of existing caravan parks. Alternatively, the contractor may elect to establish his own construction camps. The specific locations of such camps would be subject to negotiation and agreement between the contractor, land owners and the appropriate local government authority. Camps would be located in proximity to the project and on completion of works in a particular area would be removed to a new site. The vacated site would be restored to meet the requirements of the property owner and the local government authority.

Camping arrangements, if utilised, would consist of modern caravan type accommodation providing sleeping, eating and sanitary facilities as well as vehicle and plant servicing arrangements. Waste, including sanitary waste, would be disposed of in accordance with the requirements of the local Council.

The type of work to be performed would not require heavy workshop facilities on site. The contractor may, however, establish a small field depot to carry out running repairs and maintenance on his plant. The location of such depots, and the storage of the relatively small quantities of fuels and oils involved in the Contractor's day-to-day operations, would be chosen and operated so as to avoid impacts on neighbours such as through noise or water pollution.

4.4 ROUTE DESCRIPTION

4.4.1 General

In this section the proposed route of the transmission line is described in sufficient detail to allow an analysis of its potential environmental impacts in Section 5. The description in the text is supported by Exhibits 4.1 to 4.4.

The exhibits show the nominal route alignment of the transmission line currently proposed as a solid block line, embedded in a grey band of variable width. This zone is called the route bandwidth. It coincides with Route Concept D shown on Exhibit 3.2, and avoids all areas of primary constraint. The bandwidth represents the likely extent of variations from the nominal route alignment that may be incorporated in the detailed siting of the line to take account of local factors such as outbuildings, vegetation, property boundaries and factors that emerge from negotiations with property owners. Residences within the bandwidth would be avoided by the final transmission line alignment.

Primary constraints occurring within approximately two kilometres of the nominal route alignment have been mapped on Exhibits 4.1 to 4.4, as well as Category 3 vegetation (a secondary constraint) identified during detailed route investigations.

The total length of the line would be approximately 40.5 kilometres.

4.4.2 Arrangements at the Lismore Substation

The proposed transmission line will transmit power from the Lismore Substation, which is located approximately three kilometres to the west of Lismore. The substation is supplied by three 132kV transmission lines from the south.

The line will initially terminate on the northern side of the substation during its period of operation at 66 kV. This will require the construction of a new switchbay. The line will later be reterminated on the southern side when it becomes necessary to operate the line at 132 kV.

An existing 66kV transmission line to the Ewingsdale substation leaves the Lismore substation on its northern side and crosses the Leycester Creek floodplain. The alignment of the proposed transmission line would cross the floodplain to the west of the existing Northern Rivers Electricity Lismore to Mullumbimby 66 kV line.

4.4.3 Lismore to Tullera

Between Lismore and Tullera, the proposed route proceeds through Landscape Zones 1 and 2 shown in Exhibit 2.5 and described in Section 2.5.4. From the Lismore Substation, the alignment crosses cleared, improved pasture land of the Leycester Creek floodplain (Landscape Zone 1), approximately 450 metres to the west of the existing Lismore to Mullumbimby 66kV transmission line. A short length of the line in this section would be located within foreground views of several residences in South Lismore.

North of Nimbin Road, the route deviates to the north east and passes from the floodplain (Landscape Zone 1) to more elevated land (Landscape Zone 2). It crosses the existing 66kV line and follows the eastern slopes of the Boerrie Creek valley, passing through several stands of disturbed native vegetation. This alignment has been selected to minimise disturbance to the residents of Boerrie Creek and to avoid Lismore City Council's planned urban area to the east. It also avoids possible views of the line from Lismore by traversing the western slopes of the ridge which runs from Modanville to Lismore.

At a point approximately two kilometres up the Boerrie Creek valley, the route deviates to the east to pass through a saddle in the Modanville/Lismore north-south ridgeline, crossing Dunoon Road immediately south of its junction with McLeay Road. The route loses elevation sharply after crossing Dunoon Road and traverses undulating terrain at the footslopes of the Tullera plateau. The line would be located immediately to the south of steeply sloping land so that it would not be visible from residences at Tullera.

South of Tullera, and approximately one kilometre to the north west of Woodlawn College, the route turns in a north easterly direction and negotiates undulating grazing land parallel to, and approximately 900 metres to the east, of the Dunoon Road. It avoids two areas of undisturbed native vegetation sited within the bandwidth immediately to the east of Tullera, and also passes generally to the east of an area designated by Lismore City Council for future horticultural plantations, and immediately east of existing horticulture, approximately 1.7 kilometres north east of Tullera. The alignment over this section of the route has been selected to avoid the proposed line being viewed from Tullera and from existing rural residential dwellings to the north and west of Tullera, and to avoid existing horticultural plantations to the north of Tullera. The route would also avoid planned rural residential and horticultural areas to the west and north of Tullera. The deviation from the Boerrie Creek valley also means that residents adjoining Hewitt Road would not be subject to a second high voltage power line in the upper parts of the valley.

4.4.4 Tullera to Corndale

North east of Tullera, the route proceeds into the undulating land of Landscape Zone 3 and heads in a northerly direction, crossing two spurs of the Modanville/Lismore ridge system, before passing down a relatively steep slope to cross the Numulgi Creek, approximately 900 metres west of Numulgi. The route is sited to avoid several areas of disturbed native vegetation located

within the bandwidth in this length, but crosses through two dense stands of camphor laurel. A north easterly direction is then followed through steep terrain in the vicinity of the Numulgi trig station, including a crossing of a ridgeline which runs between Dunoon and Numulgi. The route passes through grazing land to the west of the trig station before crossing several tributaries of Coopers Creek. This section of the route has been sited to avoid rural residential areas adjoining Duncan Road, Fairfull Road, Cosy Camp Road and Graydon Road, areas of disturbed native vegetation to the north of Numulgi and horticultural plantations adjoining Duncan Road. The alignment avoids a landing strip near Ewing Bridge, is removed from large areas of land to the north of Numulgi designated by Lismore City Council for future rural residential and horticultural uses, and passes to the west of a Scenic Preserve area nominated by the National Trust of Australia (N.S.W.). The route also passes to the north of a small open forest remnant north of Numulgi.

After crossing Hunters Hill Road the route passes into the Coopers Creek floodplain, and traverses Corndale Road approximately 600 metres north of Ewing Bridge. The route negotiates Coopers Creek approximately 800 metres east of Corndale Road, from where it traverses a short length of higher ground, before again crossing Coopers Creek. Access to the line at this point would be required from Bailey Road. This alignment has been chosen to avoid populated areas adjoining Graydon Road and Williams Road, to minimise the length of floodplain traversed and to avoid visually exposed areas. The route is located outside the view catchment of the village of Corndale, and avoids several areas of disturbed native vegetation located within the bandwidth. It passes to the west of an exposed high point near Williams Road and crosses through a saddle in a north/south ridgeline 1.5 kilometres east of Corndale.

4.4.5 Corndale to Federal

The nominal alignment continues in a north easterly direction east of Corndale through undulating grazing land (Landscape Zone 3), avoiding heavily populated areas and several remnant stands of disturbed native vegetation within the bandwidth. At a point approximately 1.6 kilometres to the east of Rosebank, the route turns in an easterly direction to avoid a ridge system and the eastern extremity of a large horticultural plantation. Terrain in this section is undulating and the land used for grazing purposes. The bandwidth has been located to avoid several areas of undisturbed native vegetation which adjoins Coopers Creek at Beacon Dip, approximately 2.5 kilometres south-east of Rosebank. Several other areas of disturbed native vegetation and horticultural plantations to the north of south of the alignment are also avoided. The Coopers Creek floodplain is crossed at right angles approximately 1.3 kilometres west of Eureka.

The route then turns in a northerly direction crossing Eureka Road approximately one kilometre to the north west of the village of Eureka. In doing so it keeps outside view catchments from Eureka and avoids the north south ridge system which runs from Goonengerry to the south of Eureka. The route then proceeds along the eastern slopes of the Whian Creek valley, removed from a number of rural residential dwellings adjoining Eureka Road, on the western side of the Whian Creek valley. A stand of remnant rainforest with an intact canopy, located within the bandwidth approximately 0.9 kilometres north of Eureka, is avoided by the proposed alignment in this area. The route passes to the east of an exposed spur approximately 1.2 kilometres to the east of Kings Road before continuing up the Whian Creek valley and crossing Kings Road approximately 1.7 kilometres west of Federal. In this

area, the route has been sited to achieve maximum separation from rural residences adjoining Eureka Road and Kings Road in order to minimise adverse visual impacts. In doing so, the alignment traverses relatively short lengths of land designated by the Byron Shire Council for future rural residential and horticultural uses. Several dense stands of disturbed native vegetation are traversed in this section, while other areas of disturbed vegetation immediately to the south of the route's southerly crossing of Kings Road are avoided. The route avoids existing rural residential enclaves in outlying areas of Federal, and also planned rural residential areas immediately to the west and east of Federal.

4.4.6 Federal to Lavertys Gap

North of its first crossing of Kings Road the route continues in a northerly direction, through steeply undulating grazing land, before coming in relatively close proximity of the existing Lismore to Mullumbimby 66kV line at its northerly crossing of Kings Road, approximately 1.5 kilometres south east of Goonengerry. The line crosses the ridge at a lower altitude than the existing 66 kV line to avoid the prominent high ground. However, several strips of disturbed native vegetation are crossed in this length. The route passes well to the west, and out of sight, of rural residences adjoining Kings Road, between Federal and Goonengerry.

After its northerly crossing of Kings Road the route deviates to the north east to cross the Goonengerry/Eureka ridgeline at a lower altitude than the existing 66 kV line and to increase the separation from rural residences south east of Goonengerry. In doing so, it passes through relatively large stands of disturbed native vegetation south east of Donaghys Bridge but avoids a specimen of a macadamia rainforest species identified within the bandwidth. It forms a loose parallel with the existing 66 kV line, approximately one kilometre to its east, before terminating at the proposed substation site near Lavertys Gap. In this section the route passes through steeply undulating grazing land. It passes to the east of rural residences near Goonengerry and Donaghys Bridge and avoids areas of native vegetation and horticulture. Three crossings of the Wilsons River are made and a steep ridge in Landscape Zone 6 is traversed south east of Lavertys Gap in order to reach the site of the proposed Mullumbimby Substation. The line has been sited to avoid a small patch of rainforest located on the northern side of the Wilsons River, less than one kilometre to the south of the Mullumbimby Substation. Several dense stands of camphor laurel are crossed.

4.4.7 Arrangements at Proposed Mullumbimby Substation

The proposed transmission line would be initially connected to the Northern Rivers Electricity 66 kV system at the Mullumbimby Power Station at Lavertys Gap, about five kilometres south west of Mullumbimby. It would ultimately be operated at 132 kV and terminated at a new substation to be constructed on a site adjacent to the Power Station. In its approach to the site, the line would run parallel to, and immediately to the east of, the existing 66 kV line.

4.5 COST OF CONSTRUCTION

Construction of the proposed transmission line would cost approximately \$2.0 million.

4.6 ASSOCIATED INFRASTRUCTURE

The proposed Mullumbimby Substation does not form part of the development. It is programmed for construction in the mid 1990's and will be covered by a Development Application to Byron Shire Council at the appropriate time.

4.7 ENERGY STATEMENT

The New South Wales Government has adopted an Energy Policy which requires that Environmental Impact Statements for major developments include an Energy Statement. The purpose of the statement is to establish whether a proposed development will allow efficient and rational use of energy resources.

Energy will be consumed during the construction phase of the proposed transmission line in the form of liquid fuel used to power plant and equipment and through the energy used to manufacture the materials used in construction such as concrete, galvanised steel, fittings, conductors, insulators, etc.

Energy required for operational aspects of the line includes the energy consumed in line maintenance operations and energy consumed by the line itself. The fuel consumed during periodic maintenance inspections (by vehicle or helicopter) and occasional repair works is minor. Some energy will also be lost through the small fraction of the electricity transmitted which is dissipated as heat due to resistance losses. These losses are greatest when the line is most heavily loaded but will not exceed a few percent of the electricity transmitted during normal operation of the line.

The proposed transmission line will provide an increased capacity transmission circuit between Lismore and Ewingsdale. This will reduce the electrical loading on the existing (limited power carrying capacity) transmission line supplying Ewingsdale, and from 1989, Dunoon.

Associated with the commissioning of the new line will be an overall reduction in the energy losses which are incurred during the transmission of electrical power. Furthermore, when the proposed line is eventually required to operate at 132 kV, the transmission losses will be reduced to an even greater extent.

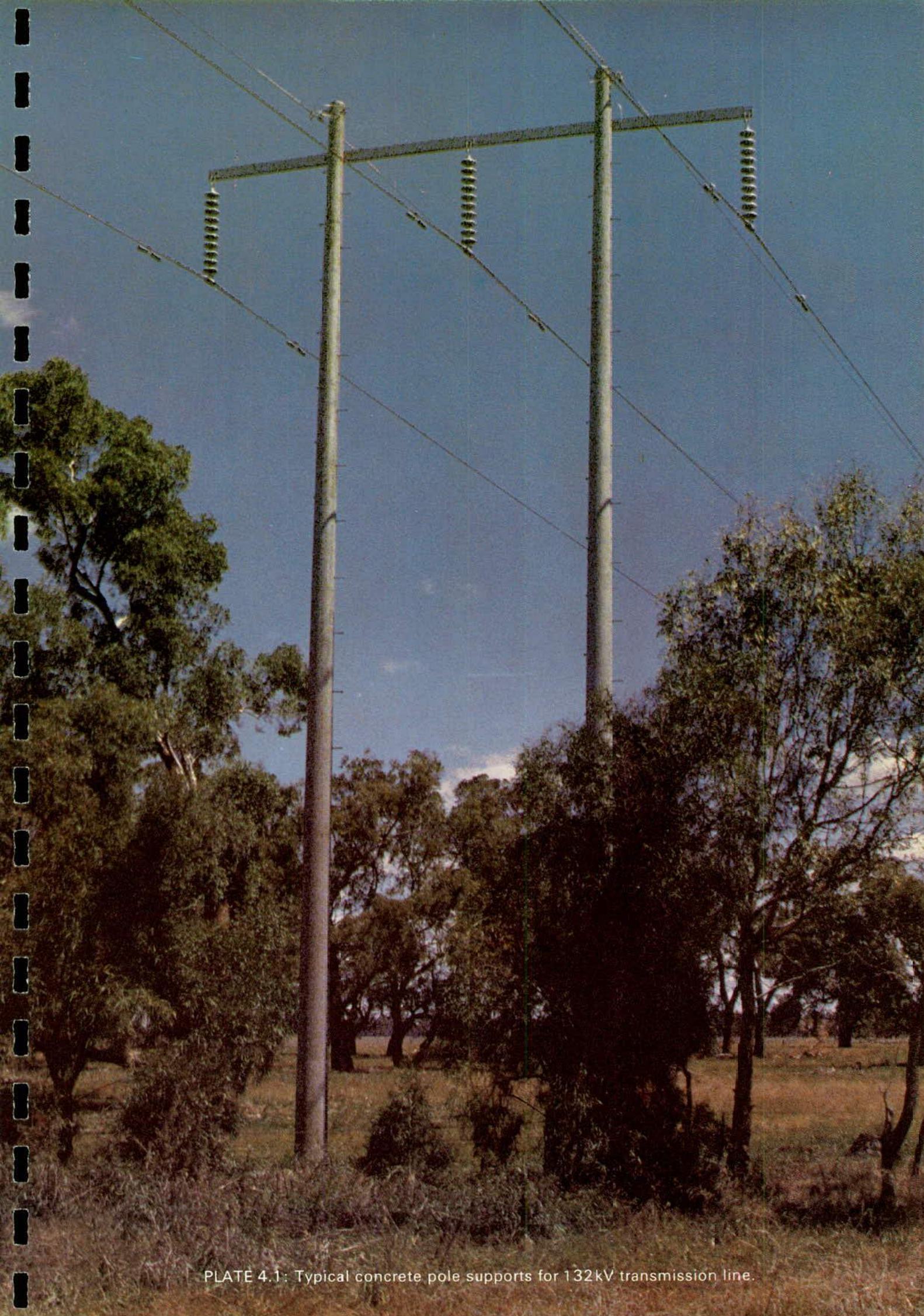


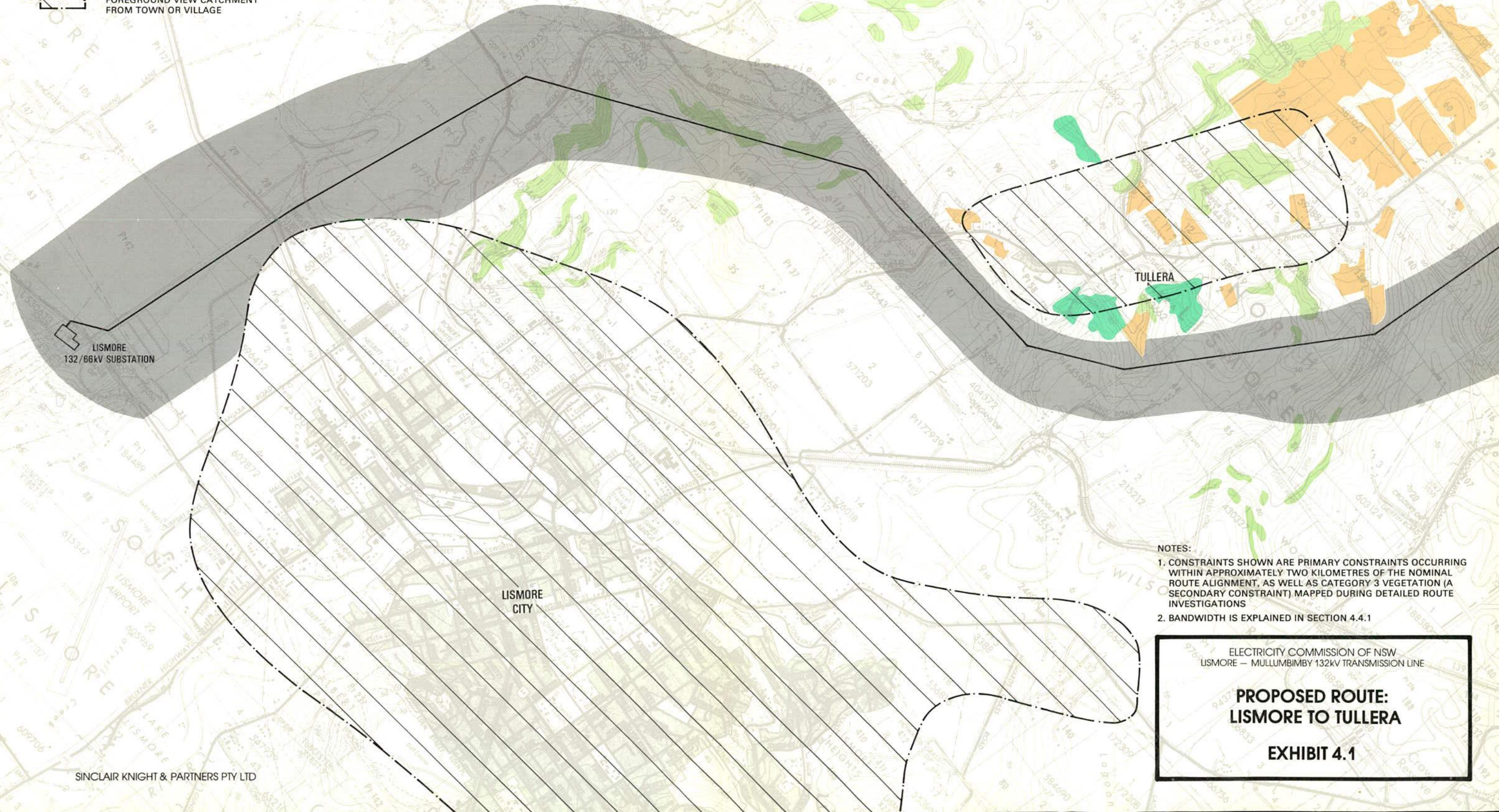
PLATE 4.1: Typical concrete pole supports for 132kV transmission line.

LEGEND

- NOMINAL ROUTE ALIGNMENT
- BANDWIDTH
- HORTICULTURE
- UNDISTURBED NATIVE VEGETATION (CATEGORY 2)
- HIGHLY DISTURBED NATIVE VEGETATION (CATEGORY 3B)
- FOREGROUND VIEW CATCHMENT FROM TOWN OR VILLAGE



0 0.5 1km
Scale



- NOTES:
1. CONSTRAINTS SHOWN ARE PRIMARY CONSTRAINTS OCCURRING WITHIN APPROXIMATELY TWO KILOMETRES OF THE NOMINAL ROUTE ALIGNMENT, AS WELL AS CATEGORY 3 VEGETATION (A SECONDARY CONSTRAINT) MAPPED DURING DETAILED ROUTE INVESTIGATIONS
 2. BANDWIDTH IS EXPLAINED IN SECTION 4.4.1

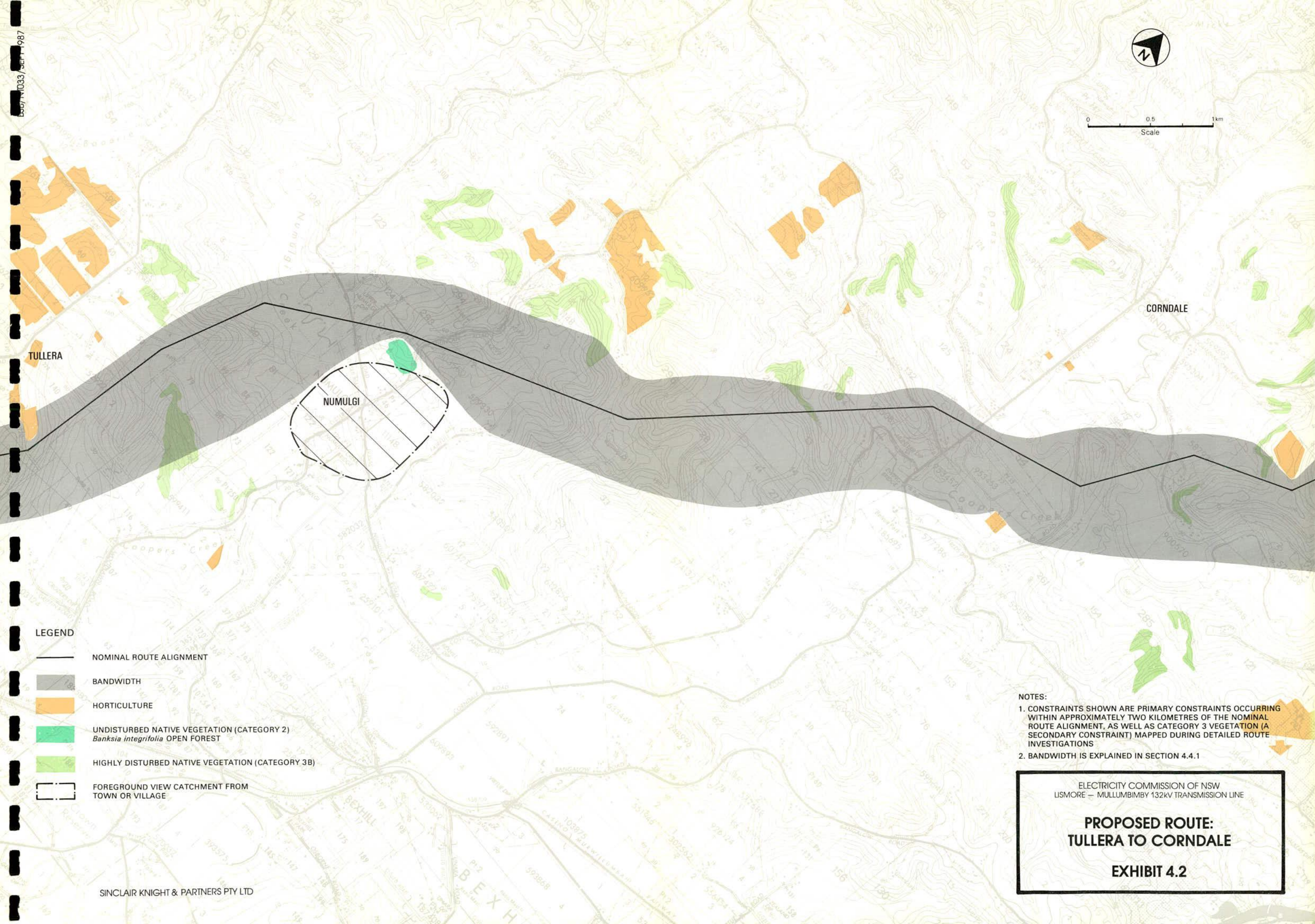
ELECTRICITY COMMISSION OF NSW
LISMORE – MULLUMBIMBY 132kV TRANSMISSION LINE

**PROPOSED ROUTE:
LISMORE TO TULLERA**

EXHIBIT 4.1



0 0.5 1km
Scale



TULLERA

NUMULGI

CORNDALE

LEGEND

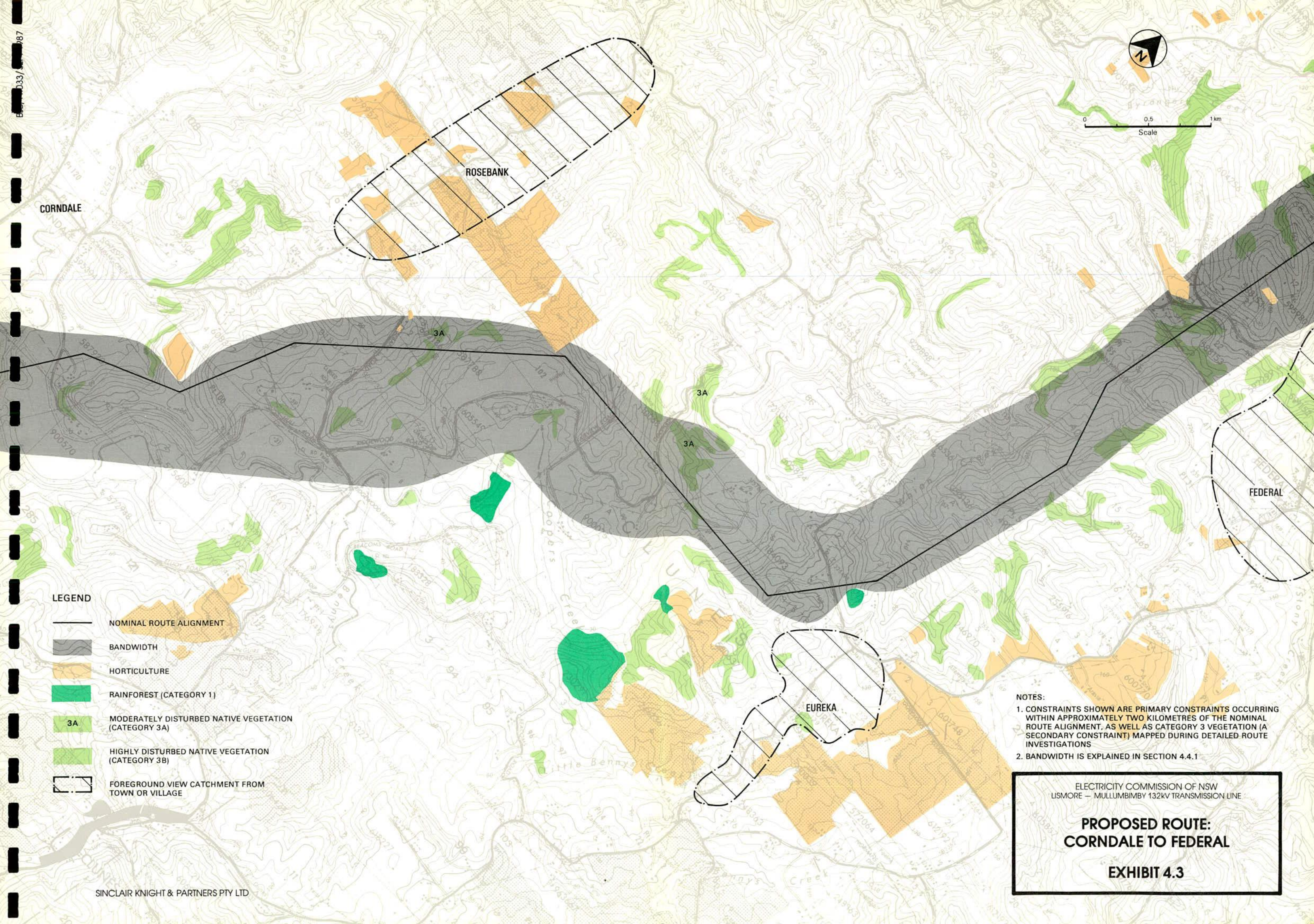
- NOMINAL ROUTE ALIGNMENT
- BANDWIDTH
- HORTICULTURE
- UNDISTURBED NATIVE VEGETATION (CATEGORY 2)
Banksia integrifolia OPEN FOREST
- HIGHLY DISTURBED NATIVE VEGETATION (CATEGORY 3B)
- FOREGROUND VIEW CATCHMENT FROM
TOWN OR VILLAGE

- NOTES:
- CONSTRAINTS SHOWN ARE PRIMARY CONSTRAINTS OCCURRING WITHIN APPROXIMATELY TWO KILOMETRES OF THE NOMINAL ROUTE ALIGNMENT, AS WELL AS CATEGORY 3 VEGETATION (A SECONDARY CONSTRAINT) MAPPED DURING DETAILED ROUTE INVESTIGATIONS
 - BANDWIDTH IS EXPLAINED IN SECTION 4.4.1

ELECTRICITY COMMISSION OF NSW
USMORE — MULLUMBIMBY 132KV TRANSMISSION LINE

**PROPOSED ROUTE:
TULLERA TO CORNDALE**

EXHIBIT 4.2



0 0.5 1 km
Scale

CORNDALE

ROSEBANK

3A

3A

3A

FEDERAL

EUREKA

LEGEND

- NOMINAL ROUTE ALIGNMENT
- BANDWIDTH
- HORTICULTURE
- RAINFOREST (CATEGORY 1)
- 3A MODERATELY DISTURBED NATIVE VEGETATION (CATEGORY 3A)
- HIGHLY DISTURBED NATIVE VEGETATION (CATEGORY 3B)
- FOREGROUND VIEW CATCHMENT FROM TOWN OR VILLAGE

- NOTES:
1. CONSTRAINTS SHOWN ARE PRIMARY CONSTRAINTS OCCURRING WITHIN APPROXIMATELY TWO KILOMETRES OF THE NOMINAL ROUTE ALIGNMENT, AS WELL AS CATEGORY 3 VEGETATION (A SECONDARY CONSTRAINT) MAPPED DURING DETAILED ROUTE INVESTIGATIONS
 2. BANDWIDTH IS EXPLAINED IN SECTION 4.4.1

ELECTRICITY COMMISSION OF NSW
USMORE — MULLUMBIMBY 132KV TRANSMISSION LINE

PROPOSED ROUTE:
CORNDALE TO FEDERAL

EXHIBIT 4.3



0 0.5 1km
Scale

GOONENGERRY

LAVERTYS GAP

FEDERAL

LEGEND

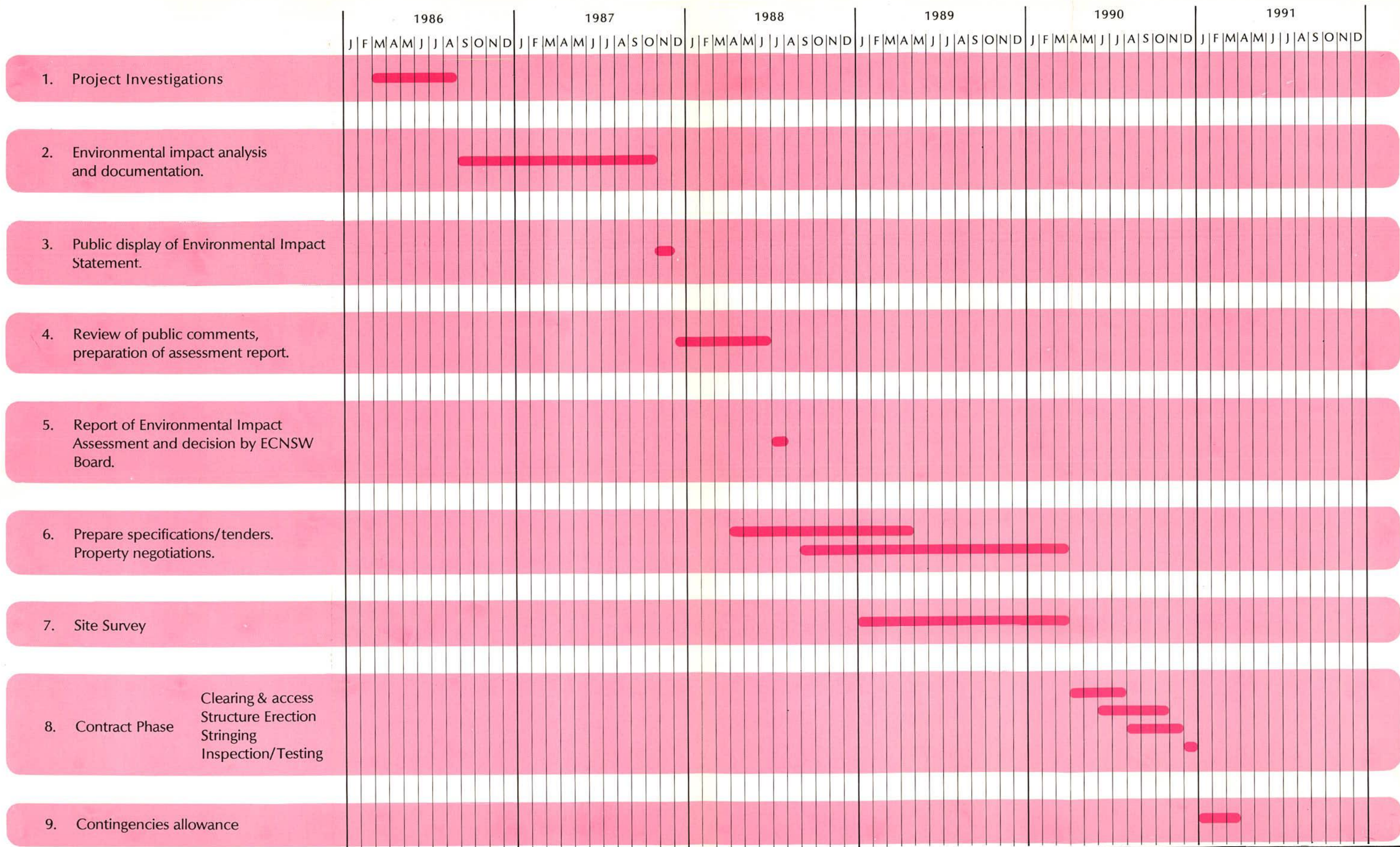
- NOMINAL ROUTE ALIGNMENT
- BANDWIDTH
- HORTICULTURE
- RAINFOREST (CATEGORY 1)
- UNDISTURBED NATIVE VEGETATION (CATEGORY 2)
- 3A MODERATELY DISTURBED NATIVE VEGETATION (CATEGORY 3A)
- 80 HIGHLY DISTURBED NATIVE VEGETATION (CATEGORY 3B)
- FOREGROUND VIEW CATCHMENT FROM TOWN OR VILLAGE

- NOTES:
1. CONSTRAINTS SHOWN ARE PRIMARY CONSTRAINTS OCCURRING WITHIN APPROXIMATELY TWO KILOMETRES OF THE NOMINAL ROUTE ALIGNMENT, AS WELL AS CATEGORY 3 VEGETATION (A SECONDARY CONSTRAINT) MAPPED DURING DETAILED ROUTE INVESTIGATIONS
 2. BANDWIDTH IS EXPLAINED IN SECTION 4.4.1

ELECTRICITY COMMISSION OF NSW
LISMORE – MULLUMBIMBY 132KV TRANSMISSION LINE

**PROPOSED ROUTE:
FEDERAL TO LAVERTYS GAP**

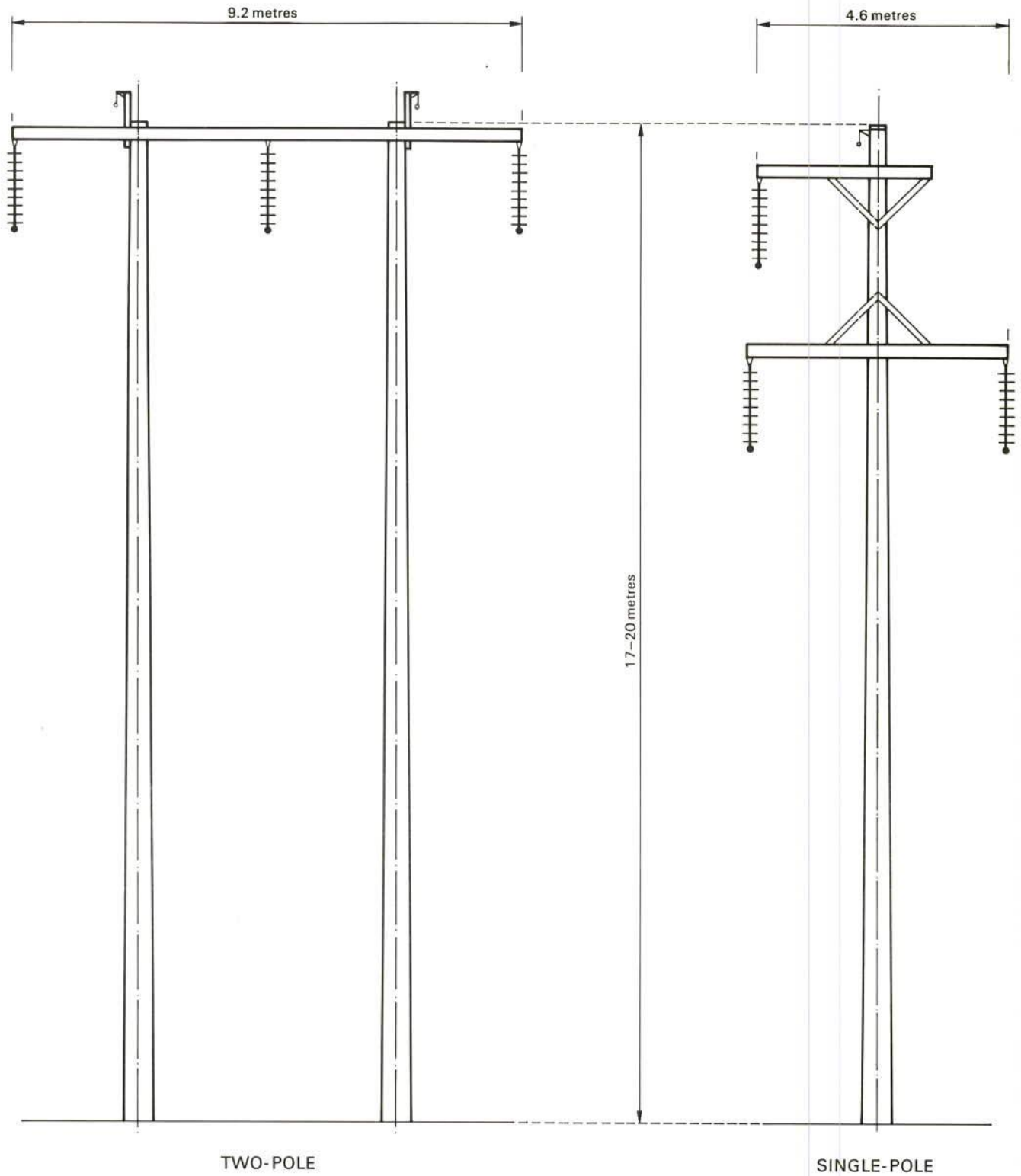
EXHIBIT 4.4



ELECTRICITY COMMISSION OF NSW
LISMORE — MULLUMBIMBY 132kV TRANSMISSION LINE

DEVELOPMENT PROGRAM

EXHIBIT 4.5



ELECTRICITY COMMISSION OF NSW
USMORE — MULLUMBIMBY 132kV TRANSMISSION LINE

TYPICAL 132kV SUSPENSION STRUCTURES

EXHIBIT 4.6

5. Environmental Safeguards and Impacts

5.1 INTRODUCTION

This section evaluates the potential environmental consequences of constructing the proposed transmission line shown in Exhibits 4.1 to 4.4 and described in Section 4. Although the proposed transmission line would require an easement predominantly 45 metres wide, the potential environmental impacts of the line are assessed over a bandwidth generally about one kilometre wide, to allow for the possibility of the nominated alignment being shifted to take account of local factors such as outbuildings, vegetation, property boundaries and factors that emerge from negotiations with property owners. The bandwidth represents the most likely area within which the transmission line would be located. As explained in Section 4, it coincides with Route Concept D shown in Exhibit 3.2, and avoids areas of primary constraint.

The evaluation is carried out with respect to the primary and secondary constraints identified during the Route Selection Phase of the study (see Section 3), and other factors requiring consideration for compliance with the Environmental Planning and Assessment Act, 1979, as amended. Where a potentially significant impact is identified, the particular safeguards which have been incorporated into the location or design of the line, or which would be observed during the construction phase, are specified. Detailed environmental assessment has been undertaken for a nominal alignment of the transmission line, and its associated bandwidth, as described in Section 4.

The section begins with a description of the relevant statutory planning considerations, and then considers potential visual impacts, agricultural effects and disturbance to vegetation and wildlife. This is followed by an analysis of potential impacts on residential amenity, including a discussion of safeguards to be adopted to control visual impacts at individual properties, easement acquisition and compensation procedures, safety issues, perceived health effects and noise and air quality impacts. Other land use impacts are then evaluated and engineering considerations such as flooding, water quality, land stability, soil erosion and utilisation of extractive resources analysed. The section concludes with a consideration of heritage and archaeological impacts, and the route's compatibility with Local Government planning initiatives.

5.2 STATUTORY PLANNING CONTROLS

The route of the proposed development passes through land administered by Lismore City and Byron Shire Councils. All of the existing and proposed land use zonings in either the current or draft Local Environmental Plans (see Section 2.5.2 for details) of both local government areas permit development of the proposed transmission line. In all cases, the application of State Environmental Planning Policy No. 4 (development without consent) would enable the Electricity Commission to determine the development and, subject to a positive determination, construct and operate the line.

5.3 VISUAL IMPACTS

5.3.1 Assessment Criteria

In assessing the visual impact of the proposal, a strip of land two kilometres wide on each side of the nominal route alignment has been examined. This width was selected on the basis that, under average light conditions and with an unimpeded view of the proposed line, the supporting structures and conductors would be difficult to perceive from beyond a distance of two kilometres, even to an observer who was aware of the position of the line.

Areas of high visual sensitivity (as defined in Section 2.5.4) have been mapped on Exhibits 2.6 and 2.7. They comprise foreground view catchments of towns and villages (a primary constraint) and foreground view catchments of rural dwelling clusters, scenic preserves, lookouts and roads with major scenic destinations, ridgelines and areas of dense vegetation (secondary constraints).

5.3.2 Safeguards

Visual impacts have been minimised by avoiding view catchments from towns and villages (a primary constraint) and minimising intrusion into the other areas of high visual sensitivity described in Section 5.3.1 (secondary constraints).

As well as avoiding areas of primary constraint shown on Exhibit 3.2, the line avoids the scenic preserve area nominated by the National Trust of Australia (NSW) between Bangalow and Lismore, and view catchments of roads (i.e. Rocky Creek Dam Road, Nightcap Range Road and Upper Coopers Creek Road) with scenic destinations within the Nightcap Range such as Rocky Creek Dam and Minyon Falls.

The proposed line would also minimise crossings of visually prominent ridgelines and stands of dense vegetation. Where dense vegetation is required to be crossed, impacts would be minimised through judicious placing of structure supports, preservation of existing vegetation or, by replanting the easement with low growing native shrubs.

5.3.3 Assessment of Impacts

Visual impacts of the proposed transmission line are assessed by considering it in the context of the criteria outlined in Section 5.3.1. The discussion primarily concentrates on the visual accessibility of the line, view distance and view angle. No account can be taken in such a discussion of the high visual absorption characteristics of much of the land in the area due to the mosaic of texture and colour contrasts created by different vegetation types and land uses. As a general observation this local characteristic will do much to visually absorb both the supporting structures and conductors.

Foreground View Catchments of Towns and Villages

As shown in Exhibits 4.1 to 4.4, the nominal alignment and bandwidth of the proposed transmission line adjoins areas of high visual sensitivity at South Lismore, Tullera, Numulgi, Federal and Goonengerry.

At South Lismore, the alignment crosses the Leycester Creek floodplain approximately 500 metres from the nearest residences. Construction of the transmission line would not result in a significant impairment of the visual environment for these residences due to the low surrounding topographic relief and the presence of the existing Lismore to Mullumbimby 66kV line between the proposed line and the residences. The line has been sited along a property boundary in order to avoid passing over adjoining improved pastures.

The proposed transmission line also passes in relatively close proximity to the villages of Tullera and Numulgi. The line passes less than 500 metres to the south of Tullera. However, topographical and vegetation features at this location would combine to screen the line from the view of residences adjoining Dunoon Road.

At Numulgi, intermittent ribbon development occurs along Duncan Road, north of its intersection with Ross Road, with the northernmost residence within the village precinct being approximately 500 metres from the proposed alignment. A pocket of vegetation to the north of the village would assist in screening the line from the village and only the northernmost residences would have views of the line. These views are oblique and partially screened by scattered vegetation which would lessen adverse impact.

Topographical and vegetation features combine to shield the line from view from residences at Federal and Goonengerry. The line would also pass through several other areas of high visual sensitivity (although not sufficiently sensitive to constitute a primary constraint on route location). These comprise areas within the foreground view catchments of rural dwelling clusters, ridgelines, and areas of dense vegetation, as follows:

Rural Dwelling Clusters

For the purposes of this study, rural dwelling clusters have been defined as concentrations of five or more residences in an area of about 20 hectares or less. Clusters which would be within view of the line occur at Hewitt Road (west of Tullera), two areas on Kings Road (north of Eureka and north of Federal), one on Jarrets Road (south east of Goonengerry), and an area near Donaghys Bridge (west of Montecollum).

Impacts at each of these locations are expected to be as follows:

- Hewitt Road, west of Tullera - there is a cluster of rural dwellings adjoining Hewitt Road in the Boerrie Creek valley, west of Tullera. The residences are generally located on the eastern side of the valley, with their principal aspect comprising views down the hillslope to Boerrie Creek. The transmission line would be located approximately 800 metres upslope from the houses, in the opposite direction to their main views.

The existing Lismore to Mullumbimby 66kV line is sited in this valley, as well as another N.R.E. sub-transmission line. Both of these lines are located in proximity to Hewitt Road. A potential cumulative impact arises but this would be minimised by the siting of the proposed line up the valley sideslopes, away from the existing lines. In addition, the line deviates from the valley at the earliest practicable opportunity, well before it reaches its narrowest point and away from the majority of Boerrie Creek residences.

Kings Road, north of Eureka and north of Federal - the residences in the more southerly of the clusters adjoining Kings Road are situated on a plateau and have extensive views in most directions. The line would be approximately 1.4 kilometres from these houses. There are several valleys between the cluster and the line and the line would constitute an insignificant element in the landscape.

The northerly rural dwelling cluster on Kings Road north west of Federal is located on a ridgeline with extensive views to the west. The proposed transmission line would be within view of several of these residences. However, separation of the line from the residences (approximately 800 metres) and intervening vegetation means that there would be only a marginal impairment of existing visual amenity.

Jarrets Road, south east of Goonengerry - principal views from residences in this area are generally in an easterly direction. The line would be downslope in this direction, removed by approximately 500 metres. Potential visual impacts would be reduced by a background of riparian vegetation. Another rural dwelling cluster located within the bandwidth is located to the west of the Jarrets Road cluster south of Goonengerry. These residences are approximately 1.5 kilometres from the line and would only have glimpses of the line.

Donaghys Bridge, west of Montecollum - residences at this location are located in an enclosed, vegetated valley. Views of the proposed line to the east would be interrupted by vegetation. The existing 66kV line, which is sited between the residences and the proposed line, would tend to be the more intrusive visual element and reduce the significance of the proposed development.

In summary, the primary control on visual impacts on rural dwelling clusters was to locate the transmission line so as to avoid the majority of these areas. In consequence, a comparatively small number of rural dwellings would have visual access to the line and for the majority of these, view distance, background features and vegetation screening individually or together would help restrict the scale of residual impact.

Ridgelines

The proposed transmission line would cross six ridges, considered to be locations of high visual sensitivity, as follows:

- . the Modanville/Lismore ridgeline - this ridgeline would be crossed at right angles to the south of Tullera, immediately south of the junction of Dunoon Road and McLeay Road. The proposed crossing is sited in a saddle in the ridgeline, well screened from Dunoon Road and adjoining residences by topography and vegetation. The crossing of the ridgeline at this point would minimise views of the line from residences near Tullera.
- . spurs of the Modanville/Lismore ridgeline - two spurs of this ridgeline would be crossed between Tullera and Numulgi. However, these crossings would not occur at exposed locations and are removed from residential areas.
- . the Dunoon/Numulgi ridgeline - this ridgeline is crossed in the vicinity of the Numulgi trig-station. The crossing would be sited in a saddle of the ridgeline, approximately 20 metres below the elevation of the trig station. Topographical features would shield it from most nearby residences, although views of the line would be possible from a residence located in a north-westerly direction, approximately 500 metres away. The intervening distance would assist to moderate the impact.
- . a ridgeline 1.5 kilometres east of Corndale - the nominal alignment would pass through a saddle in a local ridgeline of relatively low elevation at this location. There are no nearby residences.
- . a ridgeline 1.5 kilometres south east of Rosebank - another high point is crossed near the Clunes/Rosebank Road. It is not in a prominent location.
- . the Goonengerry/Eureka ridgeline - the footslopes of this relatively elevated ridgeline are crossed near Jarrets Road, approximately 1.2 kilometres south east of Goonengerry. The line would be visible from several residences located on the ridgeline in Jarrets Road but it has been sited to achieve maximum separation from these residences, and from residences at Goonengerry.
- . a ridgeline formed by the escarpment of the Mount Warning caldera - this ridgeline must necessarily be crossed by any transmission line to Lavertys Gap. Considerable attention was paid to locating an acceptable crossing point because of the substantial concentration of dwellings occurring along the length of the escarpment. The nominated crossing point is located within 500 metres of three residences, two to the west and one to the east. It has been selected to achieve maximum separation from each of these residences.

It is inevitable that some ridgelines must be crossed, given the nature of the terrain. The number of crossings has been minimised and at all crossings the crossing point was carefully selected to maximise separation from residences and other generally accessible public places. Possibly the most sensitive location occurs at the crossing of the caldera escarpment immediately south of Lavertys Gap.

Dense Vegetation

The alignment of the proposed transmission line has been sited to avoid significant stands of native vegetation to reduce both ecological impacts and visual impacts due to easement clearing. However, relatively isolated stands of dense vegetation would be crossed by the proposed transmission line at the locations shown on Exhibits 4.1 to 4.4. None of these locations would be visible from towns, villages or rural residential concentrations. In addition, restricted clearing techniques would be incorporated where native vegetation stands are crossed. Adverse visual impact potential at these locations is assessed as being low.

Scenic Preserves

The proposed transmission line would be located well to the west of the scenic preserve area nominated by the National Trust between Bangalow and Lismore and will not be visible from it.

Roads with Major Scenic Destinations

The proposed transmission line would not be located within the view catchments of roads with major scenic destinations, identified in this study as Rocky Creek Dam Road, Nightcap Range Road and Upper Coopers Creek Road. It is also removed from the Coolamon Scenic Drive.

5.4 AGRICULTURAL IMPACTS

5.4.1 Assessment Criteria

An assessment of agricultural impacts requires a consideration of farming uses within the bandwidth and an evaluation of the effect that construction of the line would have on the particular activity undertaken.

5.4.2 Safeguards

The principal agricultural activities carried out in the study area are cropping, grazing, dairying and horticulture. Of these, horticulture has the potential to be most adversely affected by a transmission line. The principal horticultural plantations grown in the area comprise macadamia nut trees and avocados, both of which grow to a mature height of between 8 and 12 metres or more. This height substantially exceeds the minimum clearance requirement for the safe operation of 132kV lines. As discussed in Section 4.2.4, trees growing within the easement would require lopping generally to below four metres except in gullies. Location of a transmission line in a horticultural plantation would require continual lopping of trees with a consequent limitation on their productivity.

This limitation was considered in the adoption of horticultural plantations as a primary constraint to route location as discussed in Section 3. The proposed alignment of the transmission line has been selected to avoid existing horticultural areas and their windbreaks.

Areas designated for future horticulture use have also been mapped (see Exhibit 2.4). The alignment of the proposed transmission line has been selected to minimise intrusion into these areas.

5.4.3 Assessment of Impacts

Impact on Existing Horticulture

As shown in Exhibit 3.2, the bandwidth is located outside all existing plantations and hence there will be no impact on existing horticultural operations due to the proposed development. Possible impacts to potential horticultural areas are discussed in Section 5.12.

Impact on Other Existing Agricultural Land Use

The proposed transmission line would traverse other areas of prime quality dairying, grazing and cropping land as shown in Exhibit 2.2. The completed transmission line would not significantly affect these activities, nor cause any measurable decline in agricultural productivity for the following reasons:

- . the easement would not be fenced and cropping, grazing and dairying activities could continue to be undertaken within the easement;
- . the area alienated by the bases of the supporting structures is very small compared with the total area of arable land within the easement (less than one percent);
- . very few access tracks would be required for construction and maintenance of the line in agricultural areas due to the generally favourable terrain and ground cover;
- . the operation of the line would have no adverse effect on the behaviour, health or productivity of livestock, as has been confirmed over a long period of observation of the behaviour of animals under or near existing lines.
- . land under the line could continue to be cultivated by mechanical means, (provided that farm machinery was less than 4.3 metres high), and crop production would not be affected.
- . maintenance personnel would only need to access the line infrequently and their activities would not interfere with stock or pasture management.

There will be a slight impact during the construction phase due to the movement of vehicles, construction workers and associated machinery along the easement. This would result in very minor and temporary losses of pasture production and there may be some inconvenience to grazing and dairying activities if landowners chose to temporarily relocate stock into paddocks away from construction areas.

Aerial agriculture (crop dusting, spraying etc) is an important component of farm management techniques in the region. The avoidance of banana and macadamia plantations would mean that aerial agriculture activities generally could be continued, although some rearrangement of flight patterns may be required in locations where plantations would adjoin, or be in close proximity, to the transmission line easement. Some rearrangement of flight patterns may also be required where grazing properties are traversed. Affected landowners will be consulted during the detailed design phase of the project to determine aerial agriculture requirements.

5.5 VEGETATION AND WILDLIFE

5.5.1 Assessment Criteria

A feature of the study area is that it once supported the 'Big Scrub', an almost continuous stand of lowland sub-tropical rainforest. While the forests of the rugged Nightcap Range are generally intact, the plateau area has been extensively modified since European settlement, so that now only remnant stands of native vegetation remain.

Nonetheless, a variety of habitats, comprising rainforest, dry forest, woodland, riparian corridors, cleared land, escarpment and wetlands occur in the study area. The dry forest supports a wide range of wildlife species while the rainforest and wetland habitats support a limited number of species, although a high proportion are of conservation importance. Rainforest communities, however, have a high floristic diversity and provide habitat for a large number of rare and endangered plant species.

It was ascertained during the route location phase of this study that the local community places a high value on the conservation of both forested areas and remnant stands of native vegetation. Such areas were considered as a constraint to transmission line location during the selection of the proposed transmission line alignment (see Section 3), and a broad-scale vegetation survey was undertaken to determine vegetation types in the locality. As a result of this and other studies a preferred route concept was selected. A more detailed vegetation survey was then carried out over the bandwidth of the proposed transmission line to identify significant plant species and communities likely to be affected by the proposal. Results of this survey are included in Appendix E.

An assessment of potential vegetation and wildlife impacts of the proposed transmission line requires consideration of stands of native vegetation, rare and endangered plants, wildlife habitats, riparian corridors and the reforestation potential of land within the bandwidth of the line.

5.5.2 Safeguards

Rainforest areas have a high conservation value due to their ecological significance and value as wildlife habitat, and the importance placed on them by the local community. They were considered as posing an absolute constraint on transmission line location. Rainforest areas within the Nightcap Range were therefore excluded from consideration of possible route alignments.

Remnant stands of rainforest and undisturbed native vegetation were considered as a primary constraint on route location due to their relative scarcity in the plateau region, and the route concepts were developed to avoid such areas. The bandwidth of the proposed transmission line is generally removed from stands of undisturbed native vegetation.

In addition, stands of disturbed native vegetation were considered to form a secondary constraint to transmission line location as they may contain populations of rare and endangered plant species. Intrusion of the bandwidth into these areas has been minimized, where possible.

5.5.3 Assessment of Impacts

Native vegetation occurring within the bandwidth of the proposed transmission line consists predominantly of small, remnant patches of disturbed rainforest. Other vegetation types occurring are regrowth forests dominated by Brush Box (Lophostemon confertus) and a small area of Banksia integrifolia open forest.

Rainforest Remnants

All areas of remnant rainforest vegetation within the bandwidth of the proposed transmission line have been disturbed to some degree. However, a detailed field survey carried out within the bandwidth (see Appendix E for details) has found that two rainforest remnants are in sufficiently good condition to map as Category 1 vegetation. These occur about one kilometre north of the village of Eureka and approximately 750 metres south of the site of the proposed Mullumbimby Substation, north of the Wilsons River. The proposed route has been sited to avoid these stands.

Common species in these stands vary but include White Booyong (Argyrodendron trifoliatum), Cudgerie (Flindersia schottiana), Hairy Rosewood (Dysoxylum rufum), Yellow Carabeen (Sloanea woollsii), Sandpaper Fig (Ficus coronata), White Bolly Gum (Neolitsea dealbata) and Black Bean (Castanospermum australe). Common vines are Lawyer Cane (Calamus muelleri), Sarcopetalum harveyanum, Ripogonum discolor, Parsonsia fulva, and Native Wisteria (Millettia megasperma). Ferns may be locally abundant with common species being Bird's Nest Fern (Asplenium australasicum), Tree Ferns (Cyathea spp.), Shiny Shield Fern (Lastreopsis acuminata) and Rough Maidenhair (Adiantum hispidulum).

These areas have relatively low amounts of weed invasion due to good canopy cover but weeds may be prevalent in gaps and along margins. Major weed species are Camphor Laurel, Lantana (Lantana camara), Crofton Weed (Asgeratina adenophora), Mist-flower (A. riparia) and Wild Tobacco (Solanum mauritianum).

Rainforest remnants within the bandwidth which are moderately disturbed have been mapped as Category 3A on Exhibits 4.1 to 4.4. These stands exhibit moderate levels of infestation by exotic plants. A small area of Category 3A vegetation would be crossed north of Risleys Hill Road, between Federal and Goonengerry. Structures would be sited to minimise disturbance to vegetation at this location. However, required clearing would not constitute a significant adverse impact provided that adequate attention is paid to the control of weed infestation following site disturbance. This may be achieved through rapid revegetation of these areas but some follow up weed control may also be necessary. Other Category 3A stands that occur within the bandwidth, but which are not crossed by the proposed route alignment, are located near Coopers Creek, between Rosebank and Eureka.

All other Category 3 vegetation mapped is highly disturbed and has been mapped as Category 3B on Exhibits 4.1 to 4.4. These comprise rainforest remnants and regrowth areas occurring in more accessible areas. Camphor Laurel dominates the vegetation forming between 50% and 100% of canopy cover.

Large-leaved Privet also occurs in many areas. Native species present vary according to the stage of regrowth and extent of weed invasion. The most common are Red Kamala (Mallotus philippensis) and Blackwood (Acacia mebanoxylon). The proposed alignment crosses through about eleven of these stands. Measures would be adopted to minimize clearing at these locations, however these stands are not of conservation or ecological significance. Similarly, the impact of the development will not be of significance.

Regrowth Sclerophyll Forests

Small areas of sclerophyll forest dominated by Brush Box also occur along the proposed route. These stands are generally regrowth vegetation following past clearing and/or fire. They are highly disturbed with Camphor Laurel being common and have been mapped as Category 3B on Exhibits 4.1 to 4.4. The understorey is generally sparse with rainforest species, weeds and tick bush (Helichrysum diosmifolium) commonly occurring. Disturbance to these stands would not constitute a significant adverse impact.

Rare and Endangered Plants

Two species currently listed as rare and endangered have been identified within the bandwidth of the proposed transmission line. Both species, Endiandra hayesii and Macadamia tetraphylla, are classed as vulnerable with relatively small ranges.

- Endiandra hayesii is located in the small patch of rainforest on the northern side of the Wilsons River described previously. The alignment is located to the east of the rainforest remnant ensure the maintenance of the habitat of this species.
- Macadamia tetraphylla occurs as a single seedling one metre high with a number of other rainforest tree species within pasture about 2.5 kilometres south of the Mullumbimby Power Station. This specimen is located to the west of the proposed transmission line and would not be disturbed by any clearing required within the easement.

Open Forest

A small area of Banksia integrifolia open forest occurs within the bandwidth on a south-facing hillside approximately 500 metres north of Numulgi. The understorey consists of Bracken Fern (Pteridium esculentum) and Bladey Grass (Imperata cylindrica). This community has been mapped on Exhibits 4.1 to 4.4 as Category 2. Although Camphor Laurel is common among the canopy and saplings, the open forest represents an unusual vegetation type in the region and warrants preservation. The nominal alignment skirts around the northern edge of this stand and construction of the line would not disturb the forest area.

In this area the nominal alignment would not be altered in either a southerly or easterly direction unless it could be assured that line clearance requirements would be maintained without the need to clear the vegetation.

Reafforestation Potential

Areas of prime suitability for reafforestation include steep areas surrounding remnant vegetation stands near the Nightcap Range. The proposed route is well removed from these areas.

The transmission line will not adversely affect reafforestation plans in the region.

Wildlife and Riparian Vegetation

In general it can be expected that the better the condition of a forest stand the greater habitat value it will have. This is particularly true of the rainforest remnants where better condition implies greater structural and floristic diversity than disturbed stands. The proposed line will bypass rainforest remnants in good condition and hence there will be no attendant adverse impact on wildlife conservation values in these areas.

Disturbed stands may attain greater value than would otherwise be the case where they provide a corridor for wildlife movement, particularly in riparian situations. The riparian stands along the route are generally of low value from a plant conservation viewpoint due to the high incidence of exotic weeds. This includes stands along the Wilsons River north of Federal. Consequently, they do not constitute a substantial ecological resource.

Potential effects on riparian vegetation will not be significant, in terms of wildlife conservation.

5.6 RESIDENTIAL AMENITY

5.6.1 Assessment Criteria

Community consultation undertaken during the route location phase of the study revealed a strong desire for the proposed transmission line to be removed from population centres and individual residences. Reasons cited by the community included perceived deterioration of the visual environment, safety issues, perceived health effects, reduction in property values and concern over the adequacy of compensation payments. Other factors to be considered with regard to residential amenity include easement conditions and potential noise and air pollution impacts. Each of these issues is considered in succeeding sections.

5.6.2 Safeguards

Safeguards were incorporated into the route selection process as follows:

Visual Impacts

As outlined in Section 5.3, the alignment of the proposed transmission line was selected to avoid foreground view catchments of towns and villages, and to minimise intrusion into foreground view catchments of existing rural residential areas. Intrusion into areas designated for future rural residential uses was also minimised.

To minimise visual impacts at individual properties, it is Commission practice to consult with affected landholders prior to determination of the final route alignment. The preferred location of the transmission line within each property would be discussed with affected landowners, and their requests taken into account before a final decision on the route alignment was made. As discussed in Section 4.2.1, these discussions would occur after environmental approval had been granted to proceed with construction of the transmission line following the exhibition of this E.I.S.

Safety Issues

Numerous precautions are incorporated into the design of transmission lines to ensure the safety of the general public, construction and maintenance staff and security of the line. Adequate clearances from buildings and vegetation are maintained around the transmission line and (these are detailed in Table 4.1) by the establishment of the easement. To prevent the build up of static charges, fences and gates in the vicinity of transmission lines are earthed. This work is carried out at the Electricity Commission's cost. For safety reasons some restrictions on the use of electric fences may be required in particular cases. If the use of an existing electric fence became significantly restricted due to the operation of a transmission line, the Electricity Commission would modify the electrification of the fence in consultation with the landowner to allow its continued use.

Unauthorized activities such as climbing of poles and flying of kites near the line are discouraged by drawing attention to potential hazards through public education programmes.

The transmission line and its supporting structures would be designed and constructed in accordance with the Overhead Line Construction and Maintenance Regulations (made under the Electricity Development Act, 1945), and line fittings and materials specified to the appropriate Australian Standards. Compliance with, and in many cases, bettering of, these standards would ensure the safety of the line and its supporting structures and reduce to a minimum the possibility of accidental mechanical failure. Regular patrol inspections of the transmission line will ensure that this situation continues throughout the operating life of the line.

The potential for bushfires to be sourced from the line is not great provided adequate precautions are taken. The line will be regularly patrolled to ensure that trees growing under or near the transmission line do not grow to a height that could allow an electric arc to be struck to them from the line conductors. Patrols would be specifically mounted during spring and summer months for this purpose.

Strict requirements for bushfire prevention would be enforced during construction and maintenance of the proposed transmission line, and construction personnel would be required to comply with the relevant provisions of the Bushfires Act, Fire Brigades Act and regulations. Activities would be strictly controlled on fire ban days, and maintenance tasks would be programmed so as to minimize fire risks.

Other measures that would be adopted include the location of mobile water tankers at each construction site, radio communication from each site to a point providing telephone contact to firefighting authorities, and the issue of backpack sprays and firefighting tools to construction workers. A subsidiary 2,000 litre mobile water tanker would be located at the works depot or campsite.

Methods used for disposing of cleared vegetation would be in compliance with advice from various statutory authorities. Where burning was necessary it would be strictly controlled to minimize bushfire hazard and air pollution.

Sensitive monitoring apparatus and high speed circuit breakers would be installed to ensure that any fault which may occur on the line (due, for instance, to a lightning strike or earthing by windborne debris), is immediately detected and the line de-energised. Irrigators of the high pressure gun type would not be permitted to be used on line easements, or in such a way that a dense jet of water could strike the conductors.

Electric and Magnetic Field Effects

An analysis of recent research into the question of the effect of electric and magnetic fields associated with the operation of transmission lines is presented in Appendix G. The fields generated by the line would be very low, and comply with the recommendations of Australian and overseas Health Authorities.

Compensation Procedures

As described in Section 4.2.3, the process of easement acquisition and compensation would be undertaken in such a way as to safeguard the interests of affected landowners.

Easement Conditions

As outlined in Section 4.2.4, the safe operation of the line, and the well-being of adjoining residents, is safeguarded by applying certain restrictions regarding the erection of structures or undertaking of allowable activities within the easement.

5.6.3 Assessment of Impacts

Implementation of the safeguards outlined in the previous section would ensure that the impact on residential amenity would be minimised along the length of the proposed line. While some limitations would be placed on allowable activities within the easement, residential amenity would not be substantially impaired. A review of potential impacts is as follows:

Visual Impacts at Residences

As discussed in detail in Section 5.3.3, the proposed transmission line is not expected to cause a significant deterioration in visual quality in residential areas. The procedures discussed in Section 5.6.2 would ensure that visual impacts at individual properties would also be minimised. As a general observation, the proposed route alignment will provide the least visual impact to the community as a whole with the highest level of benefit.

Safety

The safeguards outlined in Section 5.6.2 would ensure the safety of residents adjoining the line. Other potential hazards to be considered include threats to the security of the line through bushfires and the safety of aerial agriculture. While it is unlikely that the transmission line would cause a bushfire, bushfires travelling towards the line could present a hazard to the security of the line. Where easements are only partially cleared of vegetation, passing bushfires can burn at almost full intensity underneath the conductors. Bushfires generate rising plumes of ionised gases which destroy the insulating properties of the air and can easily permit a "flashover", resulting in the line being automatically switched out of service. The passage of bushfires across transmission line easements is a frequent cause of major transmission lines being forced out of service.

The alignment of the proposed transmission line is generally separated from forested areas, and bushfires are not considered to be a significant threat to the safe operation of the line. Residential amenity, through the constant provision of an adequate and reliable power supply would be maintained.

Similarly, the transmission line would not present a significant safety hazard to aircraft. High voltage transmission lines are often used as navigational aids by pilots of light aircraft and aerial agricultural operators are involved with very few accidents with such lines. The low risk of collision means that residential amenity would once again be maintained.

Electric and Magnetic Field Effects

As outlined in Section 5.6.2 and Appendix G, the strength of electric and magnetic fields associated with the transmission line would be very low, and it may be concluded that they would not pose a public health problem or affect farming activities.

Television and Radio Reception

Television and radio reception in the primary service area of transmitting stations is normally unaffected by transmission lines. Some momentary fading of radio reception may be experienced in a car passing underneath the line, particularly if the radio signal strength is low. In fringe areas, experience has shown that a properly erected aerial generally overcomes any potential reduction in quality of television or radio reception arising from proximity of the transmission line. If a problem occurs it can usually be rectified by minor modifications to the aerial or its relocation. The Electricity Commission would be prepared to adjust aerials if any radio and television interference was directly caused by the proposed transmission line. Individual complaints will be investigated and rectified where appropriate.

Compensation Procedures

The compensation procedures adopted by the Commission protect the rights of landowners at all times and, would ensure a fair and just return to affected landowners.

Easement Conditions

The easement conditions outlined in the previous section would ensure the safe operation of the line, without causing a substantial impairment of residential amenity.

Noise Impacts

Noise would be emitted during both construction and operation of the line. There would be short-term sounds of vehicles, machinery and human voices during construction of the line, and although the erected line would generally be silent in operation, noise will occasionally be generated, for instance, due to occasional maintenance patrols or inspections, particularly if a helicopter is used, and noise from the line itself, due to either wind or rain effects.

Strong winds blowing past conductors and structures can produce a sound to add to the general disquiet on such days. The intensity of the sound would be commensurate with that produced by strong winds blowing through trees or past buildings. Conductors wetted by rain or fog may emit audible noise due to the phenomenon of corona (produced by electrical discharges at the surface of the conductor). When the rain stops, or during extremely light, misty rain or heavy fog, a 'fizzing' sound may be heard for a short period while the water droplets remain. The noise is only slightly to moderately audible in very localised areas.

None of the noises generated would be intrusive, even in close proximity to the line.

Air Quality

Possible sources of air pollution comprise vehicle and plant exhausts, dust generated by the movement of construction vehicles during dry periods, the burning of debris resulting from easement clearing, and the production of small amounts of ozone through the ionization of air near the conductors caused by corona discharges. Vehicle and plant exhausts would discharge to the atmosphere and the level of dust generated by construction vehicles would be comparable to that generated by other vehicles on gravel roads in the area. Combustion products produced from the burning of debris would be short duration. Similarly, ozone generated would not add measurably to the background levels produced by solar radiation, wind and thunderstorms. It is a very unstable gas and rapidly decomposes to oxygen with no harmful effects.

Neither of these sources of air pollution would cause any noticeable deterioration in air quality in the vicinity of the line.

5.7 LAND USE IMPACTS

5.7.1 Introduction

The quality of the scenic environment, the proximity to the coast, high rainfall and the temperate climate have combined to create a region attractive to agricultural, residential and recreational uses. The traditional agricultural base of dairying and grazing has been expanded in recent years with the introduction of horticulture on a wide scale. This has been accompanied by an influx of rural settlers and the region is now relatively densely populated by normal rural standards. The scenic attractions and recreational opportunities have also encouraged considerable tourist visitation.

Principal existing land uses in the region are residential (towns, villages and rural residential areas), agriculture (horticulture, cropping, grazing and dairying) and recreational (National Parks, Nature Reserves etc). Other land uses include forestry and extractive industries.

5.7.2 Urban

Residential impacts have been considered in terms of amenity (Section 5.6) and visual quality (Section 5.3). As discussed in these sections, the safeguards that have been incorporated into the route location process would ensure that the visual quality at residential properties is maintained. No other adverse impacts on urban amenity will result.

5.7.3 Agriculture

Potential agricultural impacts were outlined in Section 5.4. The proposed route has been located to avoid existing horticultural plantations, and the crossing of cropping, dairying and grazing land would not substantially affect productivity. No significant adverse agricultural impacts are expected.

5.7.4 Recreation and Tourism

Recreation areas within the study area such as the Nightcap National Park, Big Scrub flora reserve, Minyon Falls flora reserve, and Rocky Creek Dam recreation reserve were considered as an absolute constraint to transmission line location. The proposed alignment would not affect any of these areas. It also avoids their principal access roads, as well as the Bangalow Road, and the Coolamon Drive, both of which are used by substantial numbers of recreational motorists. The avoidance of the designated scenic preserve area nominated by the National Trust of Australia (N.S.W.) between Bangalow and Lismore and other prominent locations, such as the Open Air Cathedral at Bexhill, would assist in maintaining the natural appeal of the area to tourists.

The route would pass through a planned section of the Byron Shire Trail at Kings Road, west of Federal. As discussed in Section 2.5.5, the trail is planned to comprise a series of walking and horseriding routes which link the coast with the Nightcap Range. Adequate clearances would be provided to allow safe passage under the line and visual impacts would be minimised by the location of the transmission line at right angles to the planned trail.

5.7.5 Forestry

State Forests located within the study area include Whian Whian, Dorroughby and Goonengerry. No State Forests would be affected by the proposed route.

5.7.6 Extractive Industries

Two quarries are located within the study area, west of Boerrie Hill and north of Goonengerry. Both quarries are outside the bandwidth of the proposed route and would not be affected by construction of the proposed transmission line.

5.7.7 Transportation

The proposed route would cross a number of local roads and pass in proximity to light aircraft landing strips near Ewing Bridge and south west of Numulgi.

Specified clearances for local roads are sufficient to ensure the passage of the highest vehicles likely to be included in the general traffic stream. Very short term interruptions to road traffic may result during the construction phase when conductors are strung across the roadways.

The line has been located to achieve maximum separation from the airstrip. In addition, a steep hill approximately 800 metres to the south of the landing strip at Ewing Bridge indicates that the strip may operate in a one-way fashion. The proposed location of the transmission line may not therefore inhibit the use of this landing strip. Consultations will be undertaken with the airstrip operator during the detailed design phase to ascertain operating requirements.

The operator of the landing strip situated to the south west of Numulgi will also be consulted during detailed design of the line. The nominal route alignment is located approximately 500 metres to the west of this landing strip.

5.7.8 Services

The proposed route would cross the existing Lismore to Mullumbimby 66kV transmission line north of Boerrie Creek Road, and several other subtransmission and distribution lines. In addition, the proposed line would be approximately 500 metres from the existing 66kV line where it crosses the Leycester Creek floodplain.

Where the proposed line crosses the existing 66 kV line, the conductors would be elevated by either reducing the length of the spans or erecting taller poles. Similar measures would be undertaken to ensure that adequate clearances are provided at crossings of subtransmission and distribution lines.

The existing transmission lines would be taken out of service, at the discretion of the distribution authority, during the stringing process. This would cause short interruptions to the operation of affected lines.

The paralleling of the 66kV line would not cause any adverse effect on the operation of either of the lines. There is some possibility of both lines being put out of operation in the case of bushfires, lightning strikes, and damage due to flood debris (in the case of the Leycester Creek floodplain), but the risk is not sufficiently large to outweigh the environmental benefits which will result (the 66kV alignment in this section is particularly good from a visual impact point of view and this feature was capitalised upon in route selection for the proposed line).

The proposed route of the transmission line passes in proximity to a possible location of a proposed regional water supply dam. While location of a transmission line in such an area would represent a compatible land use, attention would be required to locate supporting structures in appropriate locations, clear of the potential water storage areas.

5.8 FLOODING

5.8.1 Introduction

Principal watercourses crossed by the bandwidth of the proposed transmission line are Leycester Creek, Boerrie Creek, Numulgi Creek, Coopers Creek (five crossings) and Wilsons River (three crossings).

The Leycester Creek floodplain has been identified (Reference 2) as a hazardous area, being defined as an area where high velocities of flow or excessive depths of inundation occur. A worst possible flood event would produce a flood depth over the floodplain of two to three metres, with an estimated flow rate in the order of one metre per second which is comparatively high by Australian standards.

Coopers Creek is crossed five times by the bandwidth and three times by the nominated route alignment. It is anticipated that a worst possible event in Coopers Creek could involve a two metre flood travelling at one metre per second.

The crossings of Wilsons River occur at its upper reaches where the narrow floodplain could be spanned. Boerrie Creek and Numulgi Creek would similarly not involve difficult crossings.

5.8.2 Safeguards

A potential risk to transmission line security in floodplain areas occurs when rafts of debris build up around structures, causing a substantial increase in the load on structures. Single pole supporting structures, without guy wire supports, would generally be used in floodplains to avoid this occurrence. Where the need for a guy is unavoidable, a guy pole arrangement would be used with the pole being more than nine metres from the structure. The guy pole would be designed to withstand anticipated loads and to provide a substantial margin of safety. Where double pole structures are found to be necessary, appropriate flood debris barriers would be erected.

The single pole structures would be designed to withstand floodwaters two metres deep, travelling at one metre per second, including impact loads of large floating logs or other flood debris. Foundations would be strengthened to allow for the reduction in soil strength due to saturation by floodwaters.

The line would be designed with the additional height necessary to provide statutory clearance (ie 6.7 metres) above the 1:100 year flood level. This would ensure that rescue boats could pass safely under the line during times of flood.

5.8.3 Assessment of Impacts

The safeguards outlined would ensure that continued safe operation of the transmission line during floods.

The supporting structures would not present an impediment to creek discharges, and no adverse hydrological impacts would result.

5.9 STABILITY AND SOIL EROSION

5.9.1 Introduction

The majority of the proposed route generally passes through krasnozems soils which constitute a moderate sheet and gully erosion risk. The greatest stability and soil erosion hazard would arise in areas where deep profiles of these soils occur in protected lands (ie land sloped 18 degrees or greater). Mass movement could be a problem in such areas unless adequate precautions are taken.

Other soils traversed by the proposed route are the chocolate soils and dark alluvial clays. Sheet erosion and mass movement are a common feature of chocolate soils, particularly on steep slopes denuded of tree cover. Dark alluvial clays occur on the river flats near Lismore, and although their erodibility is high, the erosion hazard is low due to the flat terrain and they would not present an erosion problem.

Ground subsidence is not a factor in route selection since mining is not undertaken in the area.

5.9.2 Safeguards

Particular attention to erosion control and soil conservation would be paid on krasnozems and chocolate soils occurring within protected lands. The detailed requirements of the Catchment Areas Protection Board will provide the basis of the controls adopted. However the emphasis in control will be on retaining existing vegetation, wherever practicable. Where clearing is necessary, ground disturbance would be minimised and suitable grasses established to minimise the erosion risk. Attention would also be given to track location and construction in these areas. Again, the emphasis on track location is to avoid long uninterrupted slopes and the need for substantial cut and fills. Suitable drainage will be provided to the requirements of the Soil Conservation Service. Detailed erosion control procedures will be determined in consultation with the Service after selection of the final route.

5.9.3 Assessment of Impacts

Transmission lines are comparatively low impact developments from the soil erosion point of view. The Commission maintains a close relationship with the Soil Conservation Service and, provided that all relevant safeguards are observed, serious soil erosion would not occur.

5.10 WATER QUALITY IMPACTS

The proposed transmission line crosses several streams which are prescribed under the Soil Conservation Act. They are Leycester Creek, Coopers Creek and Wilsons River.

The line and its supporting structures would be sited to minimize disturbance to riparian vegetation. However, where clearing was necessary, approval would be sought from the Catchment Areas Protection Board prior to any clearing of vegetation within twenty metres of the stream banks, as required.

It is unlikely that any adverse water quality impacts would result from the required creek crossings.

5.11 HERITAGE AND ARCHAEOLOGICAL IMPACTS

5.11.1 Heritage Impacts

The route of the proposed transmission line is well removed from historic buildings included in the Register of the National Trust of Australia (N.S.W.). The Mullumbimby Power Station, located near the proposed substation site at the northern terminus of the proposed route, was classified by the Trust in 1979. The substation and transmission line would be built adjacent to the Power Station, and is considered to be compatible with it.

The proposed alignment is located well clear of the North Lismore General Cemetery/Pioneer Park, and other cemeteries at Clunes, Bexhill and Dunoon. The route is removed from both the proposed Urban Conservation Area for the town of Bexhill and the designated Scenic Preserve situated between Bangalow and Lismore.

5.11.2 Archaeological Impacts

The Electricity Commission would undertake archaeological surveys of the entire route following detailed design. Previous surveys have indicated that aboriginal activity was primarily centred around permanent watercourses. This suggests that archaeological sites would be concentrated in the same areas. These areas are already generally highly disturbed by previous agricultural activities and the likelihood of finding intact sites of significant value is considered to be low.

The likelihood of disturbance would be further reduced by the siting of supporting structures on higher ground, well clear of watercourses. In addition, it is normally possible to avoid interfering with archaeological sites wherever they occur by a variety of strategies, including protective safeguards during construction, careful selection of sites for supporting structures or, where necessary, by making variations in the route.

In the unlikely event that an archaeological site had to be disturbed during construction, the Electricity Commission is required to seek prior approval from the Director of the National Parks and Wildlife Service.

5.12 COMPATIBILITY WITH PLANNING INITIATIVES

5.12.1 Introduction

Comments made during the route selection phase of the study stressed the importance of considering both existing and future land uses in the region. The consensus was however, that existing uses be given priority.

Nevertheless, possible future uses were taken into account and both Lismore City and Byron Shire Councils have been consulted to ascertain possible future land uses in the study area. As outlined in Section 2.5.2, both Councils are currently preparing new Local Environmental Plans for their respective local government areas. Proposed zonings which allow land uses that have the potential to be affected by transmission line location have been mapped and are shown on Exhibit 2.4. Future land uses that constitute a constraint to route selection are proposed urban and rural residential areas, and horticultural areas. It is also desirable that intrusion into areas designated for scenic protection be minimised, and that possible reforestation initiatives not be compromised.

5.12.2 Assessment of Impacts

The alignment of the proposed transmission line avoids all areas designated as possible future urban and rural residential areas, and intrudes into relatively short lengths of possible future horticultural land north east of Tullera, and between Eureka and Federal. As described in Section 5.3 and Section 5.5, visually prominent locations are also generally avoided, and land with high reforestation potential would not be affected.

It is considered that the proposed transmission line generally would be compatible with possible future land uses.

5.13 SOCIAL IMPACTS

Transmission line construction is unlikely to provide significant employment opportunities for local residents. The line contractor will bring a permanent skilled workforce to the site to carry out specialised work. At the discretion of the contractor there may be some avenues for local involvement such as in the installation of gates, the construction of access tracks, fence erection, or in general duties. Local materials would be used for improving the surface of access tracks and pouring concrete pole foundations. Maintenance facilities and stores would also be sourced locally.

The temporary construction workforce which is expected to reach a maximum of twenty people could be expected to contribute somewhat to the local economy in that their food and daily recreation requirements would usually be supplied through towns and villages in the region.

5.14 EQUITY ISSUES

The question of equity was raised during the route selection phase of the study in relation to the possible siting of the proposed line in proximity to the existing Lismore to Mullumbimby 66kV line. While some residents felt it would be advantageous to confine transmission line impacts to a single corridor by siting the proposed line adjacent to the existing line, others expressed the view that this would impose an unfair additional burden on residents. Their opinion was that the 'burden' of services infrastructure should be spread amongst the community.

The alignment of the proposed transmission line minimises cumulative impacts by avoiding any close paralleling of the existing 66kV transmission line. Locations where the two lines would be in proximity are immediately south of the site of the proposed Mullumbimby Substation, north from the Lismore Substation across the Leycester Creek floodplain, in the lower Boerrie Creek valley, and for a short length at the northern crossing of Kings Road, between Federal and Goonengerry.

The alignment south of the proposed Mullumbimby Substation has been selected to maximise separation from adjoining residences, and existing vegetation would provide good screening opportunities, while the section out of the Lismore Substation also has reasonable separation from residential areas at South Lismore. The visual impacts of the line across the Leycester Creek floodplain and in the Boerrie Creek floodplain were discussed in Section 5.3. It is generally considered that the proposed route provides a fair balance of impact for all members of the community.

5.15 RECONNECTION FOR 132 kV OPERATION

After its initial years of operation at 66 kV, the line will be reterminated at both the Lismore and Mullumbimby ends to enable operation at 132 kV. These subsequent works will be minor in nature and confined to the immediate environs of the Lismore Substation and the future Mullumbimby Substation. They are not considered likely to significantly affect the environment.

5.16 CONCLUSION

The preceding discussion has demonstrated that the safeguards incorporated into the planning and construction of the proposed transmission line would ensure that it would minimise adverse environmental impacts in the region. In all instances, impacts identified would represent marginal changes in the existing situation rather than the introduction of a significant new and inconsistent element. Considerable attention has been applied to minimising impacts in closely settled areas and to allowing existing agricultural uses to continue, as well as avoiding disturbance to valued native vegetation stands. General compatibility with potential future land uses has also been achieved. Adequate soil erosion control would occur through close consultation with the Soil Conservation Service.

As discussed in Part A, the proposed development is best suited to providing for the power needs of the Far North Coast Region, and its implementation would have beneficial implications for future growth and development in the region.

In this context, and provided the recommended environmental safeguards are observed, a basis is provided for approval of the proposed development.

Appendices

Appendix A

Route Concepts Brochure and Responses



ELECTRICITY COMMISSION OF
NEW SOUTH WALES

LISMORE TO MULLUMBIMBY 132kV TRANSMISSION LINE



AN INVITATION TO COMMENT

SINCLAIR KNIGHT & PARTNERS

An invitation to comment

A number of alternative routes are currently being considered for a new transmission line between Lismore and Mullumbimby. Your comments are invited to assist us in the selection of a preferred route.

Background

Electricity demand in the far North Coast region of NSW has been expanding at a rate of 7% per annum. The Electricity Commission of NSW (ELCOM) has responded to this increased power need with the formulation of a 7 stage program to upgrade electricity supplies to the region. Details of the program were explained in ELCOM's Information paper entitled 'Electricity Supply - Far North Coast New South Wales', published in August, 1986. The proposed transmission line outlined in this brochure is one component of the upgrading program.

The proposal

Sinclair Knight & Partners has been appointed by ELCOM to prepare an Environmental Impact Statement for a 132

kilovolt (kV) transmission line which it proposes to build between the existing substation at Lismore and a new substation near Mullumbimby.

The line will be of twin concrete pole construction, similar in appearance to that shown in the photograph. Heights of the poles will vary with terrain requirements, but will be in the order of 16 to 25 metres.

The planning process

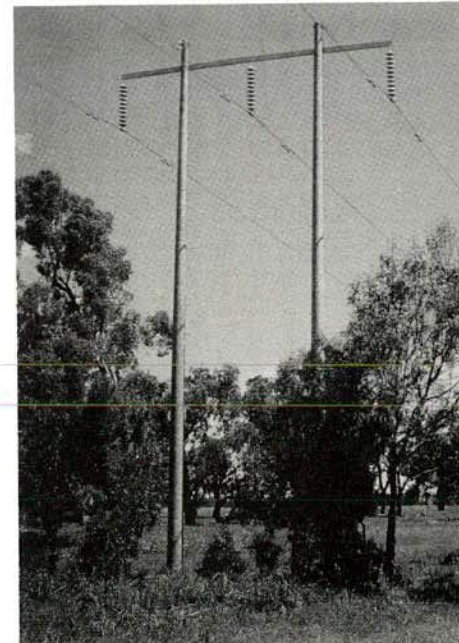
Planning for the location of the transmission line has so far involved identification of constraints to route selection, and development of various route concepts shown on the map. The next stage, a review of public comments received on the concepts, will be followed by selection of a preferred route concept.

Further investigations will then lead to the determination of a 45 m transmission line easement from within the preferred route concept. A full description and environmental assessment of the preferred route and all alternatives considered will be published, in the form of an Environmental Impact Statement (EIS). The EIS will be placed on public exhibition in 1987, at which time formal public comment will be invited.

Constraints to route location

The route concepts shown have been developed taking into account constraints identified after discussions with local agricultural and environmental groups, representatives of Byron Bay Shire and Lismore City Councils, and studies of physical, biological and social environments. Areas offering the highest constraint to route selection have been considered as those with intense agricultural uses such as horticulture, undisturbed native vegetation, and areas within view of towns, villages and tourist lookouts.

Intrusion into areas adjoining concentrations of rural residential developments, areas of disturbed native vegetation, and view catchments of scenic drives have also been minimised. Other identified constraints include proposed residential (urban and rural) areas and planned horticultural developments.



Typical Concrete pole supports for 132kV line.

Alternative route concepts

The route concepts shown conform to the environmental criteria outlined and represent a balance of engineering and economic factors. A number of other routes have also been investigated, including a southern/eastern line which follows an easterly direction from the Lismore substation and passes to the south of the city before turning north and crossing the Bruxner Highway near Wollongbar.

Alternative locations for the Mullumbimby substation were also considered. These options were not proceeded with for environmental or economic reasons.

Features of each of the concepts shown on the plan are:

Option A

Option A follows cleared grazing land north from Lismore and minimises disturbance to horticulture by traversing steep terrain to the west and north of Dunoon, at the footslopes of the Nightcap Range. It is generally well removed from population centres and passes to the south of forested areas which include tourist destinations such as Rocky Creek Dam and Minyon Falls Flora Reserve. As

for all the options, Option A follows the existing Northern Rivers County Council (NRCC) Lismore to Mullumbimby 66kV line from Goonengerry Mountain to the site of the proposed Mullumbimby substation.

Option B

Option B closely parallels the existing NRCC Lismore to Mullumbimby line over its full length and has the apparent advantage of confining transmission line impacts to a single corridor. It would however have an adverse effect on horticulture near Dunoon since additional land would be required to accommodate both lines in a wide easement. The line crosses the Lismore/Dunoon Road and would be visible from parts of Dunoon and Modanville.

Option C

This option parallels the existing NRCC line apart from a deviation to the east in the vicinity of Dunoon to minimise disturbance to horticultural plantations. The line avoids undisturbed forest vegetation and passes through moderate to steep sloping valleys of the plateau area.

Option D

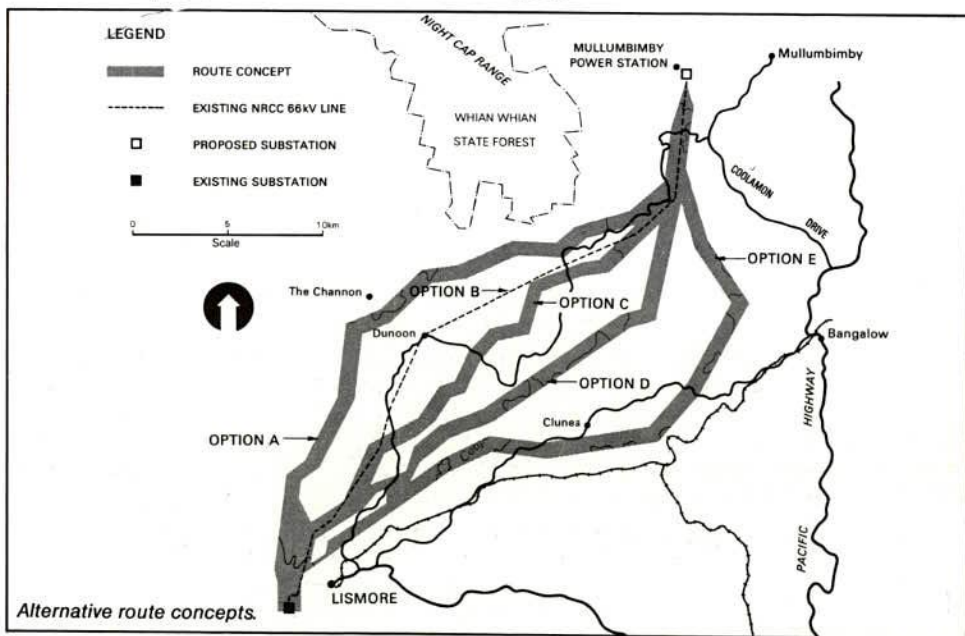
Option D avoids horticultural plantations, and the steeper terrain to the east of Dunoon, by traversing the sideslopes of the Coopers Creek valley. This option passes through mainly cleared grazing land and avoids both horticultural activities and undisturbed vegetation stands.

It follows the existing NRCC line for short lengths north of Lismore and south of the site of the proposed Mullumbimby substation.

Option E

This option provides an easterly alternative which again minimises areas of steep terrain by following the sideslopes of the Wilson River floodplain. It avoids horticultural plantations and areas of undisturbed native vegetation, and crosses the Bangalow Road south of Clumes and east of Springvale Hill.

The line also follows the existing NRCC line for short lengths north of Lismore and south of the site of the proposed Mullumbimby substation.



What we want to know

Name: _____

Address: _____

Postcode: _____

Please send me further information on the alternative concepts for the proposed 132kV transmission line from Lismore to Mullumbimby.

We would like you to tell us which of the route concepts you prefer, and also whether you agree with the factors taken into account in locating the corridors.

Please complete the questionnaire contained in this brochure and return it to our address given.

All comments will be fully

considered before a preferred route is selected. Your early reply would be appreciated.

If you would like a more detailed map of the route concepts and further background information before you respond to this brochure, please send us the coupon.

LISMORE TO MULLUMBIMBY 132KV TRANSMISSION LINE AN INVITATION TO COMMENT

We would like your comments on the alternative route concepts outlined in this brochure, and the priority you place on each of the identified constraints to route selection. Your comments will assist us in gaining an appreciation of community opinion and be valuable in the preparation of the EIS for the project. Please return this form to our Sydney office as soon as possible.

Personal/Community Group Response

- Constraints identified during the route location investigation are listed below. Please rate each constraint according to the importance you assign to it.

Constraint	Importance			
	High	Medium	Low	Nil
Proximity to towns/villages				
Disturbance to intense agricultural uses such as horticulture				
Disturbance to native vegetation				
Views from existing rural residential dwellings				
Views from tourist roads and lookouts				
Views from main roads				
Proximity to planned horticultural developments				
Proximity to planned rural residential areas				

Are there any other constraints you think are important?

- Which route concept do you prefer? Why?

- Do you have any comments on any other relevant matters you think are important?

Name: (optional) _____

Address: _____

Community Group represented (if applicable): _____

Please post responses to:

Lismore to Mullumbimby Transmission Line Study
Sinclair Knight & Partners Pty Ltd
1 Chandos Street, St Leonards NSW 2065

Route Concepts Brochure Responses

A total of 423 replies were received in response to the invitation to comment contained in the Route Concepts brochure. These comprised 345 questionnaire responses, 77 letters and two petitions. Opinions expressed in the questionnaire responses and letters were reviewed to gain an appreciation of community views and concerns.

The invitation to comment contained in the brochure was principally aimed at determining what priority the community placed on a number of factors that had been identified during the community workshops as possible constraints to transmission line location. Respondents were asked to note eight constraints (and any others that they felt should be considered) in terms of their perceived importance.

Responses received were analysed in terms of the number of High, Medium, Low and Nil Importance votes given to each of the identified constraints. A high importance rating was accorded a score of three points, medium importance two points, low importance one point and nil importance zero points. The points were then added to determine an order of community priority.

Results indicated that views from residential areas (both existing and planned) were considered to constitute the principal constraint to route selection. Disturbance to existing and planned intense agricultural uses such as horticulture also rated highly. Disturbance to native vegetation was rated as being of medium importance while views from tourist roads, lookouts and main roads were accorded a low importance. Other issues of concern, not directly related to route selection, were perceived health effects, property devaluation, project justification, affects on tourism and a concern that the line was to benefit coastal areas rather than the Lismore/Mullumbimby region.

The questionnaire also asked respondents which concept they preferred and the reasons why. Option A received the highest number of votes as the preferred route concept, principally due to the perception that it was the option which was most removed from population centres, and would affect the least number of people. Option B was the second most favoured route concept, while all other options received a similar number of votes. Options D and E were the most non-preferred route concepts, principally due to responses received from the Federal Action Group, who perceived that both options would create adverse impacts in the Federal area. Seventy-six responses were received from the Federal Action Group as a form letter.

Respondents generally preferred the option which was most distant from their place of residence, although reasons for a particular preference were often not stated. Other matters raised by respondents included the need to select a route with the least cost of construction, potential effects on television reception, suggestions for the use of alternative sources of energy, and possibilities for a coastal route.

The two petitions received were from residents of the Booerie Creek, Tullera and Modanville community, and from residents of Rosebank. The first of these petitions urged the Electricity Commission to locate the transmission line in an area with large holdings and a low rural population. Residents expressed their distress at the concentration of options advocated through their locality, especially considering that many residents already bear the burden of the existing N.R.E. 66 kV line. A number of supply options were suggested, including supply from Queensland, a coastal route and an alignment paralleling the Lismore to Bangalow Railway Line.

The petition from Rosebank residents indicated their objection to the proposal to erect the proposed transmission line in their area due to impacts on bushland, its likely proximity to houses and adverse visual impacts.

Appendix B

Selected Photographs

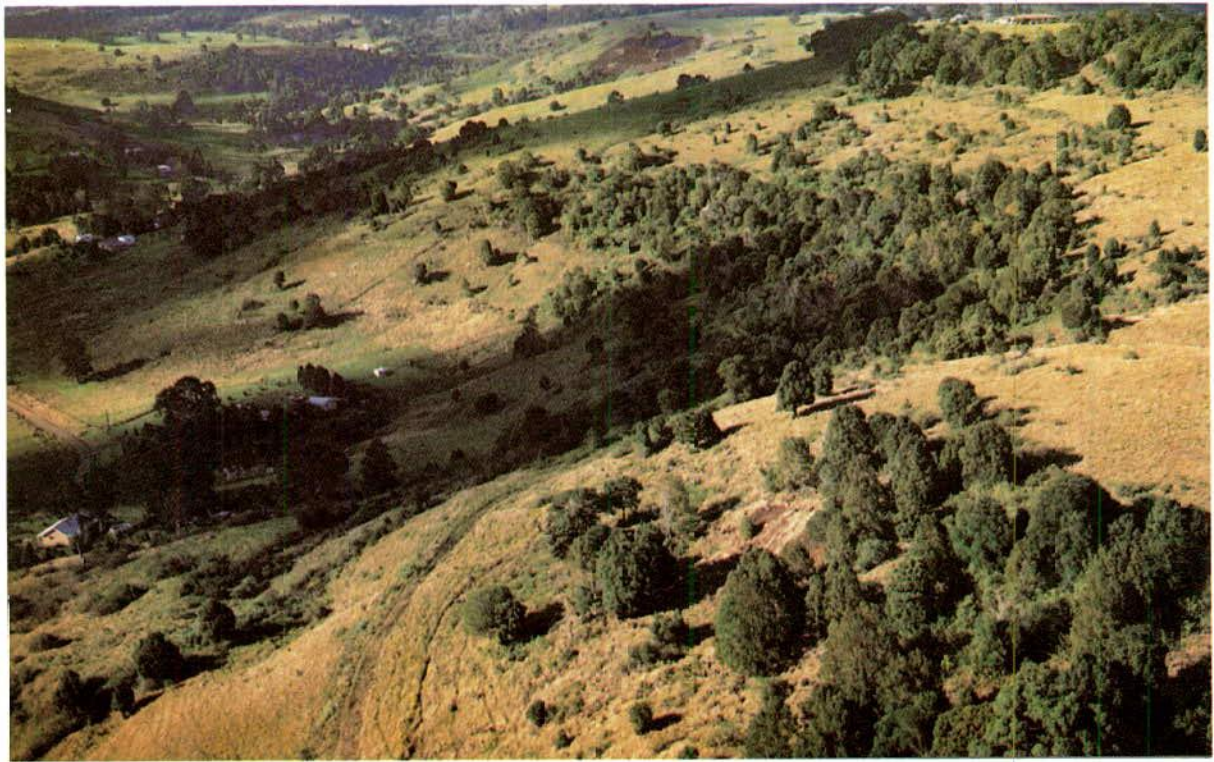


PLATE B.1: View north along the Booerie Creek valley, south west of Tullera. The nominal route alignment traverses the valley sideslopes in the foreground and middleground, before heading east towards Tullera.

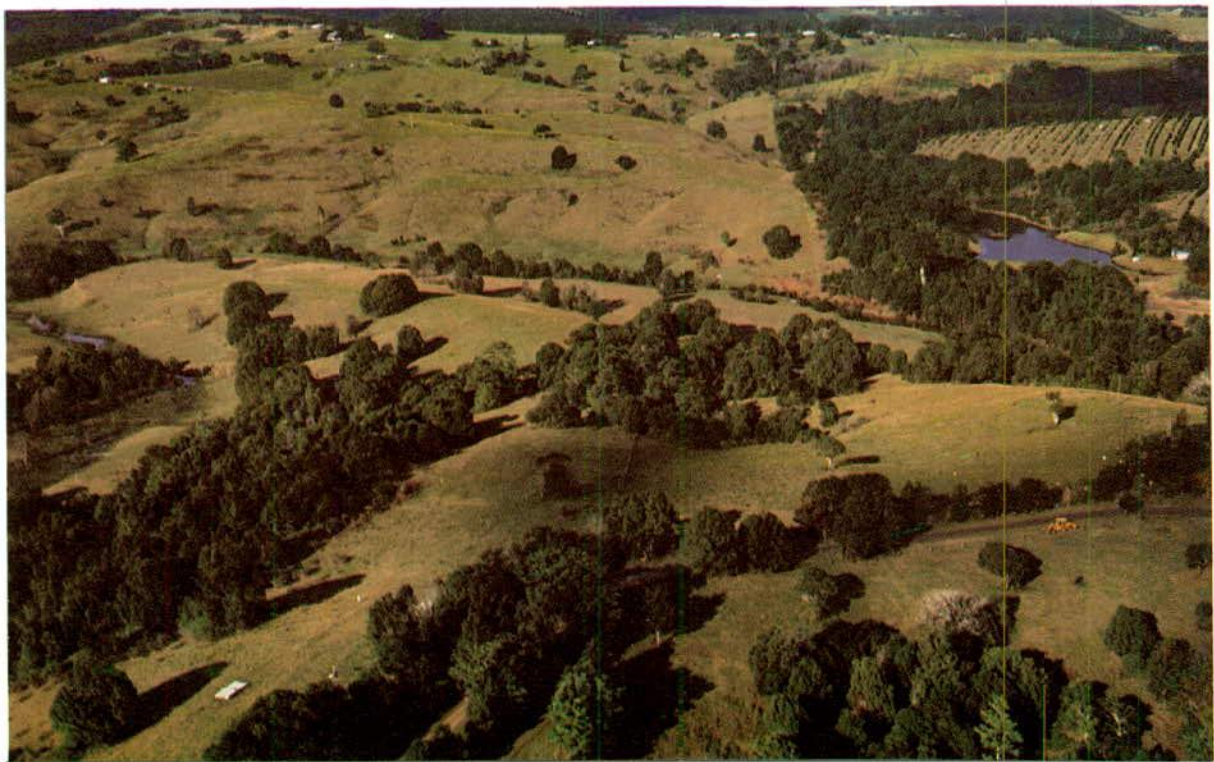


PLATE B.2: View east from near the Ridgewood Road crossing, west of Eureka. The nominal route alignment passes through the scattered vegetation in the foreground and avoids the riparian vegetation of Coopers Creek and the horticultural plantation before turning north towards Goonengerry.



PLATE B.3: View north from Kings Road crossing, south of Goonengerry. The nominal route alignment passes on the near side of the hill shown in the centre of the photograph, approximately midway between the residences shown.



PLATE B.4: Looking south east towards the Mullumbimby Power Station and the coastal escarpment. The line terminates near the Power Station and runs up the escarpment near the middle of the photograph.

Appendix C

Requirements of the Director of the Department of Environment and Planning

**Department of Environment and Planning**

The Secretary,
Electricity Commission of N.S.W.,
G.P.O. Box 5257,
SYDNEY. N.S.W. 2001. 00.

Remington Centre
175 Liverpool Street, Sydney 2000
Box 3927 G.P.O. Sydney 2001.
DX. 15 Sydney

Telephone: (02) 266 7111 Ext. 7234

Contact: Ms. S. Jones

Our reference: 86 2190

Your reference:
54666.T/P/TL/PH

Attention: Mr. P. Heraud

Dear Sir,

RE: PROPOSED ELECTRICITY TRANSMISSION LINE FROM LISMORE
TO MULLUMBIMBY

I refer to your letter dated 21 August, 1986 which indicates that you are consulting with the Director with regard to the preparation of an environmental impact statement (EIS) for the above-mentioned proposal.

2. As you are aware, the amendment to State Environmental Planning Policy No. 4 gazetted on 7th October, 1983 permits certain public utility undertakings, including the construction of electricity transmission lines, to be carried out without consent in those areas where such land uses are permissible under any relevant environmental planning instrument applicable to the subject land. In this respect we suggest that the Commission liaise with local government and any other affected government instrumentality to ascertain the statutory provisions applicable to the proposed works.

3. It should be noted that the above-mentioned policy does not provide for the construction of transmission lines and associated works where these are specifically prohibited under an environmental planning instrument applicable to the land to be affected by the proposed works. In such a case, a rezoning may need to be sought by the appropriate local council. From the area indicated on the map accompanying your letter of 21 August, 1986 it would appear that there are no SEPP 14 Wetlands affected by the proposed development.

4. An EIS that relates to an activity referred to in Section 112(1) of the Environmental Planning and Assessment Act, 1979 shall be prepared in accordance with Clause 57 of the Environmental Planning and Assessment Regulations, 1980 and bear a certificate as required by Clause 59.

5. Pursuant to Clause 58(1) of the E.P. & A. Regulation the Director has specific requirements with respect to the form and content of the statement. The matters specified in the attachment to this letter should be addressed in completing the preparation of the EIS.

6. Given the special characteristics of the site, it is considered that the views of the Department of Agriculture, and the Bushfire Council of NSW should be sought and appropriately addressed in the EIS. Where matters are likely to come within the scope of the legislation relative to air, water and noise control as administered by the State Pollution Control Commission, the views of the Commission should be sought.

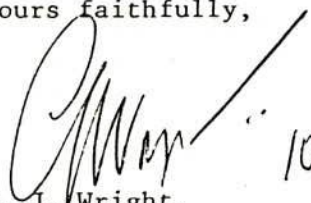
7. Further, the National Parks and Wildlife Act contains legislative requirements for the preservation of relics and aboriginal places. The advice of the National Parks and Wildlife Service should be sought on the need for a professionally conducted aboriginal archaeological survey for inclusion in the EIS and on the appropriate manner for carrying out such a survey.

8. When an adequate EIS for the subject proposal has been prepared, The Electricity Commission, as the determining authority, should proceed with the matter in accordance with Sections 112 and 113 of the Act and place the statement on public exhibition. The procedures for public display that are to be followed by the proponent and determining authority are as in Clauses 60 to 64 of the Environmental Planning and Assessment Regulation, 1980.

9. At such time as copies of the completed environmental impact statement are forwarded to The Secretary, it would be appreciated if two additional copies of the environmental impact statement could be forwarded to the Department, as well as details of the period of public exhibition and proposed public display locations. Should any submissions be made during the period of public exhibition, it is advised that such submissions should be forwarded to the Secretary and in the event of issues of interest to the Department being raised in any submissions received, we will advise you accordingly.

10. Should you require any further information regarding this matter, please do not hesitate to contact us again.

Yours faithfully,

 10/9/86
C. J. Wright,
Manager, Assessments Branch

Environmental Impact Statement
Proposed Electricity Transmission Line Lismore to Mullumbimby

A comprehensive environmental impact statement should adequately cover all matters specified in clause 57 of the Environmental Planning and Assessment Regulation, 1980.

The matters should be clearly and succinctly outlined in the text and where appropriate supported by adequate maps, plans, diagrams or other descriptive details to enable all concerned to gain a clear understanding of the full scope of the development and its likely impact on the environment.

The following particular matters should be included in its coverage:

1. Objectives and justification of the proposed transmission line and its compatibility with the existing regional transmission line network, including any provisions for rationalisation with existing lines to avoid proliferation and any proposals for longer term augmentation of that network.
2. Background information
 - . Proposed location and routes of the transmission line;
 - . Broad nature and extent of all works proposed, including any possible substation and ancilliary works;
 - . Tenure of affected lands and site boundaries;
 - . Details of environmental planning instrument provisions, affecting the proposed works and affected and adjacent lands.
3. Alternative routes examined to service the objectives of the proposal including identification of constraints and criteria used in the selection of the recommended route, together with clear reasons for the rejection of other alternative routes considered.
4. Description of the proposed transmission line including:
 - Details of the form and physical dimensions of tower structures, lines and conductors and any associated facilities that may be required;
 - Anticipated construction and siting problems;
 - Construction camps: establishment and disestablishment and general clean up and rehabilitation after construction;
 - Staging and hours of operations for the transmission line construction;
 - General provisions for access during construction and for servicing and maintenance during operation;
 - Provisions for clearance and land use within easements;
 - Accommodation for ground subsidence;
 - Environmental safeguards to minimise visual impact, hazard potential and the effects of the line on the natural environment, land use management, residential development and amenity, etc.

5. A full description of the existing environment, sufficiently comprehensive and quantified to allow a proper assessment of impact to the level of anticipated influence. Aspects to be considered to include:

- Topography, vegetation, meteorology, ecology and agriculture;
- Areas of visual significance and/or with potential for visual impact from the constructed line, e.g. skylines, treelines, river crossings, etc.;
- Buildings having architectural/heritage values;
- Archaeological and historical aspects;
- Adjoining and nearby land uses.

6. Assessment of environmental impact of the proposed works and the efficacy of the proposed environmental safeguards incorporated in the proposal to mitigate impact during the construction and operation of the proposed transmission line having regard for:

- . Areas likely to be subject to urban growth or other land use change (in particular National Parks) in the future;
- . Areas frequented for active or passive recreation;
- . Areas of particular scenic appeal; potential for skyline, treeline and topographic impact;
- . Land of particular importance to agriculture and management of same including land spraying;
- . Flood prone land;
- . Commercial forest, where commercial timber could be lost;
- . Cumulative effects taking into consideration existing linear developments including transmission lines, service corridors, roads and railways;
- . Other features of particular local or community concern;
- . Historic sites and/or archaeological sites.
- . Reference or proclaimed national parks, nature reserves or flora reserves;
- . Other natural areas which may have wildlife or habitat conservation value (including riverine, swamps, natural grasslands or woodlands).;
- . Clearance, disposal and control of vegetation with the transmission line easement.;
- . Provisions for existing and future land uses within the transmission easement.;
- . Visual impact including route selection, camouflaging, aesthetic treatment and landscaping, etc.;
- . Television/radio reception;
- . Wind noise;
- . Hazard including for lightning strikes, fires and security arrangements.

7. Authorities Contacted

The names of authorities and organisations contacted should be listed including any relevant local council, the National Parks and Wildlife Service, the Forestry Commission, the Department of Agriculture, the Soil Conservation Service, and any other authority that may have an interest in the area. Any comments relating to specific matters of interest raised by such authorities should be included in the EIS. The EIS should demonstrate how these comments have been taken into account in the final proposals for the subject development.

8 A clear statement is required concerning any band width of the route proposed in item 4 and the scope provided therein to accommodate individual landowners' requests for possible minor variations to the route, the precise location of towers and matters relating to construction practices, access arrangements and line/easement maintenance etc. consistent with the continuing use and management of lands that may be affected by the construction and operation of the transmission line. The Commission's standard practice for consultation and consideration of landowners' interests in this regard before the final alignment is determined should be described in the EIS.

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b/4/82

Appendix D

Landscape and Visual Assessment

ELECTRICITY COMMISSION OF NEW SOUTH WALES

LISMORE TO MULLUMBIMBY
132kV TRANSMISSION LINE

SINCLAIR KNIGHT AND PARTNERS

LANDSCAN PTY LTD
Landscape Architects
115 Sailors Bay Road
NORTHBRIDGE NSW 2063

Phone: 958 1533

MARCH 1987

APPENDIX D: LANDSCAPE AND VISUAL ASSESSMENT

1.0 OBJECTIVE: Purpose of the Study

The Visual Assessment methodology has been developed to meet the following objectives:-

- . To assess the ability of the study area to visually absorb a transmission line and to identify constraints, (where "constraints" are factors limiting the visual capability of the land to accommodate the line).
- . To provide a Visual Sensitivity map highlighting areas of high, moderate and low sensitivity to the proposal.
- . To provide guidelines by which the visual impact of the transmission line structures may be reduced.

2.0 ASSESSMENT

In order to achieve the objectives, an analysis has been undertaken of factors that offer the most significant visual constraints to the proposal.

These factors are:-

- . Topography
- . Vegetation Cover
- . Visibility

3.0 VISUAL SENSITIVITY

Visual Sensitivity has been assessed through the factors identified in item 2.0, that is Topography, Vegetation Cover and Visibility, and has been categorised as:

High
Moderate
Low

3.1 Topography

Topography has been analysed according to the individual landforms and their constraints to route selection.

High Sensitivity: Ridges

Ridges offer the highest constraint due to their elevation and degree of visibility.

Ridges are areas of high elevation that visually divide the landscape.

The extent of ridges has been defined to extend twenty metres (20m) from the highest point down the hillslope. Below 20 metres the towers would be concealed below the ridge top. (Refer to Figure 1).

Moderate Sensitivity: Valley Floor

The Valley Floor offers a moderate sensitivity to the transmission line due to their low elevation and lack of variation in elevation. Visibility is also contained within the valley, reducing the extent of impact from the transmission line.

The valley floor incorporates the river or drainage line and extends to the edge of the valley where the degree of slope changes.

Low Sensitivity: Hillslopes

The hillslopes offer low sensitivity to the proposal due to their inherent screening. Visibility of the tower is minimised as silhouetting of the towers against the sky is avoided since the line is located below the ridgeline. Those hillslopes of the lowest elevation exhibit the least constraint.

Hillslopes are areas of moderate relative elevation and extend between Valley Floors and Ridges.

3.2 Vegetation Cover

Vegetation has been analysed according to its structural form, percentage cover and density. Vegetation species have not been considered as they do not affect the visual sensitivity. The basis of the vegetation cover assessment has been to minimise disturbance to this cover.

High Sensitivity: Dense Vegetation

Dense vegetation offers a high constraint to the transmission line due to its uniformity of texture and colour. The introduction of a cleared easement through this vegetation cover would produce a major impact of high visibility.

Dense vegetation is vegetation cover greater than seventy percent (70%).

Moderate Sensitivity: Open Pasture and Tree Cropping

Open Pasture and perennial cropping areas offer a medium constraint to the proposal. The introduction of a cleared easement within these areas would create less impact than through dense vegetation. Tree cropping is also moderately sensitive as the introduction of a cleared easement would provide a moderate impact.

Open pasture is vegetation cover less than twenty percent (20%).

Low Sensitivity: Scattered Vegetation

Scattered vegetation offers a low constraint to the proposal due to its variation in form and texture. This exhibits screening capabilities thereby reducing the impact of a cleared easement and transmission towers.

Scattered vegetation, as defined in the factor maps, is vegetation cover between twenty and seventy percent (20-70%).

3.3 Visibility

Visual sensitivity depends on the locations from which the transmission line can be viewed, frequency, and duration of views combined with the purpose of views. The following viewpoints have been considered:-

Viewpoints

- . Towns and Villages
- . Rural Dwelling Clusters
- . Lookouts
- . Roads to scenic destinations

Visual Catchments

Visual catchments have been plotted from these viewpoints to determine the extent of view.

In order to assess the degree of visibility from the viewpoints nominated, the length of view has been considered.

The following view lengths have been formulated from site analysis and observation. Refer to Figure 3.

Foreground (0 to 500 metres)

This has been defined as the distance from the observer to 500 metres. Within this zone the transmission line would be prominent.

Middleground (500 metres to 2 km)

This has been defined as the zone beyond 500 metres to an extent of two kilometres. The transmission line within this zone would not be prominent but would be perceived.

Background (beyond 2 km)

The zone, beyond a two kilometre distance from the observer has been defined as background. Within this zone the transmission line would be difficult to perceive. Perception would decrease with distance.

View lengths and viewpoints have been assessed to define the following areas of visual sensitivity.

High Sensitivity

Foreground views from towns, villages and rural dwelling clusters are highly sensitive due to their high frequency and duration of view.

Foreground views from lookouts and roads to major scenic destinations are highly sensitive due to the scenic purpose of the view.

Moderate Sensitivity

Foreground views from main roads and local roads are moderately sensitive due to their frequency of view and middleground views from towns, villages, rural dwelling concentrations, lookouts and scenic drives are moderately sensitive.

Low Sensitivity

Middleground views from main and local roads, background views from towns, villages, rural dwelling clusters, scenic drives and lookouts are of low sensitivity.

4.0 EXISTING ENVIRONMENT: Landscape and Visual Sensitivity

The visual assessment component of the study, assesses the visual impact of a twin pole transmission line on the landscape. The landform's ability to visually absorb the transmission line and its sensitivity to the proposal has been analysed.

This is not an analysis of 'visual' or scenic quality'. Scenic quality is a subjective measure of the relative merit of a particular area in visual terms. As a result it can vary, and is dependent on the viewer. By assessing the visually sensitivity, that is the ability of an area to absorb the impact of changed conditions, the degree of objectivity is increased.

The existing environment has been assessed according to the methodology outlined previously. The following descriptions are based on the factors Topography, Vegetation cover and Visibility. Zones have been identified within the study area which exhibit similar characteristics based on the analysis of these factors.

ZONE 1:

This zone comprises the Lismore Flood Plain and extends from Lismore up the wide valley floors of the Wilson River, Cooper's Creek, and Terania Creek.

This area is low in elevation and topographically consists of Valley Floors.

Vegetation Cover is predominantly open pasture.

Foreground views from Lismore, Eltham and Bexhill along with foreground views from the Open Air Cathedral at Bexhill and the Scenic Reserve nominated by the National Trust between Bangalow and Lismore are highly sensitive.

Most of the remaining areas are moderately sensitive due to the combination of Valley Floor and Cleared Pasture. Foreground views occurring from Bangalow Road between Lismore and Bexhill, and Wyrallah Road are moderately sensitive.

ZONE 2:

Located to the Northwest and Southeast of Lismore this area is higher in elevation than the flood plain.

Predominant ridges in the area include the ridgeline running approximately North-South from Modanville to the Lismore Flood Plain and the ridge running east from Goonellabah to Wollongbar. The Hillslopes are dissected by the ridges and Valley Floors of Zone 1.

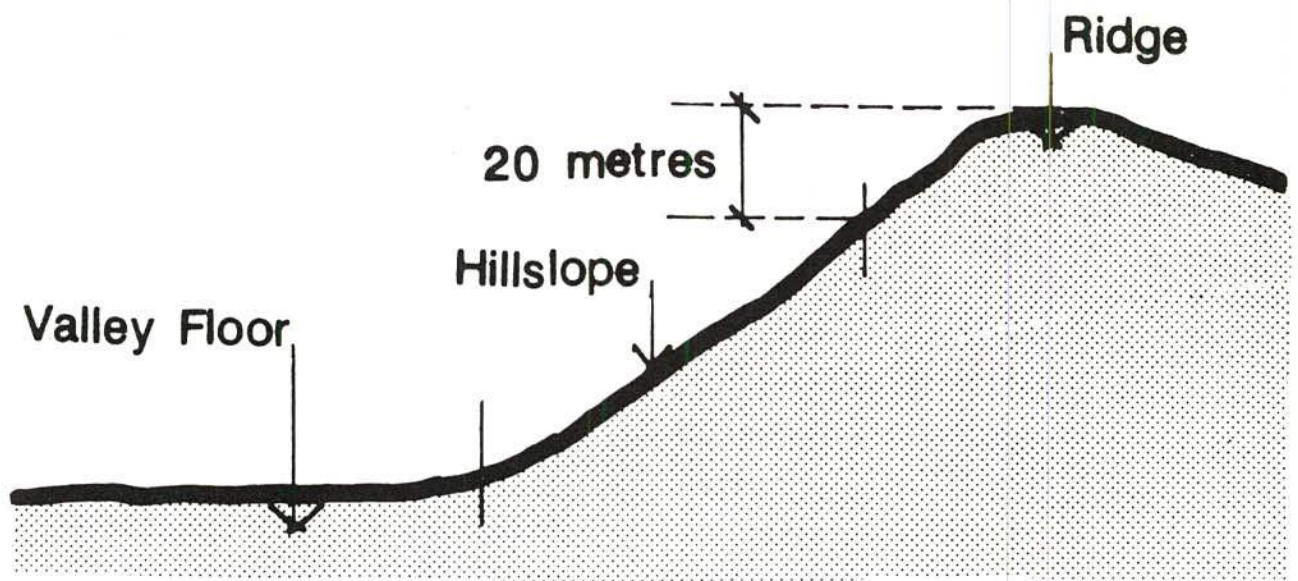


FIGURE 1 : TOPOGRAPHY

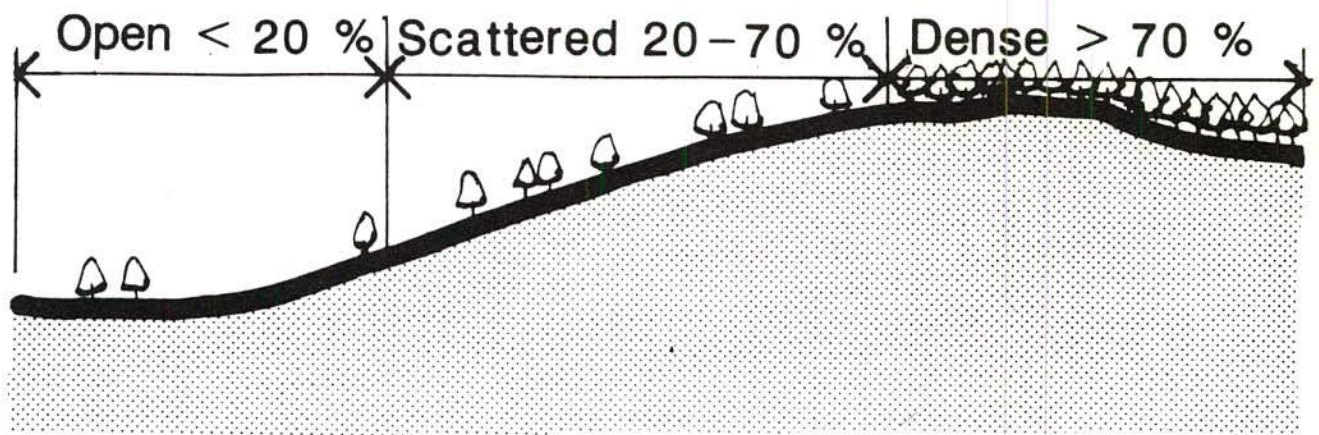


FIGURE 2: VEGETATION COVER

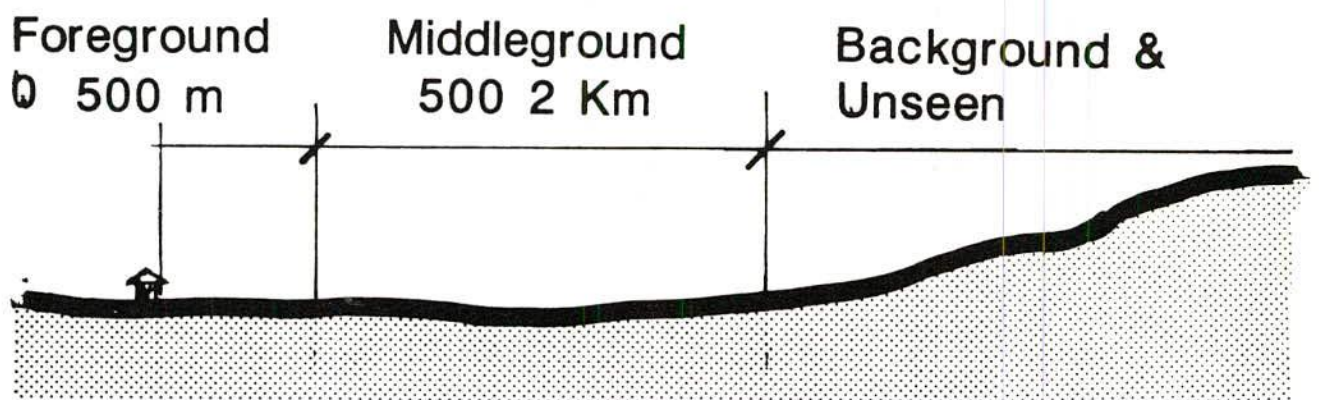


FIGURE 3 : VISIBILITY

NOT TO SCALE

Vegetation Cover is a combination of densities. Small pockets of dense vegetation occur to the south west of Modanville surrounded by areas of scattered vegetation. The rest of the area is predominantly Open Pasture.

Visual sensitivity is high within close proximity to the towns of Modanville Kerrong and Goonellabah. View catchments along the Dunoon Road to Modanville are mainly to the foreground and are moderately sensitive. Similarly the Bruxner Highway views are foreground.

Areas of the highest sensitivity to the proposal include:

- . Foreground views from the towns of Modanville, Keerong and Goonellabah.
- . Foreground views from the rural dwelling clusters adjoining the Dunoon Road and in the Boerrie Creek Valley.
- . Ridges identified previously.
- . Areas of dense vegetation.

Most of the remaining area is moderately sensitive to the proposal due to the extent of Open Pasture. Small areas of low sensitivity are present to the south of Goonellabah and amongst the scattered vegetation to the west of the existing transmission line.

ZONE 3

This is the largest zone within the study area and extends from Wollongbar to the south, Numulgi in the west and Federal in the north. Two sub-zones have been identified:-

Zone 3a

Topography is gently undulating in this sub-zone with few prominent ridgelines. Medium width Valley Floors and hillslopes occur.

Vegetation Cover consists of Open Pasture and some Tree Cropping around Pearce's Creek.

Significant viewpoints in the zone are from the towns of Bangalow, Booyong, Newrybar, Clunes, Pearce's Creek and Wollongbar.

Areas of high sensitivity include:

- . foreground views from these towns,
- . foreground view catchments from rural dwelling clusters adjoining Bangalow Road,
- . the ridgeline running east-west from Booyong.
- . the Scenic Reserve nominated by the National Trust.

The remaining areas are moderately sensitive due to the extent of Open Pasture.

Zone 3b Topography is more steeply undulating within this sub-zone and of higher elevation than the previous zones. Ridges are common and dissect the landform. Hillslopes are extensive and Valley Floors minimal, as the land is steeply undulating.

Vegetation is characterised by small areas of Dense Vegetation concentrated to the North and North West. There are large areas of scattered vegetation south-east of Repentance Creek. Tree Cropping is concentrated to the South-West of this zone.

Visibility is mainly within the foreground views from towns including Numulgi, Eureka, Federal and Goonengerry. Roads within the area are predominantly single lane sealed or gravel roads with low frequency and foreground views.

Areas of high sensitivity to the proposal include:

- . Foreground views from towns identified previously.
- . Ridges occurring between Eureka, Federal and Goonengerry, north of Bangalow to Byron View and between Corndale and Diamond Springs.
- . Areas of dense vegetation.

The remainder of the zone is dissected by moderately sensitive areas with some areas of low sensitivity occurring where scattered vegetation combines with hillslopes.

Zone 4

This Zone is located between the Nightcap State Forest and Zone 3.

The elevation of this zone is high, increasing from Zone 3. Ridges predominate with steep hillslopes. Valley Floors are lacking.

Vegetation Cover consists of large areas of dense vegetation and increasing areas of scattered vegetation to the north.

Areas of high sensitivity to the proposal include:-

- . The ridges
- . Dense Vegetation Areas
- . Foreground views from Dunoon, The Channon and Dorrroughby.
- . Foreground views from rural dwelling clusters
- . Foreground views from Rocky Creek Dam Road, Nightcap Range Road and Upper Coopers Creek Road.

Zone 5

This zone includes the forested Nightcap Range to the north west of the Study Area.

Topography consists of dominant ridges and steep hillslopes. Vegetation Cover is entirely Dense Vegetation.

Views within the zone are restricted while long views are available to these ridgetops from the other zones.

This area is highly sensitive to the proposal due to the presence of ridges and dense vegetation.

Zone 6

At the north eastern edge of the study area, this zone includes the escarpment, forming a prominent topographic feature of regional significance.

Vegetation Cover within the zone is predominantly Open Pasture with some scattered vegetation.

Visibility from and to the area is high. Coolamon Scenic Drive traverses the ridge along most of its length and has long views to the ocean.

This area is highly sensitive to the proposal.

5.0 ROUTE CORRIDOR COMPARISON

OPTION A

Option A crosses Character Zones 1, 2 and 4, identified in Section 4.0.

It follows Valley Floor (of medium visual constraint) out of Lismore to the north and skirts the hillslope region (of low visual constraint) on the eastern side of the Terania Creek Valley. It then follows the edge of Dense Vegetation to the south and east of the Whian Whian State Forest.

Vegetation within the corridor is predominantly open pasture (of moderate sensitivity) and scattered vegetation (of low sensitivity). Some areas of dense vegetation are crossed north of Dunoon and in the northern sections of the corridor.

Generally this Option avoids towns but is located near rural dwelling clusters.

Areas of high sensitivity crossed by this corridor include:-

Ridges:

- . North of Lismore: The corridor crosses a north-south ridge north of Lismore for a short distance. There is an opportunity to locate the transmission line within the saddle region of the ridge minimising its elevation and visibility. This would reduce the visibility from Lismore and residences on the outskirts.
- . East of Keerong: A high point, 178 metres above Terania Creek Valley Floor, is crossed. The transmission line should be located within the hillslope region either side of this high point. This would reduce visibility from the residences within the valley.
- . South of The Channon: The corridor crosses the saddle region of an east-west ridge, at right angles. It's distance at a high elevation is therefore minimised.
- . North of Dorroughby: Four north-south spurs are crossed for short distances at right angles.

Dense Vegetation Cover:

Generally crossings of short distance occur over the following dense vegetation areas:-

- . Boerie Hill
- . East of Keerong
- . South of The Channon
- . North of Dunoon
- . Repentance Creek
- . Goonengerry

Visibility

Route Option A corridor is located within the following foreground views (of high visual sensitivity)

- . Rocky Creek Dam Road, Nightcap Range Road and Upper Coopers Creek Road: This option crosses these roads to scenic destination points.
- . Rural Dwelling Clusters: Southeast and northwest of Blakebrook, southeast of Keerong, south of The Channon, west of Dorroughby, Repentance Creek, south of Goonengerry and west of Montecollum.

In summary this option crosses a number of ridges for short lengths and is screened from long views by the steeply undulating topography to the north.

It is generally removed from population centres but is within foreground views of a large number of rural dwelling clusters. Small areas of dense vegetation are crossed, creating adverse impacts where combined with ridges.

OPTION B

Option B crosses the Character Zones 1, 2, 3 and 4 identified in Section 4.0.

Option B parallels the existing NRE line for its entire length. It follows valley floor out of Lismore to the north before traversing the hillslope region along Booerie Creek. The northern portion of the route follows undulating to steep terrain.

Vegetation within the corridor is generally open pasture to the south (of moderate sensitivity) and scattered vegetation to the north (of low sensitivity). Some Dense Vegetation areas (of high sensitivity) are crossed in the northern section of this option.

This option is located within close proximity to the population centres of Modanville and Dunoon and within foreground views of several rural residential clusters. The Lismore/Dunoon Road is also crossed.

Areas of high sensitivity crossed by this corridor include :

Ridges

- . North-south ridge south of Modanville - At this location the corridor crosses this major ridge diagonally, minimising the length of transmission line at high elevation.
 - . South of Dunoon - Three ridges are traversed for a length of approximately 2.2 kilometres. Middleground views from Dunoon could be available.
 - . South of Dorroughby - A major north-south ridge is traversed at right angles, crossing at high elevation for approximately 1 kilometre. Views from the scattered residences located at the intersection of Arthur Road and one lane sealed road would be available to this location.
 - . North of Rosebank - The corridor crosses the ridge jointly occupied by the one lane sealed road leading north and connects to a high point near Emerson Road. Residences along Emerson Road could view the transmission line along with residences situated on the Rosebank Road.
- South of Goonengerry The ridge connecting the Goonengerry trig point is crossed lower down the spur. The highest point of the ridge is therefore avoided.

Dense Vegetation Cover

The following dense vegetation areas are traversed for short distances :

- . East of Modanville
- . South of Dorroughby
- . Turkey's Creek
- . North-east of Federal
- . Goonengerry

Visibility

Route Option B corridor is located within the following foreground views:

- . Rural residential clusters along the Lismore/Dunoon Road
- . Modanville - To the east of Modanville the corridor is located within the foreground views of Modanville.
- . Dunoon - From areas of Dunoon the corridor would be visible within the foreground.

In summary, this option crosses a number of prominent ridges and is visible from two population centres, Modanville and Dunoon. Residences situated along the Dunoon Road would gain foreground and middleground views of this option.

OPTION C

Option C crosses the Character Zones 1, 2 and 3 identified in Section 4.0.

Option C closely parallels the existing 66KV line to the south of Modanville, and then heads in a more easterly direction through the centre of the study area. It rejoins the existing transmission line near Dorroughby and follows on its eastern side to the Mullumbimby substation.

Generally the terrain covered is varied in elevation and steeply undulating.

Vegetation within the corridor is generally open pasture in the south (of moderate sensitivity), dense vegetation areas within the centre (of high sensitivity), and scattered vegetation to the north (of low sensitivity).

This option is removed from population centres, but is located within approximately one kilometre from Corndale and in proximity to rural dwelling clusters.

Areas of high sensitivity crossed by this corridor include:-

Ridges:

- . North-south ridge south of Modanville: For 1 kilometre the corridor is located on this ridge crossing it at right angles, minimising its distance at high elevation.
- . West of Corndale: Three ridgelines are crossed for approximately 2 kilometres at this location.
- . North of Rosebank: A major high point of 213 metres elevation is situated to the south of the existing transmission line. This corridor passes through this high point, increasing its visibility. There is the opportunity to locate the corridor north or south of this high point to avoid this impact.

Dense Vegetation Cover:

The following dense vegetation areas are crossed:-

- . Boerie Creek hillslopes: ribbon strips of dense vegetation along these hillslopes are interrupted for approximately two kilometres
- . North of Corndale
- . Boomerang Creek
- . Turkey Creek
- . Goonengerry

Visibility

Route Option C is located within the following foreground views (of high sensitivity).

- . Rural Dwelling Clusters located west and northwest of Tullera, south of Modanville, west and northwest of Corndale, at the intersection of Eureka Road and Fox Road, south of Goonengerry and west of Mentecollum.

In summary this option crosses many ridges through the centre and northern regions of the study area, a number of dense vegetation areas and is located within foreground views of numerous rural dwelling clusters.

OPTION D

Option D crosses the Character Zones 1, 2, 3 and 6 identified in Section 4.0.

It follows the same route as Option C to Tullera and then follows the central region of the study area through undulating terrain, becoming steeper in the north.

Vegetation within the corridor is predominately open pasture (of medium sensitivity). Some isolated areas of dense vegetation (of high sensitivity) and scattered vegetation (of low sensitivity) are crossed within the centre and northern areas.

This corridor is located within 500 metres to one kilometre of Numulgi and 1 kilometre of Eureka and Federal but is generally removed from rural dwelling clusters.

Areas of high sensitivity crossed by this corridor include:-

Ridges:

- . Modanville/Lismore Ridgeline: The corridor crosses this ridge for one kilometre at right angles, minimising the distance at high elevation. Residences situated along this road would obtain foreground views at this point.
- . West of Numulgi: Two ridges are crossed for short distances at right angles.
- . East of Numulgi: The corridor passes through the Numulgi Trig point at 169 metre elevation, and should be rerouted in a northerly direction to avoid this.
- . South of Corndale: A prominent ridge to the South of Corndale that divides a meander in the broad valley of Cooper's Creek is crossed by this corridor. Visibility to this ridgeline is high from the valley floor.
- . West of Federal: The corridor crosses two north-south ridges.

Dense Vegetation Cover:

The following dense vegetation areas are crossed:

- . Turella Dip
- . North & West of Federal
- . Corridors along Cooper's Creek

Visibility:

Route Option D is located within the following foreground views (of high sensitivity).

- . Rural dwelling clusters: south of Tullera, northwest of Eureka, south of Goonengerry and west of Montecollum Dip.

In summary this option avoids dense vegetation areas but is visible in the areas where it crosses ridges above wide valley floors. It is generally removed from rural dwelling clusters.

OPTION E

Option E crosses the Character Zones 1, 2 and 3 identified in Section 4.0.

This option passes close to Lismore by following the northern edge of the Wilson River Flood Plain. It then heads in an easterly direction within close proximity to the Bangalow Road, joining the other options around Goonengerry.

Vegetation within the corridor is predominantly open pasture (of medium sensitivity). Dense vegetation (of high sensitivity) is avoided.

This option is located generally within 1 to 1.5 kilometres from the population concentrations of Lismore, Numulgi, Bexhill, Eltham, Clunes, Booyong and Federal. Its proximity to the Bangalow Road and the rural dwelling clusters situated along it, also increases its visibility and frequency of view. Bangalow Road is crossed twice.

Areas of high sensitivity crossed by this corridor include:

Ridges

- . West of Clunes: two ridges are crossed for approximately 500 metres each.
- . South-East of Federal: three ridges are crossed at right angles for short distances.

Dense Vegetation

The following dense vegetation areas are crossed:

- . West of Numulgi: 200 metres of dense vegetation is crossed.
- . South of Federal: A small number of dense vegetation pockets are crossed.

Visibility:

Route option E is located within the following foreground views (of high sensitivity)

- . Rural Dwelling Clusters.: South of Tullera, northwest of Eureka, south of Goonengerry and west of Montecollum.

In summary although this option avoids ridgelines and dense vegetation areas, its visibility would be high due to the proximity to population centres, the Bangalow scenic road and the rural dwelling clusters situated along it. It also passes through the scenic preserve area nominated by the National Trust.

OPTION F

Option F crosses the Character Zones 1, 2 and 3 identified in Section 4.0.

This option follows the existing railway line east of Lismore and joins Option E around Booyong. It passes through the Wilson River Flood Plain (of moderate sensitivity) for most of its length to Booyong where it joins option E.

Vegetation within the corridor is entirely open pasture (of moderate sensitivity). Dense vegetation (of high sensitivity) is avoided.

Bexhill and Eltham are located within this option while Booyong is approximately eight hundred (800) metres away.

Areas of high visual constraint (defined in the Appendix D) crossed by this corridor include:

Ridges

- . West of Bexhill: The ridge associated with the Open Air Cathedral and lookout at Bexhill is crossed.

Dense Vegetation

No areas of Dense Vegetation are crossed.

Visibility

Route Option F is located within the following foreground views (of high sensitivity):

- . Bexhill: The township of Bexhill and the Open Air Cathedral is located within the corridor and foreground views would be available. Areas within foreground and middleground view of the open air cathedral and lookout should be avoided.
- . Eltham: Foreground views from Eltham would be available to the transmission line as it is located inside the corridor. Views from rural residential clusters surrounding Eltham would also be available.

Although this option limits the extent of impacts on the landscape by following the existing railway line, its visibility is very high due to its proximity to population centres. Variation in topography and vegetation cover is lacking which increases the length of uninterrupted views available from many viewpoints within the area, particularly residences. It also passes through the scenic preserve nominated by the National Trust.

Appendix E

Vegetation Survey

Electricity Commission of New South Wales

**Lismore to Mullumbimby
132 kV Transmission Line**

Sinclair Knight & Partners

Mount King Ecological Surveys

Part A

STAGE 1 VEGETATION SURVEY: CATEGORY IDENTIFICATION

1. INTRODUCTION

The Electricity Commission of New South Wales proposes to construct a 132 kV transmission line between the existing Lismore Substation and the site of the proposed Mullimbimby Substation on the Far North Coast of New South Wales. The region which the proposed line traverses supports a wide range of land uses, including lands of high nature conservation value. This survey is aimed at identifying areas of vegetation that the transmission line should avoid and areas where a transmission line would be acceptable with adequate environmental safeguards.

Particular attention has been paid to the habitat of rare and endangered flora and the existence of remnant or localised vegetation types inadequately conserved in the region.

2. METHODOLOGY

Initially the vegetation of the area was mapped into broad structural groups using 1:25 000 colour aerial photography. The groups identified were:

1. Rainforest
2. Undisturbed Forest
3. Disturbed Forest
4. Cleared Land

It should be noted that Category 3 includes a wide range of habitat types extending from partially cleared eucalypt forest to highly disturbed sites dominated by camphor laurel (Cinnamomum camphora) and areas with a scattered cover of eucalypts. Category 4 includes land covered by horticultural tree crops such as macadamia plantations, as well as cleared grazing land and urban centres.

A survey of literature relating to vegetation of the study area was undertaken and contact made with officers of the National Herbarium of NSW, and the National Parks and Wildlife Service. A list of rare and endangered plant species likely to occur in the study area was compiled using information provided by the National Parks and Wildlife Service.

3. FINDINGS

3.1 DESCRIPTION OF STUDY AREA

The townships of Lismore and Mullumbimby are on opposite edges of the Big Scrub region, a dissected low plateau which once supported an almost continuous stand of lowland rainforest. The plateau is at about 100-200 m altitude with a marked escarpment on the eastern and southern sides. The land rises gradually to the northwest where the Nightcap and Koonyum Ranges are to be found. An escarpment is also found extending along the northeastern edge of the plateau overlooking Mullimbimby and the Brunswick River valley.

The Big Scrub region has rich basaltic soils which are derived from lava flows which emanated from the Mount Warning volcano. The basalts of the region are composed of rhyolite derived from a more viscous lava which resulted from more recent eruptions. The rhyolite gives rise to soils of lower fertility and supports warm temperate rainforest or sclerophyll forests as opposed to the subtropical rainforest found on basaltic soils.

3.2 VEGETATION OF THE STUDY AREA

Prior to European settlement, the area was covered by rainforests and sclerophyll forest communities. Widespread clearing, particularly of the extensive rainforest stands of the 'Big Scrub' has resulted in the native vegetation stands being largely restricted to areas of steep country unsuitable for agriculture. The forests of the Nightcap and Koonum Ranges have remained because of the rugged topography and relatively poorer soils found in those areas.

Areas of forest which were disturbed in the past often support stands of exotic plants such as Camphor Laurel (Cinnamomum camphora) and Lantana (Lantana camara).

The major vegetation types occurring in the study area are described below.

3.2.1 Vegetation Types

. Rainforest Communities

As stated previously rainforest communities once covered significant tracts of the study area. The dominant rainforest type of the "Big Scrub" was subtropical rainforest of the White Booyong association. Examples of this association exist at Victoria Park, south-east of Lismore and Booyong and east of Lismore.

Other sub-tropical rainforest associations occurring in the area are the Black Bean association (eg. Big Scrub Flora Reserve) and the Pepperberry-Fig association (eg Boatharbour Recreation Reserve).

Warm temperate rainforests dominated by Coachwood (Ceratopetalum apetalum) are found on the rhyolite derived soils in the northwest of the study area.

Dry rainforests are also found in the study area. The sites on which they occur generally experience low water availability during the late spring - early summer period due to low rainfall, steep topography and poor water holding capacity of the soil. Examples exist at Wilson's Park and Hayters Hill.

. Sclerophyll Forest Communities

Sclerophyll forest communities are located on sites which are too infertile, dry or exposed to support rainforest communities. It is possible that prior fire history is also important in determining the extent of these communities.

Moist gullies generally support forests dominated by Flooded Gum (Eucalyptus grandis) and Brush Box (Lophostemon confertus). Open forests dominated by Blackbutt (E. pilularis), Tallowwood (E. microcorys), White Mahogany (E. acmenoides) and Grey Gum (E. punctata) are more common and cover much of the area taken up by sclerophyll forests in the study area.

Drainage lines and valley floors with sandy alluvial deposits generally support open forests dominated by Forest Red Gum (E. tereticornis) and River Oak (Casuarina cunninghamiana).

In the south-west of the study area, poorer, drier sites support open forests dominated by Spotted Gum (E. maculata) and Scribbly Gum (E. signata).

Small areas of swamp forest extend into the extreme east of the study area. These forests occur on wet soils of impeded drainage which are periodically flooded. The dominant species included Broad-leaved Paperbark (Melaleuca quinquinervia), Swamp Mahogany (E. robusta) and Swamp Oak (Casuarina glauca). Drier forests in near coastal areas support open forests dominated by Forest Red Gum, Blackbutt, Red Mahogany (E. resinifera), Scribbly Gum and Pink Bloodwood (E. intermedia).

. Disturbed Forest Communities

Various primary vegetation types are included within this category. Vegetation stands included within this category include partially cleared sclerophyll forests and degraded rainforest remnants. The latter are characterised by extensive invasion by exotic plants such as Camphor Laurel and Lantana, and often by high populations of the indigenous palm, Lawyer Cane (Calamus muelleri).

Disturbed forest areas were identified from aerial photographs and represent areas which have been partially cleared or where exotic plants are evident in the aerial photos. The degree of disturbance may vary widely and hence the capacity for regeneration is variable. Clearly the least disturbed areas have the greatest potential for regeneration and long-term viability.

. Cleared Lands

The bulk of the study area is taken up by grasslands of improved pasture species. Also included within this category are tree crop plantations and associated wind breaks.

3.2.2 Rare and Endangered Flora

A list of rare and endangered plant species likely to occur in the area (Table 2) was compiled using the latest unpublished update of the CSIRO's rare plants list together with information provided by the National Parks and Wildlife Service. All plants occurring in the North Coast Botanical Subdivision are listed and the location of collections of these species were studied. Those species which had not been collected within the study area were not included in the final list. Thus there may be additional rare or endangered plant species existing in the study area which are not listed as previous collections may have overlooked them. However rare or endangered plant species located on the preferred route have been detailed in the second phase survey.

The list identifies 54 individual plant species classed as rare or endangered of which over 60% typically occur in rainforest or rainforest margins. Only nine species are considered to be adequately represented in conservation reserves. Included amongst the list are a number of species whose long-term survival in the wild is in grave doubt; eleven species are classified as being endangered and at least three species have wild populations of less than 10 plants (Leigh, Boden and Briggs 1984).

3.2.3 Riparian Corridors

Continuous vegetation cover occurring along river banks may act as corridors for faunal movements between habitats. The conservation significance of such vegetation itself is therefore largely due to the protective cover they offer for native animals. Clearing of riparian corridors by a transmission line would effectively break the movement of faunal species which may effect the diversity and population of faunal species within isolated vegetation stands.

The route concepts as shown on the Section 2 exhibits cross a number of riparian corridors. These include:

- . Wilsons River - located approximately one kilometre south of Mullumbimby Substation. This corridor represents a link between the eastern extent of the Nightcap Range and more intermittent habitats further south along the Wilsons River. All options cross this corridor at the same location. This crossing is considered to be better than others available in the area.
- . Leycester Creek - all options cross Leycester Creek, north of Lismore Substation. The banks have been mostly cleared with the selected crossing point totally cleared and therefore unimportant.
- . Coopers Creek - south of Corndale Option D crosses a thin, though largely unbroken, riparian corridor. Further north Options A, B and C cross Coopers Creek affecting a more heavily vegetated corridor. These crossings will have a higher potential to impact faunal corridors due to the proximity to more continuous vegetation stands of the Nightcap Range.
- . Boomerang Creek - this creek runs south from Boomerang Falls to Corndale and is crossed by Options A, B and C. Each crossing is through vegetated areas. This corridor is important due to extent of vegetation cover from the Nightcap Range area to just north of Corndale.
- . Numulgi Creek - crossings of Numulgi Creek occur in cleared lands and therefore will not effect any corridors.

Overall, Options A, B, and C will have a greater impact on riparian vegetation whilst D and E will have only a minor impact. Option F will not effect any riparian vegetation prior to joining Option E.

It is recommended that riparian corridors should remain intact by either crossing through cleared lands or spanning existing vegetation. If clearing is necessary then low growing trees and shrubs should be established in order to avoid disruption to faunal movements.

3.2.4 Reafforestation

Sites of highest reafforestation potential in terms of benefits gained, for example erosion control, and reduced opportunity costs in foregoing agricultural production would be the steep lands near the forested slopes of the Nightcap Range and steep hills in riverine areas. Even though heavily disturbed vegetation communities can be regenerated through careful management it is considered that less disturbed areas, and areas generally closer to the heavily vegetated Nightcap Range, have the greatest capacity for reafforestation.

4. DISCUSSION

The native vegetation of the area has been greatly reduced in extent largely as a result of clearing for agriculture. Those intact areas remaining are of considerable value, particularly remnants of the once extensive Big Scrub rainforest.

The importance of these rainforest remnants cannot be stressed too highly. Not only are they now rare in the study area due to clearing, they represent vegetation communities of very restricted distribution on a state and national basis. They are remarkably diverse communities and the remnants are the habitat for a high number of rare and endangered plant species.

All rainforest areas identified in the study area and particularly those in Table 3 (Sites of High Vegetation Significance) have been regarded as absolute constraints to transmission line location. The transmission line should be sited to avoid these areas.

It is likely that some rare and endangered plant species which occur typically in rainforests still exist as isolated individuals in agricultural land or in areas mapped in Category 3. It is for this reason that the preferred route concept was intensively surveyed in order to identify any rare or endangered species as well as to establish the conservation value of all vegetation communities within the concept. This second phase study included in Part B of this Appendix.

Eucalypt forest communities are generally uncommon in the study area due to the originally wide extent of the Big Scrub rainforest. Most of the forest types are however reasonably common on the North Coast although some rare species may occur in these forests. Nevertheless the eucalypt forest communities in the area are of conservation significance and the transmission line should minimize intrusion into these areas.

In order to provide a ready means of appreciation of the relative importance of vegetation categories mapped, Table 1 lists the categories with its associated level of constraint, based on: the scarcity of the category within the study area as well as on a regional and statewide basis; the number of rare and endangered plant species likely to occur within each category and the structural and floristic diversity of each category.

Rainforest areas have been classed as an absolute constraint for the reasons expressed previously. Forest areas and other undisturbed vegetation stands offer a high constraint due to their relative scarcity in the Big Scrub area compared to cleared land. Disturbed areas are considered to be a moderate constraint at the level of mapping involved as they may contain populations of rare and endangered plant species. Further refinement of the constraints

offered by stands within this classification are detailed in the second stage survey and shown on Exhibits 4.1 to 4.4

TABLE 1 - LEVEL OF CONSTRAINT OF VEGETATION CATEGORIES

Category	Constraint Level
1. Rainforest	Absolute
2. Undisturbed Eucalypt forests	High
3. Disturbed forest	Moderate
4. Cleared land/Horticultural crops	Low

Phase two of the survey provides additional information on vegetation communities in proximity to the preferred route alignment and identifies small remnants and populations of rare and endangered species which the transmission line should avoid. Ground truthing and improvement of mapping are provided as well as a floristic list and distributional information for plant species within the study area.

5. RECOMMENDATION

From the vegetation mapped within the study area it is considered that Options D, E and F are superior to Options A, B and C as the latter traverse some undisturbed forest and better quality disturbed forests. There is little to separate the remaining options as each traverse similar lengths of disturbed vegetation stands. It will be necessary to undertake a more detailed survey of remaining routes in order to better define resultant impacts on vegetation communities and conservation values.

Roger Lembit
Botanical Consultant
November 1986

References

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TABLE 2 - RARE AND ENDANGERED PLANTS - LISMORE-MULLIMBIMBY
TRANSMISSION LINE

Species	Risk Code	Notes/Habitat
<i>Acacia bakeri</i>	3VC-	Brunswick River
<i>Acianthus amplexicaulis</i>	3VC-	
<i>Acronychia bauerlenii</i>	3VC-	Rainforest
<i>Amerphospermum whitei</i>	3RCa	
<i>Archidendron hendersonii</i>	3VC-	
<i>Archidendron muellerianum</i>	3VCa	Rainforest
<i>Argophyllum nullumense</i>	2RC	Rainforest
<i>Atalaya multiflora</i>	3E	Rainforest, Rotary Park, Lismore, Emery's Scrub. Only 5 plants in total.
<i>Austrobuxus swainii</i>	3RCa	Rainforest
<i>Austromyrtus fragrantissima</i>	3E	Rainforest. Only 6 trees in NSW.
<i>Backhousia anisata</i>	2VCa	Rainforest
<i>Baloghia marmorata</i>	3VC-	Rainforest
<i>Bosistoia selwymi</i>	3V	Rainforest
<i>Corchorus cunninghamii</i>	3E	Rainforest margins, may be extinct.
<i>Corokia whiteana</i>	3E	Gibbergunyah Range; Big Scrub Flora Reserve.
<i>Croton stigmatosus</i>	3RCa	
<i>Cryptocarya foetida</i>	3ECi	Littoral Rainforest, Brunswick Heads
<i>Cyperus rupicola</i>	3RC-	Nightcap NP
<i>Davidsonia</i> sp. (Mullimbimby-Currumbin)	2E	Rainforest
<i>Desmodium acanthocladum</i>	2V	
<i>Diploglottis campbellii</i>	3E	Rainforest, only 7 plants known
<i>Endiandra globosa</i>	2RC-	Rainforest
<i>E. hayesii</i>	2VC-	Rainforest
<i>Eucalyptus glaucina</i>	3VC-	Drier forests
<i>E. rummeryi</i>	3V	Rainforest margins
<i>E. tetrapleura</i>	2VC-	Forests
<i>Floydia praelata</i>	3VC-	Rainforest
<i>Gahnia insignis</i>	3RC	Nightcap N.P.
<i>Helichrysum vagans</i>	2RCa	Nightcap N.P.
<i>Helmholtzia glaberrima</i>	2RC	Rainforest
<i>Hibbertia hexandra</i>	2RC-	Rainforest
<i>Lepiderema pulchella</i>	2VC-	Rainforest
<i>Macadamia tetraphylla</i>	2VC-	Rainforest
<i>Millettia australis</i>	2VC-	Rainforest
<i>Ochrosia moorei</i>	2RC-	Rainforest
<i>Olearia heterocarpa</i>	2RCa	Nightcap N.P.

TABLE 2 (Contd)

Species	Risk Code	Notes/Habitat
<i>Owenia cepiodora</i>	3EC	Dry rainforest; 30 trees
<i>Oxylobium</i> sp. (Mt Warning-Gibraltar Range)	3RC-	
<i>Parsonsia lilacina</i>	3RC-	Wilson Park
<i>Phaius australis</i>	3VCa	Poorly drained coastal area, possibly extinct in NSW.
<i>Quassia</i> sp (Mt Nardi)	3RC-	Rainforest
<i>Rhodamnia costata</i>	2V	Nightcap N.P.
<i>Rhodamnia maideniana</i>	2RC-	Davis Scrub Nature Reserve
<i>Rutidosia heterogama</i>	2VC	Coastal
<i>Sarocochilus hartmannii</i>	3VC-	Nightcap N.P.
<i>Symplocos bauerlenii</i>	2VC-	Rainforest
<i>Syzygium hodgkinsoniae</i>	2VC-	Rainforest
<i>S. moorei</i>	2ECi	Rainforest
<i>Thozetia racemosa</i>	3VC-	Coastal
<i>Tinospora tinosporoides</i>	3EC-	Rainforest, Victoria Park
<i>Trichosanthes subvelutina</i>	3RC-	Rainforest, Victoria Park
<i>Uromyrtus australis</i>	2ECi	Nightcap N.P.
<i>Westringia blakeana</i>	2RCa	Nightcap N.P.
<i>Zieria</i> sp. (Nightcap Range)	2R	Nightcap N.P.

Risk Code

1. Species known only from type collection
2. Species with a very restricted distribution
3. Species with a large range but occurring in small populations
- X. Extinct
- E. Endangered
- V. Vulnerable
- R. Rare
- C. Conserved in conservation reserves
 - a. Population in reserves more than 1000
 - i. Population in reserves less than 1000
 - Population in reserves unknown

TABLE 3 - AREAS OF HIGH VEGETATION SIGNIFICANCE

Wilson Park, Lismore	Lismore 280103	Rainforest remnant-Hoop Pine association including a number of rare species
Rotary Park, Lismore	Lismore 288130	Disturbed dry rainforest remnant, including several rare species eg. <u>Atalaya multiflora</u>
Boatharbour Recreation Reserve	Lismore 322162	Only substantial remnant of alluvial subtropical rainforest, including rare species.
Johnsons Scrub	Lismore 412253	Black Bean association, Finest and most impressive remnant of the Big Scrub (Floyd 1977)
Davis Scrub Nature Reserve	Lismore 394067	Black Bean association - Rainforest remnant
Booyong Recreation Reserve	Lismore 435201	White Booyong association - Rainforest remnant
Big Scrub Flora Reserve	Lismore 320320	Largest Big Scrub remnant - Black Bean association
Minyon Falls Flora Reserve	Lismore 381340	Rainforest - White Booyong association
Boomerang Falls Flora Reserve	Lismore 360323	Rainforest - Black Bean association
Forests of Nightcap and Koolyum Ranges including Nightcap National Park, Whian Whian and Nullum State Forests	Generally north-west of study area	Moist Hardwood Forests with areas of Subtropical Rainforest including many rare species.
Hayters Hill (West)	Ballina 567282	White Booyong association - eastern edge of Big Scrub area
Hayters Hill (East)	Ballina 572281	Hoop Pine association, including rare species
Morton's Scrub	Lismore 398258	White Booyong association
Emery's Scrub	Lismore 477194	White Booyong association includes endangered species, <u>Atalaya multiflora</u>

TABLE 3 (Contd)

Wilson's River	Lismore 448360 452350	Eucalypt forest and subtropical rainforest along river bank (Byron Shire LES 1983).
Montecollum Area	Lismore 465370 466367	Small rainforest remnants
Brunswick River and flood plains	Ballina 517424	Flood plain forest and estuarine vegetation including mangroves and habitat of rare plant, <u>Acacia bakeri</u>
South-west Brunswick Heads	Ballina 530420	Large stand of dry heath with other vegetation types - swamp forests and rainforests
Tyagarah Dunes Belongil Swamp	Large expanse of dune country between Brunswick Heads and Byron Bay	Extremely complex vegetation dominated by heath communities and including wetland communities
South-east Mullimbimby	Ballina 523360 530345	Remnant forest including <u>E. tereticornis</u> now uncommon in Bryon Shire; mainly paperbarks (<u>Melaleuca quinquinervia</u>)

Part B

STAGE 2 VEGETATION SURVEY : ANALYSIS OF PREFERRED ROUTE

1. INTRODUCTION

The Electricity Commission of N.S.W. proposes to construct a 132 kV transmission line between Lismore and Mullumbimby on the Far North Coast of New South Wales. This survey is the second phase of a study aimed at assessing the impact of the proposed transmission line on the vegetation of the area.

The first phase consisted of a literature review, broad-scale mapping (1:100 000) of the vegetation types of the study area, an assessment of the significance of these vegetation types and identification of significant plant species and communities likely to be affected by the proposal. As a result of this and other studies a preferred route for the transmission line was chosen.

The present survey is aimed at describing the vegetation of the preferred route and suggesting means whereby detrimental impacts of the transmission line may be reduced to an acceptable level.

2. METHODS

Stands of vegetation occurring along the preferred route were visited over a two day period in July 1987. At each site the structure and dominant vegetation present were recorded to enable a general description of the vegetation occurring along the route to be prepared. All species existing at each site were recorded with special note being taken of the location of any rare or endangered plant species. Unknown species were identified by reference to Williams, Harden and McDonald (1984) and the herbarium of the Forestry Commission office at Coffs Harbour.

A vegetation map of the corridor of the preferred route was prepared at 1:25 000 scale with the aid of 1:25 000 1986 colour aerial photographs. The map identified the location of vegetation types described in the text of this report.

3. VEGETATION DESCRIPTION

The report prepared for phase one of the study stated that the vegetation of the Lismore-Mullumbimby area was originally dominated by rainforest communities of the Big Scrub with smaller areas of sclerophyll forest communities and, on coastal dunes, heath communities. Widespread clearing in the 1880's has resulted in the native vegetation stands being restricted to areas of steep country unsuited to agriculture.

The first report described the vegetation in terms of the following four broad structural groups:

Category	Type
1	Rainforest
2	Undisturbed Forest
3	Disturbed Forest
4	Cleared Land

That report found that most of the vegetation stands remaining in the Big Scrub area had high populations of exotic plants, notably Camphor Laurel (Cinnamomum camphora).

The preferred route was selected to avoid any known stands of remnant rainforest in relatively good condition. These are generally those stands surveyed by Floyd in his work for the National Parks and Wildlife Service.

3.1 NATURAL VEGETATION OF THE PREFERRED ROUTE

The natural vegetation of the preferred route consists predominantly of small, remnant and regrowth patches of subtropical and dry rainforest. These are usually highly disturbed by weed invasion and/or grazing. Other vegetation types occurring within or adjacent to the bandwidth are regrowth forests dominated by Brush Box (Lophostemon confertus) and a small area of Banksia integrifolia forest. Alluvial flats and low hillslopes near Lismore support remnant species such as Paperbarks (Melaleuca spp), Forest Red Gum (Eucalyptus tereticornis) and River Oak (Casuarina cunninghamiana).

These vegetation types are described below.

3.1.1 Disturbed Rainforest Remnants and Regrowth Areas (Category 3)

Remnant rainforest vegetation is the most common forest type in the area.

Structure and floristic diversity varies considerably and depends on habitat type, history and degree of disturbance, accessibility, size and stage of regrowth.

All areas have some degree of disturbance.

The rainforest remnants which show least disturbance and which are in best condition are those on steep, rocky slopes in inaccessible areas. Structure consists of several tree layers, with vines common and ferns locally common. Tree species vary but more common species include White Booyong (Argyrodendron trifoliatum), Cudgerie (Flindersia schottiana), Hairy Rosewood (Dysoxylum rufum), Yellow Carabeen (Sloanea woollsii), Sandpaper Fig (Ficus coronata), White Bolly Gum (Neolitsea dealbata) and Black Bean (Castanospermum australe). Common vines are Lawyer Cane (Calamus muelleri), Sarcopetalum harveyanum, Ripogonum discolor, Parsonsia fulva, and Native Wisteria (Millettia megasperma). Ferns may be locally abundant with common species Bird's Nest Fern (Asplenium australasicum), Tree Ferns (Cyathea spp.) Shiny Shield Fern (Lastreopsis acuminata) and Rough Maidenhair (Adiantum hispidulum).

These areas have relatively low amounts of weed invasion due to good canopy cover but weeds may be prevalent in gaps and along margins. Major weed species are Camphor Laurel, Lantana (Lantana camara), Crofton Weed (Ageratina adenophora), Mist-flower (A. riparia) and Wild Tobacco (Solanum mauritianum). Large-leaved Privet (Ligustrum lucidum) is common towards Lismore.

As a result of the field survey two rainforest remnants were found to be in sufficiently good condition to map as Category 1. These are a stand north of the Wilson's River less than 1 kilometre south of the Mullumbimby Power Station and another about 1 kilometre north of the village of Eureka. The final route should avoid these stands.

Information provided by the survey also enabled the separation of Category 3 into two classes: 3A, moderately disturbed and 3B, highly disturbed. The moderately disturbed stands exhibit the vegetation characteristics described above with moderate levels of infestation by exotic plants.

Most highly disturbed (or rainforest regrowth) patches occur in the more accessible areas. Camphor Laurel dominates the vegetation forming between 50 and 100% of canopy cover. This species is present at all levels from seedlings and saplings to mature trees. Generally the above mentioned weeds are abundant with Large-leaved Privet common in many areas.

The native species present in these areas vary according to the stage of regrowth and extent of weed invasion. The most common are Red Kamala (Mallotus philippensis), Blackwood (Acacia melanoxylon), Guioa (Guioa semiglaucula) and Foambark Tree (Jagera pseudorhus).

3.1.2 Regrowth Sclerophyll Forests (Category 3B)

Small areas of vegetation dominated by Brush Box also occur along the preferred route. These stands are generally regrowth vegetation recovering after past clearing and/or fire. These have a high level of disturbance with Camphor Laurel being common and have been mapped in Category 3B. The understorey is generally sparse with rainforest species, weeds and Tick Bush (Helichrysum diosmifolium) commonly occurring.

3.1.3 Banksia integrifolia Open Forest (Category 2B)

A small area of Banksia integrifolia open forest occurs on a south facing hillside above Numulgi. Camphor Laurel is common among the canopy and as saplings. The understorey consists of Bracken Fern (Pteridium esculentum) and Bladey Grass (Imperata cylindrica) with few other species suggesting a history of frequent fire. This community has been mapped a Category 2B.

This vegetation type seems fairly robust although the extent to which it represents the original vegetation is unknown. Nevertheless it is an unusual vegetation type in the Big Scrub area and should be protected. The preferred route skirts the northern edge of this stand of vegetation. The final route alignment should be selected to ensure that vegetation clearance requirements of the easement do not impinge on the stand.

3.2 RARE AND ENDANGERED PLANTS

The report for phase one of the study identified 54 plant species currently listed as rare and endangered which are likely to occur in the study area. Of these 60% occur in rainforest or rainforest margins.

The detailed survey along the preferred route found only two of these species, Endiandra hayesii (2VC-) and Macadamia tetraphylla (2VC-). As indicated by the coding in brackets both these species are classed as vulnerable with relatively small ranges and although represented in conservation reserves their populations in reserves is unknown.

Endiandra hayesii was found in a small patch of rainforest on the northern side of the Wilson's River less than one kilometre south of the Mullumbimby Substation. This rainforest patch is in better condition than many others along the preferred route and some active management is taking place to assist in its preservation. The stand has been avoided by deviating the line to the east.

Macadamia tetraphylla was located as a single seedling one metre high with a number of other rainforest tree species within pasture about 2.5 kilometres south of the Mullumbimby Substation. It would be difficult to justify expense on the protection of this single plant as there is no certainty of long-term management to ensure its continued survival. Populations of Macadamia tetraphylla are known from Mount Warning National Park and the Davis Scrub, Limpinwood and Numinbah Nature Reserves.

3.3 WILDLIFE VALUES OF REMNANT FORESTS

In general it can be expected that the better the condition of a forest stand the greater habitat value it will have. This is particularly true of the rainforest remnants where better condition implies greater structural and floristic diversity than disturbed stands.

Disturbed stands may attain greater value than would otherwise be the case where they provide a corridor for wildlife movement, particularly in riparian situations. In the case of the preferred route the highly disturbed and isolated nature of the riparian stands indicates their value may not be great. Retention of middle and lower strata vegetation will minimise the effect on wildlife movement. As a general rule the riparian stands along the route are of low value from a plant conservation viewpoint due to the high incidence of exotic weeds. This includes stands along Wilson's River north of Federal.

4. CAPACITY FOR REGENERATION AND/OR REAFFORESTATION

In the initial report it was indicated that areas of prime suitability for reforestation were remnant vegetation stands near the Nightcap Range. This was suggested as it was felt this would maximise wildlife values of reforestation projects and present less conflicts with agricultural land use.

In general most land along the preferred route is suitable for reforestation with appropriate species and a long term commitment to management. However extensive long term maintenance is necessary to control invasion of Camphor Laurels into regenerating areas. Within the remnant/regrowth patches there is considerable regrowth of native species except in areas where Camphor Laurel and Large-leaved Privet are common. Present regeneration on pastures and

margins of existing rainforest consists mainly of Camphor Laurel. This species is actively invading and spreading over large areas and would be a threat to any reafforestation program.

Suffice to say the remnant rainforest patches in best condition have the greatest potential for successful regeneration.

5. REFERENCES

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LISMORE - MULLIMBIMBY TRANSMISSION LINE

Floristic List for Preferred Route

SCIENTIFIC NAME	COMMON NAME
<u>Ferns</u>	
<i>Adiantum hispidulum</i>	Rough Maidenhair
<i>Asplenium australasicum</i>	Bird's Nest Fern
<i>Arthropteris tenella</i>	
<i>Blechnum patersonii</i>	
<i>Cyathea australis</i>	Rough Treefern
<i>Cyathea cooperi</i>	Straw Treefern
<i>Cyathea leichhardtiana</i>	Prickly Treefern
<i>Diplazium dilatatum</i>	
<i>Lastreopsis accuminata</i>	
<i>Microsorium diversifolium</i>	
<i>Pteridium esculentum</i>	Bracken Fern
<u>Palms</u>	
<i>Archonotophoenix cunninghamiana</i>	Bangalow Palm
<i>Calamus muelleri</i>	Lawyer Cane
<u>Vines</u>	
* <i>Anredera cordifolia</i>	Madiera Vine
<i>Capparis sarmentosa</i>	
<i>Carronia multisepala</i>	
<i>Calystegia marginata</i>	
<i>Cayratia clematidea</i>	
<i>Celastrus australis</i>	
<i>Cissus antarctica</i>	Water Vine
<i>Derris involuta</i>	
<i>Eustrephus latifolius</i>	Wombat Berry
<i>Fawcettia tinctoroides</i>	
<i>Flagellaria indica</i>	
<i>Geitonoplesium cymosum</i>	
<i>Hibbertia scandens</i>	
<i>Maclura cochinchinensis</i>	
<i>Malaisia scandens</i>	
<i>Milletia megasperma</i>	
<i>Pandorea pandorana</i>	Wonga Vine
<i>Parsonsia fulva</i>	
* <i>Passiflora edulis</i>	Passion fruit
* <i>Passiflora subpetala</i>	
<i>Rauwenhoffia leichhardtii</i>	
<i>Ripogonum album</i>	
<i>Ripogonum discolor</i>	
* <i>Senecio mikanioides</i>	
* <i>Tradescandia albiflora</i>	Wandering Jew

Trees, Shrubs and Herbs

Acacia melanoxylon
Acmena hemilampra
Acmena Smithii
*Ageratina adenophora
*Ageratina riparia
Alphitonia excelsa
Alpinia caerulea
Anthocarapa Sp.
Aphananthe philippensis
Argyrodendron trifoliatum
Argyrodendron distylis
Arytera divaricata
Araucaria cunninghamii
Austromyrtus bidwillii
Baloghia lucida
Banksia integrifolia
Bridelia exaltata
Capparis arborea
*Cassia floribunda
Castanospermum australe
Casuarina cunninghamiana
Cinnamomum oliveri
Cinnamomum virens
Citriobatus lancifolius
Citriobatus paniculatus
Citronella moorei
Colocasia sp
Cordyline petiolaris
Cryptocarya glaucescens
Cupaniopsis parvifolia
Daphnandra sp
Decaspermum parviflorum
Diploglottis australis
Diospyros fasciculosa
Dysoxylum fraserianum
Dysoxylum rufum
Elaeocarpus grandis
Elaeocarpus obovatus
Elattostachys nervosa
Endiandra discolor
Endiandra hayesii
Endiandra muelleri
Endiandra pubens
Eupomatia laurina
Ficus coronata
Ficus macrophylla
Ficus virens
Ficus watkinsoniana
Flindersia australis
Flindersia schottiana
Geissois benthamii
Glochidion ferdinandi

Blackwood
Broad-leaved Lilly Pilly
Lilly Pilly
Crofton Weed
Mist Flower
Red Ash
Native Ginger
Incense Cedar
Rough-leaved Elm
White Booyong
Twin-leaf Coogera
Coogera
Hoop Pine
Python Tree
Brush Bloodwood
Coast Banksia
Brush Ironbark
Brush Caper Berry

Black Bean
River Oak
Oliver's Sassafras
Red-barked Sassafras
Narrow-leaved Orange Thorn
Orange Thorn
Churnwood

Broad-leaved Palm Lily
Jackwood
Small-leaved Tuckeroo
Socketwood
Silky Myrtle
Native Tamarind
Grey Ebony
Rosewood
Hairy Rosewood
Blue Quandong
Hard Quandong
Green Tamarind
Rose Walnut
Velvet Laurel
Green-leaved Rose Walnut
Hairy Walnut
Bolworra
Sandaper Fig
Moreton Bay Fig
White Fig
Strangling Fig
Teak
Cudgerie
Red Carabeen
Cheese Tree

Glochidion sumatranum
Goodia latifolia
Guioa semiglanca
Halfordia kendack
Helichnysum diosmifolium
Hodgkinsonia ovatifolia
 **Hypochoeris radicata*
Jagera pseudorhus
 **Lantana camara*
Lepidosperma sp
 **Ligustrum lucidum*
 **Ligustrum sinense*
Lomandra longifolia
Macadamia tetraphylla
Macaranga tanarius
Mallotus philippensis
Neolitsea australiensis
Neolitsea dealbata
Olea paniculata
Omalanthus populifolius
Pittosporum undulatum
Rhodamnia rubescens
Sarcomelicope simplicifolia
 **Senecia madagascariensis*
 **Sida rhombifolia*
Sloanea australis
Sloanea woollsii
 **Solanum mauritianum*
Stenocarpus salignus
Streblus brunonianus
Synoum glandulosum
Syzygium crebrinerve
Syzygium francisii
Syzygium luehmannii
Toona australis
Tristaniopsis laurina
Wilkiea huegeliana

Grasses

**Axonopus affinis*
Oplismenus imbecilis
 **Pennisetum clandestinum*
 Several other grasses in pastures

Umbrella Cheese Tree

Guioa
 Saffron Heart
 Tick Bush
Hodgkinsonia
 Cat's Ear
 Foambark Tree
Lantana

Large-leaved Privet
 Small-leaved Privet
 Prickly Mat-Rush
 Queensland Nut
Macaranga
 Red Kamala
 Green Bolly Gum
 White Bolly Gum
 Native Olive
 Bleeding Heart
 Mock Orange
 Scrub Turpentine
Bauerella

Paddy's Lucerne
 Maiden's Blush
 Yellow Carabeen
 Wild Tobacco
 Scrub Beefwood
 Whalebone Tree
 Scentless Rosewood
 Purple Cherry
 Giant Water Gum
 Riberry
 Red Cedar
 Water Gum
 Veiny Wilkiea

Whiskey Grass

Kikuyu

* Introduced species

Appendix F

Wildlife Survey

Electricity Commission of New South Wales

Lismore to Mullumbimby

132 kV Transmission Line

Sinclair Knight & Partners

Mount King Ecological Surveys

Appendix F

WILDLIFE SURVEY

1. INTRODUCTION

The transmission line will pass through the coastal lowlands associated with Richmond River systems (Environmental Region 26) and the broad valleys of the Tweed River (Environmental Region 27). The terrain is described as 60% undulating, 20% hilly and 20% mountainous with a vegetation cover that is 40% open eucalypt forest and 60% mixed closed forest. 20% of the land cover has been altered by grazing and forestry and 40% converted to introduced pasture and crops (Laut et al, 1980a and b).

The area to be affected by the proposed transmission line contains a mosaic of vegetation representing a wide range of types. The land cover ranges from dense rainforest to open dry sclerophyll forest, wetland vegetation and open grassland. As a consequence there is a wide variety of habitats within the area. The steep hills and escarpments associated with the Dividing Range form a distinctive habitat, as do the many streams and rivers flowing from the hills to the coast. Associated with the streams are numerous swamps and other waterbodies that support a distinctive flora and fauna.

For the purpose of this study the area was divided into 5 habitat types: rainforest, forest (including Hoop Pine plantations) and woodland, cleared land, escarpment and wetlands (both lentic and lotic). These habitat support a diverse range of wildlife species.

Although most terrestrial vertebrates will exploit several different types of habitat e.g. rainforest, river margins and dry forest some species are restricted to certain habitat types. Thus an evaluation of each habitat depends upon the number of associated species and the proportion of species that can be considered in need of conservation measures.

2. BACKGROUND INFORMATION

This area and the surrounding region has been the target of a considerable number of faunal surveys. Apart from the general information on the distribution of fauna obtained from The Atlas of Australian Birds (Blakers et al, 1984), Strahan (198) and Cogger (198) there are numerous reports of surveys of specific areas.

The Forestry Commission of N.S.W. (1983) has a faunal list of the Casino District which partially covers the survey area and a description of the fauna of the Terania Creek area (Forestry Commission of N.S.W., 1979). Surveys have been reported from the Urbanville region (Pugh, 1982), Mount Warning (National Parks and Wildlife Service, 1979), Big Scrub region (Holmes, 1986) and the Byron Bay region (B.E.A.C.O.N., 1981, Martin, 1976). Other surveys of the area include those by the Australian Museum (1976) of East Australian rainforests and by the Conservation and Wildlife Society (1978). Distribution maps of mammals in the northern coast and tablelands are given in Denny and Press (1982).

3. ANALYSIS OF DATA

The number of bird and mammal species within each habitat type (not escarpment) was calculated from the species lists and habitat preferences; from these figures the proportion of birds and mammals occupying each habitat was obtained. Also the number of species of conservation concern in each habitat was obtained and the proportion of important species calculated. Species of conservation concern included those with low and/or declining status, limited distribution, included on international treaties etc.

4. RESULTS

Of the more than 250 bird species known from the region the majority (64%) are found in the dry forest habitat. Cleared habitat supports about 25% of the total number of bird species and wetlands about 24%. The rainforest habitat supports 16% of the avifauna. These numbers are approximate only as many species use all habitats.

For the native mammals (bats excluded) about 92% occupy the dry forest habitat, 33% are found in the rainforest, 18% in the cleared areas and 10% in the wetlands. The proportion of species of conservation concern in the dry forest is 5% for birds and 5% for mammals. In the rainforest this is 24% for birds and 8% for mammals and in the cleared areas the proportions are 16% (birds) and 0% (mammals). 19% of the avifauna and 25% of the mammals are considered of conservation importance in the wetlands.

5. CONCLUSIONS

5.1 Ranking of Habitats

Although the dry forest supports the widest range of faunal species, it does not have many species of conservation importance associated with it. Conversely, the rainforest and wetland habitats support a limited number of species but a high proportion of animals of conservation importance. The cleared (grassland) habitat is low in faunal diversity and contains few species of importance (most are not limited to this habitat).

On the basis of the above information the habitats are ranked in order of importance as rainforest (highest importance), wetlands, forest and cleared (lowest importance). The wide range of bird species of conservation importance in the rainforest includes the Eastern Bristle Bird, paradise Riflebird, Topknot Pigeon and Rufous Scrubbird. In the wetlands habitat the important birds include some vulnerable species such as the Black-necked Stork and Brolga and migratory waders e.g. Latham's Snipe, Pectoral Sandpiper.

The habitats can also be ranked in terms of their area and distribution. Forested and cleared lands are widespread throughout the region and occur as large parcels of land, whilst rainforest and wetlands are in discrete areas and are not as widely distributed. This again leads to a ranking of habitats similar to that derived from the fauna analysis.

5.2 Impact

The construction of a transmission line can have various impacts upon the natural environment. The clearing of the easement can result in the loss of some habitat. In the case of forested or cleared land this has little impact upon the fauna as these habitats are widespread and common and it has been shown that the creation of a grassland habitat within timbered land can lead to an increase in the diversity of species. The removal of large trees can have some effect upon nesting species but this would be small. If the middle and lower story vegetation is encouraged to grow along the route then the construction of the transmission line will not significantly affect the movement of small ground species through the area.

Disturbance of the escarpment habitat may have some impact upon the fauna as this habitat is limited and cannot regenerate. The escarpments can also be used as wildlife corridors and should not be disrupted. It is recommended that the transmission line avoid escarpment areas as much as possible.

Removal of vegetation from along rivers etc may result in the creation of barriers to wildlife movement along streamside corridors. It is recommended that minimum tree removal take place along watercourses and if clearing is necessary then regrowth of middle and lower strata vegetation regrowth be encouraged. This issue is further addressed in the second phase vegetation survey contained in Appendix E2.

There is a possibility of wildlife-transmission line collisions if the route passes over or near waterbodies. As some of the waterbirds are of conservation significance care should be taken to avoid waterbodies if possible. If powerlines are constructed near waterbodies then the likelihood of collision can be minimized by attaching streamers etc to the lines.

There should be no construction of the transmission line through rainforest habitat. This habitat is limited in the area (see Exhibit 2.3) and is of high conservation importance. Changes to the floral composition due to the opening of the canopy structure and changes to the soil structure are likely to affect many of the species associated with this habitat. There are many invertebrate species endemic to rainforests (Kikkawa and Monteith, 1980), as well as some vertebrates. Loss of small amounts of this limited habitat could result in a reduction in the overall population status of some wildlife species.

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Appendix G

Electric and Magnetic Field Effects

Appendix G

ELECTRIC AND MAGNETIC FIELD EFFECTS

1. FACTORS ASSOCIATED WITH ELECTRIC AND MAGNETIC EFFECTS

When transmission lines are energized, electric and magnetic fields are created in the space surrounding the live conductors (wires). The electric field intensity at any point depends on the operating voltage (volts) whilst the magnetic field varies with the line current (amps). The strengths of these fields decrease rapidly with increasing distance from the live conductors.

1.1 Electric Field

The earth's natural electric field ranges from 100 V/m (volts per metre) in fair weather to up to 20 000 V/m or 20 kV/m in thunderstorms. Inside dwellings, the proximity of domestic appliances and low voltage wiring produces ambient electric fields of 0.1-100 V/m depending on the mains voltage and the distance from which the field is being measured. An electric field is not generally noticeable to human beings until it reaches about 10 kV/m.

In close proximity to a transmission line, objects that are insulated from the ground may develop an electric charge, similar to the static charges that build up on a person who walks across a nylon carpet. For example, a rubber-tired tractor operating under high voltage transmission lines may give off small spark discharges if a person in contact with the ground touches the tractor.

However, occasional spark discharges are not harmful. Persons on the easement will not build up any charge unless insulating (e.g. plastic or some rubbers) footwear is worn. Most large metallic objects in the vicinity of the line, particularly long parallel objects such as wire fences, would be earthed by the Electricity Commission during construction. This will prevent them from building up any electric charge. Where necessary, special arrangements would be made for electric fences.

Figure 1 compares the electric field strengths of typical 132 kV, 330 kV and 500 kV Electricity Commission transmission lines with that of a 765 kV transmission line in the United States which was approved in 1978 following a major public inquiry. The figure has been prepared for the lines at their normal operating voltage and at a typical operating temperature, and shows the decrease in the strength of field with increasing distance from the conductors. The curves apply at the point of the span where the conductors are closest to the ground, and are applicable for cleared level ground where there is no shielding provided by conducting objects such as structures or vegetation. In normal operation, the electric field strength on the easement of the Electricity Commission's 132 kV transmission lines is less than 2 kV/m in the localized area under the low point of a typical span, and is less than 0.5 kV/m at the edge of the easement. People would not generally be able to perceive such low electric fields.

1.2 Magnetic Field

Naturally-occurring magnetic fields in the earth's atmosphere generated by solar activity, thunderstorms and the solar and lunar cycles that influence electric or wind currents in the ionosphere can reach levels of 500 milliteslas; the earth itself has a static magnetic field of about 0.05 millitesla. Inside dwellings, magnetic fields of up to 0.5 milliteslas or higher occur close to many common household appliances.

Under the low point of the span of a typical 132 kV transmission line in normal operation, where the conductors are closest to the ground, the magnetic field strength would generally be less than 0.003 milliteslas.

A magnetic field of about 250 milliteslas is required to induce a perceptible current in the human arm. In countries where exposure standards have been set, the limit for occupational exposure (generally taken as eight hours a day) is 5 milliteslas. The field within the proposed transmission line easements would be more than a thousand times lower than this, and outside the easement it would be very much lower still.

1.3 Electric and Magnetic Field Measurements

As part of the community consultation program and in response to requests received at the public meetings, Commission representatives carried out electric and magnetic field measurements in the vicinity of the existing Lismore to Mullumbimby 66 kV transmission line, which is owned and operated by Northern Rivers Electricity.

A number of measurements were carried out in the Lismore, Mullumbimby and Modanville areas. Measurements were taken near the existing 66 kV line as well as inside residences close to the line.

The electric and magnetic field strength readings under the transmission line indicated that the electric field was generally less than 0.6 kV/m and the magnetic field less than 0.002 millitesla. At a distance of 20 metres from the line these field strengths dropped substantially to less than 0.1 kV/m for the electric field and less than 0.0002 millitesla for the magnetic field.

Electric and magnetic field strengths were measured in a number of residences in close proximity to the line. These measurements showed quite clearly that the existing line had no measurable influence on the field levels in these residences. In fact, the major source of magnetic fields in the residences were due to common household electrical appliances.

For example, near television sets magnetic fields up to 0.009 millitesla were measured, and at a distance of about one metre the field was measured at 0.0002 millitesla. Magnetic fields up to 0.001 millitesla were measured near electric stoves and near an electric welder the field exceeded 0.01 millitesla, which is about five times higher than the field measured under the 66 kV transmission line.

In addition to the measurements outlined above, the opportunity was taken to more fully discuss concerns regarding electric and magnetic fields and their alleged effects on human and animal health.

1.4 Electric and Magnetic Fields and Public Health

Humans are constantly exposed to electric and magnetic fields of natural and artificial origin at a variety of frequencies. Some of these fields emanate from such familiar appliances as television sets, hair dryers, radios, radar, and microwave ovens. Some, like the electromagnetic fields that assist in the healing of bone fractures, have beneficial uses; others, such as x-rays have both beneficial and adverse effects. However, it must be emphasized that high voltage transmission lines operate at extremely low frequency (ELF), and the electric and magnetic fields associated with them should not be confused with forms of radiation, such as microwaves and x-rays, which have very much higher frequencies, behave in a different manner and have quite different effects. Nevertheless, in recent years, members of the public have expressed some concern that the electric and magnetic fields associated with transmission lines might have harmful effects on the health of humans, and animal and plant life.

In 1984, a joint group of the World Health Organization and the International Radiation Protection Association studied all available research, and approved the publication of Environmental Health Criteria 35: Extremely Low Frequency (ELF) Fields. This report concludes that:

'Adverse human health effects from exposure to ELF electric field levels normally encountered in the environment or the workplace have not been established.'
(WHO 1984, 88)

The Radiation Health Committee of the Australian National Health and Medical Research Council has advised that this WHO document was the most authoritative on the subject currently available, and considered that its conclusions and recommendations offered an acceptable basis for the design and operation of high voltage transmission lines.

The designs and practices of the Electricity Commission are consistent with the World Health Organization's conclusions and recommendations. Further, to ensure that the Electricity Commission is kept well informed on these matters, close contact is maintained with leading experts around the world and particular attention is paid to the findings of public inquiries and the results of independent reviews.

The Health Department of Victoria recently commissioned an independent review of the transmission line and substation design practices of the State Electricity Commission of Victoria (SECV), in relationship to health and safety. The report arising from this review, which was conducted by Dr H B Graves (March, 1986) of the United States, compared levels of electric and magnetic fields found in the everyday environment with those produced by transmission lines and substations, as well as reviewing the scientific literature on the biological effects of electric and magnetic fields. In the report, Graves stated:

'[Concerning] levels of electric and magnetic fields found in the everyday environment: transmission lines are not the only, and, in many cases, are not the most powerful, sources of such fields. Indeed, simply bending over at the waist will induce internal electric currents comparable to those induced by a power frequency magnetic field of 0.1-0.2 microtesla. These points take on particular significance when it is realized that some of the concern about

biological effects stems from studies suggesting that magnetic field strengths of less than 0.1 microtesla are somehow associated with adverse effects. None of the epidemiological studies reported to date have adequately quantified exposure of subjects to electric and/or magnetic fields, much less separated contributions from transmission or distribution systems from household exposure due to appliances or due to other common, everyday sources.'

Graves concludes that:

'It is not possible to make unequivocal statements about the potential health hazards of any agent. However, a careful review of the literature on biological, including human health, effects of extremely low frequency electric and magnetic fields leads to the firm conclusion that no adverse health effects of exposure to fields in the range of those associated with SECV transmission lines or stations have yet been established and to the further conclusion that such adverse health effects are very unlikely.

It is therefore concluded that SECV practices regarding electric field strength on transmission line easements or in stations are not considered to pose a public health problem. This conclusion is consistent with conclusions of essentially all major reviews on biological effects of electric and magnetic fields.'

Subsequently, the Victorian Government announced that it was satisfied with the conclusions of the review and that, in making its decision to approve the construction of a proposed transmission line, the Government had available to it the very latest data and research findings of experts in the field.

The design practices of the Electricity Commission are substantially similar to those of the SECV, and Dr Graves' findings and conclusions may be considered to apply.

Therefore, it may be concluded, on the bulk of scientific evidence, that the electric and magnetic fields associated with the proposed transmission line would not pose a public health problem.

1.5 Electric and Magnetic Field Effects and Farming Activities

The effects of power frequency electric fields on plants have been exhaustively studied by Dr G McKee for more than a decade. On the basis of both short and long-term experiments involving exposure of thousands of plants from a wide variety of species, McKee concludes that no economic or ecological harm would occur to plants growing under or adjacent to power transmission lines. This conclusion has been confirmed by further surveys of plants living under or near high voltage transmission lines.

Effects of power frequency fields on livestock have been studied extensively in the United States and Europe, and research is continuing. For example, a study in Oregon, USA, conducted over five summers between 1977 and 1981, investigated the behaviour of cattle near a 1,200 kV prototype power line. Each year five different steers were placed in a pasture where they could range both close beneath and further away from the line, and their location throughout the day was monitored with time-lapse cameras. Forage, salt and water consumption were measured, and the line was alternately de-energized

and energized at times during the study. The animals showed no reluctance to graze or drink beneath the line, which produced a maximum field of 12 kV/m (substantially higher than that likely to be encountered on the proposed line). Statistical analysis of the 1980-81 data indicated that the cattle spent somewhat more time near the line when it was de-energized, but did not demonstrate whether this was a transient effect due to audible noise and/or the electric field.

A study was conducted during 1977-79 in Indiana to determine whether electric and magnetic fields produced by a 765 kV transmission line had any detectable effect on farm animals. Beef and dairy cattle, sheep, pigs and horses on eleven farms were included in the study. The participating farmers were interviewed bi-monthly and periodic inspections of the livestock were made by a veterinarian. None of the eleven farm operators indicated in any of the bi-monthly reports submitted throughout the two-year study, or during investigators' visits to the farms, that they observed any health problems or behavioural changes with the animals that could be thought attributable to the 765 kV line. One farmer reported that horses appeared to avoid the high ground under the line, whilst another observed that his cattle seemed to prefer to be under it.

All the farmers in the above study stated they would prefer that the power line was not on their property. However, the main reason for this was the nuisance it caused when cultivating around towers and the greater care needed when operating the large farm equipment that was required in these particular areas. Three of the participants purchased their farms after the 765 kV transmission lines were already on their properties; none had been negatively influenced by the fact that the line was on the property when they contemplated farming operations there, and their subsequent experience had confirmed that the line was not a deterrent to successful animal husbandry.

Research has been carried out in Sweden on cattle located and housed near 400 kV lines. These studies were prompted by reports that cattle fertility had decreased on two farms after 400 kV transmission lines traversing the properties were energized. A pilot study of thirty-six herds exposed to 400 kV transmission lines, on properties where artificial insemination was used, found no effects on cattle fertility when compared to a control group.

A six-year study of fifty-five dairy farms in Ohio located near 765 kV lines was also carried out. This study found no indication that the presence of the lines had any long-term effects on milk production, or that there was a change in health problems after the lines were energized. Another study conducted primarily by mail survey of 106 farms throughout Sweden found that, on average, the fertility of cows exposed to 400 kV lines for more than 15 days per year did not decrease.

A biological study of the effects of the electric field of a 345 kV power line on pigs in Iowa has been reported. Sixty crossbred pigs were randomly divided into two groups. One group was located and housed under the 345 kV line while the other group was located about 1 kilometre away from the line. Individual pig weights and intakes of pen feed were recorded fortnightly. There were no differences between the control and exposed groups for gain in body weight, feed intake, carcass grade, carcass yield or backfat thickness. It was also found that no apparent behavioural changes had occurred.

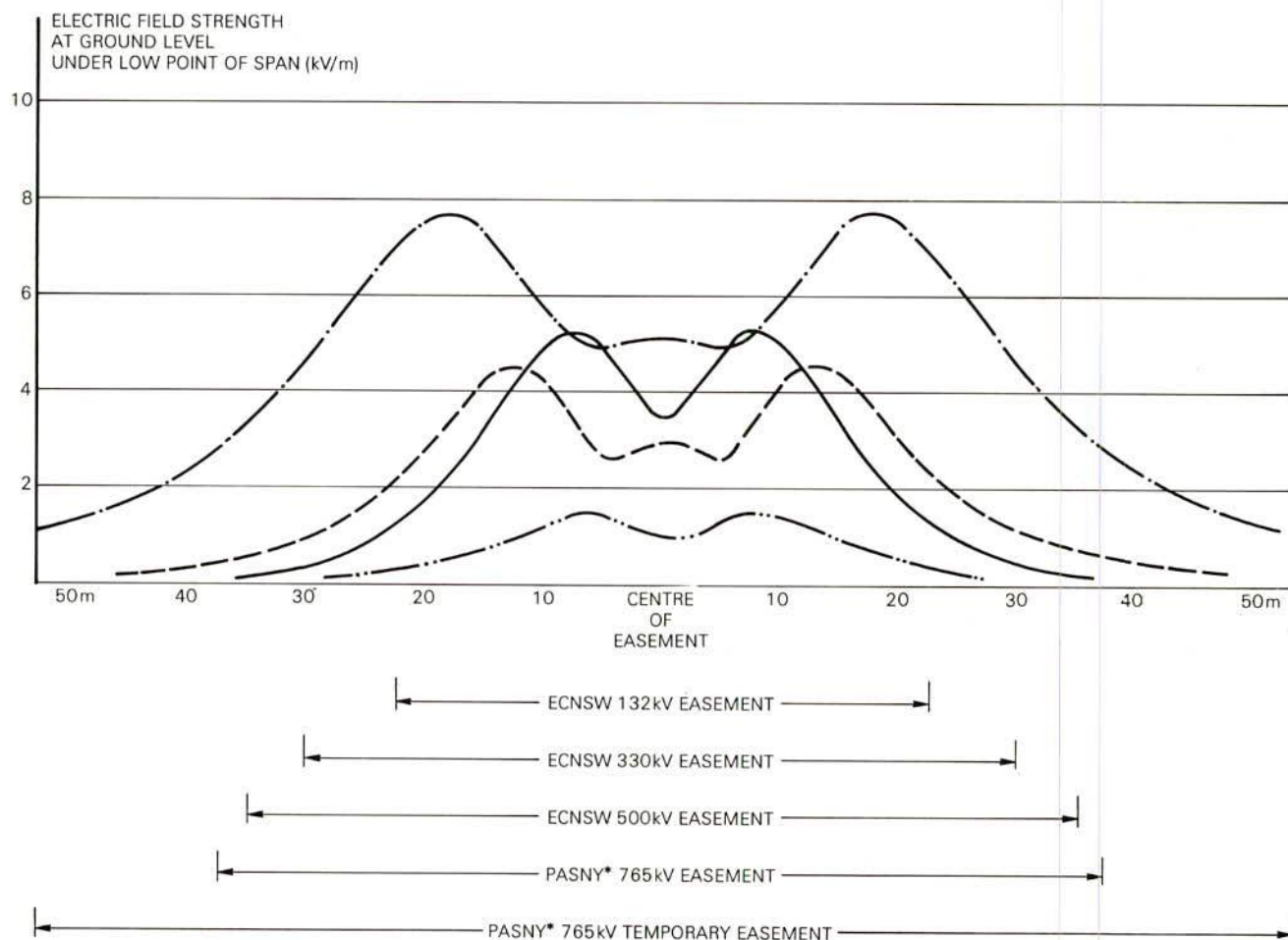
A more recent phase of the same pig study was concerned with reproduction. Here the findings indicated no effect of the 345 kV line on pregnancy rate, frequency of birth defects, or in weight gain of progeny.

Graves's report, mentioned earlier, also concluded that plant life, domestic and wild animals would not be adversely affected by electric or magnetic fields associated with SECV 220 kV transmission lines or substations (honey-bees kept in hives are a special exception to this).

The only adverse effects on rural activities which have been established concern beehives of certain designs. These effects have been documented in a series of comprehensive studies carried out by researchers in the United States. It is generally accepted that some reduction in the productivity of bees can be expected where the hives are located in areas where the electric field strength is in excess of 7 kV/m, due to voltage drops within the hive causing bees to be shocked as they move around. Some minor effects have also been reported in areas where the field strength is as low as 2 kV/m but there are no known effects on hives installed in areas where the field strength is less than 2kV/m. Although this potential problem exists, it is easily and inexpensively avoided by screening or earthing of the hives and in this regard the Electricity Commission will provide information to assist any concerned apiarist. It should also be noted that the Electricity Commission is not aware of any documented cases where its existing lines have caused problems for bee keepers.

On the basis of many years of research, including both laboratory and field studies, it may be concluded that typical exposure to fields associated with the proposed transmission line would not adversely affect livestock or plant life.

Figure 1



LEGEND

- · — 765kV SINGLE TRANSMISSION LINE
QUEBEC-MASSENA-MOSES (USA)
- 500kV DOUBLE CIRCUIT TRANSMISSION LINE
ERARING-KEMPS CREEK
- - - 330kV SINGLE CIRCUIT TRANSMISSION LINE
YETHOLME-WELLINGTON
- ... 132kV SINGLE CIRCUIT TRANSMISSION LINE
ARMIDALE-INVERELL

* PASNY - POWER AUTHORITY OF THE STATE OF NEW YORK

NOTE: WORLD HEALTH ORGANISATION CONCLUSIONS (1984) OCCUPATIONAL EXPOSURE:
NO HAZARD UP TO 20kV/m, NO NEED TO LIMIT GENERAL ACCESS UP TO 10kV/m

COMPARISON OF ELECTRIC FIELD STRENGTHS OF TYPICAL TRANSMISSION LINES

Source: THE ELECTRICITY COMMISSION OF NEW SOUTH WALES

Appendix H

Liaison With Other Authorities

Appendix H

Liaison with Other Authorities

In addition to the public consultation program, a number of Government departments and Authorities at Commonwealth, State and Local levels were contacted with regard to the proposed transmission line development. Comments received provided assistance in the compilation of this document and where necessary adjustments were made to the proposals to accommodate specific requests.

Listed below are the responses from the authorities consulted and where appropriate a review of their comments and concerns is provided.

H1 COMMONWEALTH GOVERNMENT

Department of Aboriginal Affairs - The Department suggested that the NSW National Parks and Wildlife Service should be advised of the development. The cataloguing and protection of aboriginal relics, either known or unknown is of specific concern to the National Parks and Wildlife Service.

Comment : The NSW National Parks and Wildlife Service has been consulted during the course of the EIS investigation.

Department of Arts, Heritage and Environment - The Department has no specific interest in the area affected by the nominated routes, nor comments on the environmental impact assessment process in this case.

Comment : Noted.

Department of Communications - The Department advised that it has no formal objections to any of the basic routes indicated. However the department considers that route A would have the least effect on domestic radio and television reception in the region.

Comment : The Department's view has been noted. As explained in Section 5, radio and television reception is normally unaffected by transmission lines, and therefore does not form a constraint to route selection.

CSIRO Finance and Administration The Organization advised that it does not wish to make any representation regarding the proposed development.

Comment : Noted.

CSIRO Division of Radiophysics - The Division has no objection to the proposed development.

Comment : Noted.

Department of Local Government and Administrative Services - The Department is at present considering the effects of the proposal on properties held.

Comment : Noted.

The Pipeline Authority - The Authority advised that the proposed transmission line does not affect any of its property or facilities.

Comment : Noted.

H2 STATE GOVERNMENT

Department of Agriculture - The Department provided detailed information regarding agricultural activities within the area including recent mapping data for both Lismore City and Byron Shire Councils. In particular, agricultural suitability mapping was provided which highlighted the extent of Class 1, 2 and 3 lands. It is these areas that constitute high quality grazing and horticultural lands. The horticultural lands are mainly confined to the elevated red soil areas with grazing activities occurring throughout the valley floors and foothills.

Options B and E were regarded as the least desirable options since they traversed the most important agricultural lands. The Department considers that both existing and potential uses are important considerations in choosing a preferred route. Other relevant considerations are the importance of aerial agriculture to the expanding horticultural industry, and the local impact of tree clearing in disturbing windbreaks. It was noted that windbreaks are required to protect horticultural crops from prevailing winds.

The Department is not aware of any rare species or association of flora and fauna in any of the localities affected by the route concepts.

In addition to the matters raised above the Department advised that the EIS should give due consideration to existing and potential land uses.

Comment : The issues raised by the Department have been addressed in the EIS in Section 2.3.4 and 2.5.3. The value of prime quality agricultural land was reflected in the route selection procedure, with all class 1, 2 and 3 lands posing a moderate constraint. These areas are shown on Exhibit 2.2.

Catchment Areas Protection Board - The Board noted that its prime function is the preservation of tree cover on steeply sloping lands and prevention of indiscriminate destruction of trees along the banks of rivers and lakes. A map prepared by the Soil Conservation Service which detailed protected lands indicated that there were a number of areas of protected lands and prescribed streams in the study area.

The Board advised that the transmission line options may effect the following prescribed streams: Benny Creek, Coopers Creek, Leycester Creek, Rocky Creek, Terania Creek and Wilson River.

Accordingly the removal or lopping of any trees within protected lands or along the banks of prescribed streams will require the approval of the Board as required under Division 2 Part IV of the Soil Conservation Act, 1938.

Comment : The information provided is noted. The Electricity Commission will make all necessary applications once a final route alignment has been determined. Protected lands have been mapped (see Exhibit 2.1) and has been taken into account in the route selection procedure.

Department of Education - The Department advised that schools which are located between Lismore and Mullumbimby will not be affected by the proposed route.

Comment : Noted.

Energy Authority of NSW - The Authority (now Department of Energy) advised that only transmission line projects of 330 kV or higher be referred for comment.

Comment : Noted.

Department of Environment and Planning - The Department provided details of the Director's requirements for the form and content of the environmental impact statement.

Comment : This environmental impact statement has been prepared in accordance with the Director's requirements and with Clauses 57 and 53 of the Environmental Planning and Assessment Regulation, 1980. The Director's requirements are contained as Appendix C of this statement.

Department of Environment and Planning - Northern Regional Office - The Office advised that none of the route concepts impact on any land identified under State Environmental Planning Policy No. 14 - Coastal Wetlands. The Office also advised of local planning instruments and the identification of agricultural protection zones. The Office is concerned that the agricultural potential of these lands should not be compromised by any constructions or use which would reduce their value to agriculture.

Comment : Areas of high agricultural value are shown on Exhibit 2.2 and discussed in Sections 2.3.4 and 2.5.3. These areas have been assessed as posing a secondary constraint to route selection.

Forestry Commission of NSW - The Commission advised of a section of Whian Whian State Forest south of Rocky Lake which may be affected by Option A. It would be preferred if the line avoids the forest but there would be no particular management difficulties if Option A is adopted. The Commission is not aware of any rare species or associations of flora and fauna which could be affected by the line proposal.

Comment : The Option A concept has been located so as to avoid the particular section of Whian Whian State Forest. All state forests within the area have been included in the primary constraints which are discussed in Section 3.4.2 and shown on Exhibit 3.2.

Heritage Council of New South Wales - The Council advised of the various registers of heritage items. The EIS should also contain a comprehensive assessment of the affected area for items of natural and cultural significance as well as impact on landscape and aesthetic values. The Council considers that the main areas likely to contain items of heritage significance will be the surroundings of rural homesteads.

Comment : A landscape analysis was undertaken which is contained in full as Appendix D. An archaeological survey of the preferred route will be conducted prior to construction.

Lands Office Grafton - The Office advised that since very little Crown land is affected, the eventual route will have very limited impact upon such lands. The Office made the observation that under the circumstances it would appear desirable for the eventual route selected to parallel the existing 66 kV line illustrated as Option B.

Comment : Noted.

Joint Coal Board - The Board advised that the route options are located over coal bearing strata of the Clarence Basin. The Board however does not anticipate that the coal deposits will be of commercial interest in the foreseeable future and therefore offers no comment on line construction.

Comment : Noted.

Department of Main Roads, NSW - The Department has no objection to any of the route options provided that all structures are erected outside main road reserves and sufficient vertical clearance is provided.

Comment : Noted.

Mine Subsidence Board - The route options do not lie within a proclaimed Mine Subsidence District nor within a coal basin. The line will not be affected by coal mining operations.

Comment : Noted.

Public Works Department - The Department advised of lands in which the Minister has an interest. The Department also advised of possible sites for a future water supply dam.

Comment : The preferred dam site is located on Exhibit 2.1. Although the dam does not pose an absolute constraint to route location the preferred route has been located so as to avoid the lower reaches of the proposed dam.

Soil Conservation Service - The Service provided detailed information regarding the following:

- Protected lands - being defined as lands generally having a slope greater than 18°. All routes traverse protected land. Destruction of trees within protected lands requires the authority of the Catchment Areas Protection Board.

Prescribed streams will be crossed by all options. Destruction of trees within, or within 20 metres of the bed or banks of these streams also requires the authority of the Catchment Areas Protection Board.

Soils - the dominant soil groups are the Dark Alluvial Clays, Krasnozems and Chocolate Soils. Their erodibility and erosion risk varies however generally the clays have a low erosion hazard, Krasnozems having a moderate hazard and Chocolate soils having the greatest risk of erosion.

Erosion control measures - disturbance during construction must be kept to a minimum to ensure effective control of soil erosion and to prevent slope failure. Establishment of an adequate vegetation cover and the adoption of appropriate maintenance techniques is essential for the continued stability of the transmission line easement and associated access tracks as well as protecting adjacent lands and streams from degradation by sedimentation.

Comment : The requirements of the service will be adhered to during the construction phase activities. Appropriate revegetation works will be implemented within the easement. Where possible existing low growing vegetation within the easement will not be cleared.

State Pollution Control Commission - The Commission has no special requirement other than for due care with regard to siting of earthworks away from water courses and the implementation of adequate erosion and sedimentation controls. The Commission prefers Option C.

Comment : Attention will be paid to the matters of concern to the SPCC during the construction phase.

Department of Mineral Resources - The Department has investigated the proposed development in relation to minerals, petroleum and coal resources.

Minerals - no commodities of significance to the Department are affected by any of the alignments.

Petroleum - the proposed routes partially affect a Petroleum Exploration Licence. The effect is unlikely to be major since exploration activities will be undertaken close to existing roads.

Coal - all options will overlay coal measures of various depths. The only known mine is a tunnel and workings at Bexhill. Although no mining has been recorded in the last fifty years in this area, there still remains a resource of underground steaming coal for future use.

Of the proposed route, Option B or Option C would have the least effect on any future mining of coal resources.

Comment : Noted.

State Rail Authority of NSW - The Authority advised that none of the route concepts nominated affect lands for which the Authority has a specific concern.

Comment : Noted.

Department of Water Resources - The Department has no objections to the proposal. The Department advised that the proposed Mullumbimby Substation is located close to Yankee Creek which is a tributary of Mullumbimby Creek. Therefore appropriate precautions should be taken to protect surface water from contamination by spills or leaks of toxic liquids.

Comment : All necessary precautions will be implemented in accordance to the Departments requirements.

H3 LOCAL GOVERNMENT

Byron Shire Council - Council has provided information relating to natural and cultural resources within the Shire as well as assistance in public meetings. Council has indicated its preference for a northern most route.

Lismore City Council - Council declined to comment on the route concepts. However, it was felt that the transmission line should avoid populated areas and ridgelines, prime agricultural areas (especially areas already established). The line should also avoid the creation of cleared 'corridors' through vegetated areas, and have due regard to the aims and objectives of Council's draft Local

Environmental Plan. There should not be any infringement on the Lismore Airport or on aircraft movements.

Council also requested that the route options be expanded to include lines following the railway line between Lismore and Bangalow, a coastal alignment and a direct line from Coffs Harbour.

Northern Rivers Electricity - N.R.E. has examined the alternative routes and advises that there is no conflict of interest in regard to any proposals it has, nor the future uses of the existing 66 kV line.

Rous County Council - Council advised of the proposed regional dam site. It appears that Option E would significantly conflict with Council's proposed site.

Comment : Discussions with Lismore City Council have indicated that the proposed regional dam would not form a significant constraint to route location.

H4 NON GOVERNMENT

The Australian Gas Light Company - The Company advised that it has no operating activities in the area and therefore no objections, comments or concerns regarding the proposal.

Byron Environmental and Conservation Organisation (BEACON) - This organisation considered that it was inappropriate to comment on any route options before exhibition of the EIS. Criteria that will be used by the organisation at that time will be that the preferred option should render minimal impact upon established native vegetation and faunal communities, archaeological sites, environmental protection zones and visual amenity and consider land uses planned for sites surrounding the proposed route.

Several aspects of the Route Concepts brochure were commented on, including the insufficient time provided for responses, information relating to project justification, specialist studies undertaken, health effects, compensation procedures, and the need to provide a 45 metre easement. It was also suggested that 1:25 000 topographic maps should be provided in future.

Aspects that need to be considered during construction of the line were identified as vegetation screening, retention of native vegetation in the easement where possible and replanting of native vegetation in the easement where clearing is required.

Comment : The aim of the Route Concepts brochure was to gain an initial appreciation of community priorities and concerns to assist in the selection of a preferred route alignment. Detailed analysis of issues such as project justification, compensation procedures, health effects and results of specialist studies undertaken have been included in the EIS, together with detailed topographic mapping.

The considerable interest generated by the Route Locations brochure resulted in the community consultation phase being extended to a five month period. All comments received during this time have been considered in the preparation of the EIS.

Suggestions made by BEACON in relation to clearing techniques have been noted.

Big Scrub Environment Centre - This group reserved detailed comments on the route concepts and a preferred option until publication of the EIS. Concern was expressed at the potential disturbance to native vegetation if the transmission line easement were to pass through forested areas. It was considered that route location should consider possible future uses of land such as reafforestation of erosion prone Class 4 and 5 agricultural quality land (as defined by Soil Conservation Service). 'Big Scrub' considers that potential forest could occupy the area between the Nightcap Range and the Wilson River valley, and, as such, 'Options A, B, C and D, and to a less extent E, all have the potential for major impact by incising many valley side slope forested corridors.' It was noted that reafforestation initiatives are actively promoted by many Government Departments and community groups concerned about sustainable land use and rational resource utilization.

The Centre also commented on the quality of the Route Concepts plan and the timing of the public exhibition period.

Comment : Reafforestation potential has been considered as a factor to be considered in route location. Comments relating to mapping and the public exhibition period of the Route Concepts brochure are as for the BEACON submission.

Federal Action Group - Replies generally followed a set format and indicated a strong concern that local residents be given priority over visitors and non-residents. None of the route concepts were preferred, with Options C, D and E being most disliked. Advantages were seen in locating the line along either an existing road or railway corridor. Concern was expressed concerning potential health effects, visual amenity, disturbance to horticulture and native vegetation, property devaluation and interference with appliances.

Appendix I

References

Appendix I

References

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 - 1.1 North Coast Draft Regional Environmental Plan 1987.
 - 1.2 A Rural Lands Policy for the North Coast Region of New South Wales, 1985.
2. Lismore City Council
 - 2.1 Lismore Draft Local Environmental Plan, 1986
 - 2.2 Local Environmental Study : Rural Strategies, 1983
 - 2.3 Local Environmental Study : Urban Strategies, 1986
3. Byron Shire Council
 - 3.1 Byron Shire Draft Local Environmental Plan, 1986
 - 3.2 Byron Shire Environmental Study, 1983
 - 3.3 Byron Shire Residential Development Strategy, 1986 (jointly prepared with Department of Environment and Planning)
 - 3.4 Keeping Byron Unique : The Byron Shire Trail
4. Department of Agriculture, New South Wales
 - 4.1 Lismore Area : Agricultural Land Suitability Study, 1983
 - 4.2 Byron Area : Agricultural Land Suitability Study, 1983
5. NSW Land Coordination Unit, Far North Coast Development Working Party
 - 5.1 Far North Coast Report, 1984
6. Public Works Department of NSW
 - 6.1 Lismore Flood Plain Management Study, 1980
7. Soil Conservation Service of NSW
 - 7.1 Soils of the Casino Soil Conservation District, 1982
8. Electricity Commission of NSW
 - 8.1 Transmission Line Easements : Rural Areas
 - 8.2 Electricity : What is Electromagnetic Radiation?
 - 8.3 Transmission Lines and Public Health
 - 8.4 Electricity Supply : Far North Coast N.S.W.
 - 8.5 Bulk Electricity Supply to the Far North Coast of New South Wales
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 - 9.1 Tree Trimming and Planting near Power Lines, 1983
10. Dr H B Graves
 - 10.1 A review of the State Electricity Commission of Victoria Transmission Line and Station Design Practices in Relationship to the Health and Safety Effects of People, 1986. Prepared for the Health Department of Victoria.