BEENUP POWER SUPPLY

CONSULTATIVE ENVIRONMENTAL REVIEW

SECWA

Prepared by

DAMES & MOORE

Report No. ESD 72/91

September 1991

CONSULTATIVE ENVIRONMENTAL REVIEW

BEENUP POWER SUPPLY

for

State Energy Commission of Western Australia

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September 1991

CONSULTATIVE ENVIRONMENTAL REVIEW

BEENUP POWER SUPPLY

The Environmental Protection Authority (EPA) invites people to make a submission on this proposal.

The Consultative Environmental Review (CER) for a proposed 132kV Transmission Line to the Beenup Mineral Sands Mine has been prepared by The State Energy Commission of Western Australia (SECWA) in accordance with Western Australian Government procedures. The report will be available for comment for 4 weeks, beginning on 2 September 1991 and finishing on 30 September 1991.

Comments from Government agencies and from the public will assist the EPA to prepare an Assessment Report in which it will make recommendations to Government.

Following receipt of comments from Government agencies and the public, the EPA will discuss these comments with SECWA and may ask for further information. The EPA will then prepare an assessment report with recommendations to Government, taking into account issues raised in the public submissions.

WHY WRITE A SUBMISSION?

A submission is a way to provide information, express your opinion and put forward your suggested course of action including any alternative approach. It is helpful if you indicate any suggestions you have to improve the proposal.

All submissions received will be acknowledged.

DEVELOPING A SUBMISSION

You may agree or disagree, or comment on, the general issues discussed in the CER or with specific proposals. It helps if you give reasons for your conclusions, supported by relevant data.

You may make an important contribution by suggesting ways to make the proposal environmentally more acceptable.

- clearly state your point of view;
- indicate the source of your information or argument if this is applicable; and
- suggest recommendations, safeguards or alternatives.

POINTS TO KEEP IN MIND

By keeping the following points in mind you will make it easier for your submission to be analysed.

Attempt to list points so that the issues raised are clear. A summary of your submission is helpful. Refer each point to the appropriate section, chapter or recommendation in the CER. If you discuss different sections of the CER keep them distinct and separate, so there is no confusion as to which section you are considering.

Attach any factual information you wish to provide and give details of the source. Make sure your information is accurate.

Please indicate whether your submission can be quoted, in part or in full, by the EPA in its Assessment Report.

REMEMBER TO INCLUDE; YOUR NAME, ADDRESS, DATE.

THE CLOSING DATE FOR SUBMISSION IS: 30 September 1991

SUBMISSIONS SHOULD BE ADDRESSED TO:

The Chairman
Environmental Protection Authority
1 Mount Street
PERTH WA 6000

SUMMARY

BEENUP POWER SUPPLY
CONSULTATIVE ENVIRONMENTAL REVIEW

INTRODUCTION

The State Energy Commission of Western Australia (SECWA) is proposing to construct and operate a 132 kilovolt (kV) transmission line between either the Picton or Manjimup substations and the proposed mineral sands mine at Beenup.

SECWA's preferred option is for an overhead supply at 132kV from the Manjimup substation.

The line would be constructed using steel lattice towers approximately 20-30 metres (m) in height with a typical span between the towers of 300-400m. SECWA is also considering the use of concrete poles, however the decision to use these will be dependent on cost and availability.

SECWA is responsible for the planning, design, construction, operation and maintenance of the transmission lines and substations required for the supply of electrical energy in Western Australia.

SECWA has a responsibility under the State Energy Commission Act (1979) to provide adequate supplies of electricity, reliably and economically, to both new and existing customers throughout Western Australia. The Beenup mineral sands deposit, situated on farmland 17km northeast of Augusta, is one of the world's major ilmenite discoveries and the proposed mine has a life expectancy in excess of 20 years. Developing this resource will require electricity for both the mining and preliminary ore-processing operations. The existing electricity supply close to the mine cannot support the load and so it is proposed to construct a new powerline. The estimated initial load for the mine is 12.5MW and the possible ultimate load is estimated to be 17.5MW

TIMING

The Beenup Mineral Sands Mine is due to be commissioned in July 1994 and power supply to the site will be required by that time. To meet this deadline SECWA is aiming to obtain environmental approval by December 1991.

Construction of the line is expected to take place during dry summer periods. Survey and clearing would be carried out during November 1992 - May 1993 and construction during November 1993 - May 1994.

Although construction can technically proceed during winter months, difficulty with access, the presence of dieback and the potential for its spread during winter are reasons for the restricted construction periods.

NEED FOR THE PROPOSAL

The present requirement for a power supply is to provide a secure and reliable supply of electricity to the proposed Beenup Mineral Sands Mine. The mine will be commissioned and operated by Mineral Deposits Ltd (MDL), a wholly owned subsidiary of Broken Hill Proprietary Company Limited (BHP) and a member of BHP-UTAH Minerals International.

In addition to providing power to the mine site, the transmission line may provide a short-term power supply backup for the Augusta area and thus supplement power supplies derived from Margaret River. In the long-term the proposed line will be capable of supplying other development power loads in the area and depending on the location of the development, will reinforce the existing power supply system from Picton to Margaret River. At present the distribution of electricity is via 22kV lines originating from substations at Margaret River and Busselton.

ENVIRONMENTAL ASSESSMENT

The Environmental Impact Assessment procedure is a formalised process designed to provide information to the Environmental Protection Authority (EPA) and the public about proposed developments which have the potential to generate significant environmental effects.

The Environmental Protection Act, 1986 was proclaimed on 20 February 1987 and the proposal will be assessed under this legislation.

Following referral of a proposal to the EPA, the Authority determines the level of environmental assessment required and, in conjunction with the Proponent, develops guidelines for the appropriate environmental report. In the case of the Beenup Power Supply proposal, the EPA required that a Consultative Environmental Review (CER) be produced. The report will be available for comment for 4 weeks, beginning on 2 September 1991 and finishing on 30 September 1991.

The CER evaluates the supply alternatives for the Beenup Mineral Sands Mine and presents the rationale behind the selection of the preferred supply alternative.

It is important to recognise that although approval is being sought for a 1km wide corridor, the actual easement required for the line is only 40-60m wide. Once the line route (and associated easement) has been determined, SECWA will relinquish all interest in the balance of the corridor.

ISSUES

Seven significant issues were identified as important when siting a transmission line during the initial corridor route selection studies. These were:

- the potential conflict between the proposed transmission line and objectives of the CALM who manage the State Forest areas (including dieback risk);
- the potential conflict between a proposed transmission line and the lifestyles sought by many residents;
- the importance of retaining as much vegetation as possible to reduce potential erosion problems and to maintain the water quality in the many catchments potentially affected by the line;
- the community concern about electro-magnetic fields around high voltage powerlines;
- the potential impact on the many major tourist destinations and picnic areas popular within the area; and
- the impact on agricultural production, both broadacre pasture and more intensive horticultural production.

CORRIDOR SELECTION

SECWA has presented a number of corridor options within the CER. Each option was initially identified by a comprehensive corridor selection procedure which uses a computer based Geographic Information System (GIS) to combine and analyse all the relevant environmental, social, economic and technical data.

The use of GIS technology to identify corridors differs from the traditional corridor selection procedure in that the identified corridor represents the optimum corridor for the study area based on the priorities assigned to relevant issues. This minimises the need to undertake extensive manual and often subjective comparisons of numerous and complex corridor networks.

PUBLIC CONSULTATION

Following the initial identification of the corridor options an extensive public consultation programme was established by SECWA. The feedback and comments received during these consultations have assisted SECWA in optimising and fine-tuning the original corridors proposed.

Information from surveys conducted during the public consultation programme identified that for residents in the area, the four most important issues were:

- interference with agricultural land use;
- conflict with residents lifestyles;
- health risks; and
- devaluation of private land.

Also identified during the public consultation was the preference for SECWA to use the Manjimup to Beenup corridor.

The outcome of the studies was the identification of three viable corridor options, namely:

- Manjimup to Beenup;
- Picton to Beenup via Great North Road; and
- Picton to Beenup via Margaret River.

All of these options are considered as viable options by SECWA.

AFFECTED ENVIRONMENT

The study area for the proposal stretches between Bunbury and Augusta, approximately 200km and 320km south of Perth. Traditionally, the area's main industries have been dairy farming, beef cattle farming and timber production. However, the discovery of heavy mineral sands in the area in the 1940s-1950s, the rapid development of a wine-making industry and the growth of tourism have led to a broadening and diversification of its economic base. The region has also proved popular to many people seeking an alternative lifestyle or a place to retire.

The land uses potentially affected by the corridor options include agriculture, State Forest, tourism activities, and transport.

Areas which are entered in the Interim List of the Register of the National Estate occur in the area. The AHC areas potentially impacted by the corridor options include the Blackwood River Conservation Park, Rapids Conservation Park, Mowen Conservation Park, Chester Nature Reserve, Beavis Block, and Giblett Forest Block.

As a result of the long history of European settlement within the south west, many items of heritage interest also exist mostly in townsites.

A detailed inventory of potential transmission line visibility and landscape resources was prepared during the corridor selection phase of the project.

In general, line corridors within State Forest have a limited impact on the landscape due to the restricted range from which the corridor is visible. Exceptions to this occur when the line traverses valleys or areas of high slope. Where the corridor segments traverse agricultural land the area from which the proposed transmission line can be seen increases.

ENVIRONMENTAL CONSEQUENCES

The CER presents commitments and mitigation procedures for all three options to demonstrate that the constraints and impacts associated with each option can be effectively managed. The constraints can be summarised as follows:

- Picton-Beenup via Great North Road - impacts on 126 private properties and 58 buildings, and environmental impact on The Rapids, Mowen and Blackwood Conservation parks;

- Picton-Beenup via Margaret River - impacts on 179 private properties and 103 buildings, and passes through the hinterland of Margaret River frequented by tourists. The visual impact of this line is the highest of the three options; and
- Manjimup to Beenup - limited social impact (only 18 private properties) but requires the most clearing of the options (320ha). This option also passes through Karri forest, some of which is interim listed with the Australian Heritage Commission.

The Manjimup option is considerably shorter than the other options - 90km compared with 131km for Margaret River Option and 114.5km for the Great North Road option.

The clearing of approximately 60ha of Karri forest within the areas listed with the AHC represents a significant impact for the Manjimup option. SECWA believes that a detailed construction and operation programme developed to the satisfaction of CALM can minimise the impact on these areas.

PREFERRED CORRIDOR OPTION

SECWA's preferred corridor option is the Manjimup to Beenup corridor. Second preference is the Picton to Beenup via Great North Road option and third preference is for the Picton to Beenup via Margaret River option.

This preference is based on a number of criteria which can be summarised as follows:

- the Manjimup is the shortest of the three options and the indicative costs of construction show the economic benefits for this corridor:
  - Manjimup Option $12.5m;
  - Great North Road Option $15.0m; and
  - Margaret River Option $17.0m;
- all corridors cross areas which are interim listed with the Australian Heritage Commission. SECWA is confident that the impacts on these areas, particularly for the Manjimup option can be reduced to an acceptable level;
- only 20ha of the Karri forest to be impacted by the Manjimup Option has not been previously logged;
- approximately 70km of the Manjimup corridor follows existing forest haul roads and tracks which further reduces the clearing requirement;

- o the vegetation clearing prescriptions developed and presented in the CER will reduce the environmental and social impacts associated with clearing in State Forest to an acceptable level; and
- o approximately 77km of the Manjimup corridor is completely within State Forest. It therefore affects only 18 private properties.

SECWA acknowledges that further detailed discussion with CALM and the EPA is required before clearing for construction can commence within the State Forest. However, this discussion and planning can only be proceeded with and finalised after approval for the Manjimup corridor has been obtained.

COMMITMENTS

A comprehensive list of commitments is provided in the CER. These commitments deal with issues including:

- o compensation;
- o vegetation clearing;
- o dieback;
- o rare flora;
- o electromagnetic fields;
- o soil erosion; and
- o impact on land use.

The commitments have been developed by SECWA in consultation with affected landholders to reduce and manage the potential impacts associated with the construction, operation and maintenance of a transmission line.

Some of the more important commitments are summarised below:

Notices of Entry

A "Notice of Entry" for the purposes of investigation and survey will be issued to all registered land proprietors whose properties are affected by the approved transmission line corridor.

A copy of a plan showing the approximate location of the line corridor relative to each property will be included with the "Notice of Entry".

Before any line construction commences a second "Notice of Entry" for the purpose of construction will be issued for just those properties affected by the transmission line.

Compensation

Compensation for the easement will be negotiated with the registered and land proprietor. This will be based on valuations provided by the Valuer General's Office.

Compensation will also be negotiated with land holders for any loss of production caused by the line construction and future operational activities.

Owners will also be offered seedlings to replace any trees removed from the property. These trees should be established in a new area remote from the easement.

Clearing of Vegetation

Construction and operation of the powerline will require the clearing of vegetation from the line easement and, in some cases, from the surrounding area. Within State Forest the line easement will include a 4m wide vehicle access track which will be cleared to groundlevel. The corridors have been selected to follow existing roads in State Forest to reduce the amount of vegetation clearing.

Clearing will be kept to an absolute minimum and the top layer of soil shall, as far as possible, be left undisturbed.

Maintenance Clearing

SECWA will maintain the cleared areas within the transmission line easement. Easement maintenance will be aimed at maintaining vegetation which will not impinge on the clearance limits of the line.

Flora and Fauna

Once the corridor has been fixed by consultation with landholders, and EPA approval subsequently obtained, a detailed survey of the flora and fauna of the area will be undertaken in conjunction with the centreline survey. Should any areas of significance be identified the line route will be adjusted accordingly.

Gates

Single or double metal gates, properly hung, will be erected in fences along the route of the easement where permanent access is necessary. Gates on boundary fences will be kept locked, if required, during the construction of the transmission line and SECWA will install its own padlock alongside the property owners' padlock where access is required from an adjacent road.

Fences

Fences may be opened and restored where necessary, although access is normally made along the easement via the gates mentioned above. In difficult terrain, permission to use the owners' gates and tracks may be negotiated.

Access Tracks

Access tracks are sometimes necessary off the easement to reach the transmission lines construction sites. Under such circumstances appropriate arrangements shall be negotiated with the property owners concerned.

Electric and Magnetic Fields

An operating transmission line creates electric and magnetic fields around the line conductors. These fields diminish rapidly with distance from the line.

The International Radiation Protection Authority, in conjunction with the World Health Organisation (WHO), has published documents containing recommended limits for both electric and magnetic fields. Comparison of these limits with field measurements made near operating 132kV transmission lines in Western Australia show the field strengths inside and outside the new powerline easement will be below the WHO standards under normal operating conditions and will remain below these standards even under emergency load conditions.

Aboriginal Site Surveys

Prior to construction, SECWA will commission a survey made by an agency or contractor, of archaeological, paleontological, and historical sites within the area to be occupied by the line easement. The results of this survey will be provided to the WA Museum. SECWA, will relocate the proposed transmission line facilities in order to avoid destruction of archaeological, paleontological or historic values.

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CONSULTATIVE ENVIRONMENTAL REVIEW

BEENUP POWER SUPPLY

1.0 INTRODUCTION

1.1 BACKGROUND

The State Energy Commission of Western Australia (SECWA) is proposing to construct and operate a 132 kilovolt (kV) transmission line between either the Picton or Manjimup substations and the proposed mineral sands mine at Beenup. SECWA's preferred option is for an overhead supply at 132kV from the Manjimup substation. The line would be constructed using steel lattice towers approximately 20-30 metres (m) in height with a typical span between the towers of 300-400m.

SECWA is also considering the use of concrete poles, however the decision to use these will be dependent on cost and availability.

The study area location for the proposal is shown on Figure 1 and a detailed description of the proposed transmission line is provided in Section 6.0.

1.2 THE PROPONENT

The Proponent for the project is the State Energy Commission of Western Australia (SECWA). SECWA is responsible for the planning, design, construction, operation and maintenance of the transmission lines and substations required for the supply of electrical energy in Western Australia.

The head office for SECWA is:

363-365 Wellington Street
Perth WA 6000

The postal address for SECWA is:

GPO Box L921
Perth WA 6001

SECWA contact:

Mr Rudy Teh

1.3 PURPOSE AND NEED

SECWA has a responsibility under the State Energy Commission Act (1979) to provide adequate supplies of electricity, reliably and economically, to both new and existing customers throughout Western Australia. The Beenup mineral sands deposit, situated on farmland 17km northeast of Augusta, is one of the world's major ilmenite discoveries and the proposed mine has a life expectancy in excess of 20 years. Developing this resource will require electricity for both the mining and preliminary ore-processing operations. The existing electricity supply close to the mine cannot support the load and so it is proposed to construct a new power line. The estimated initial load for the mine is 12.5MW while the possible ultimate load is estimated to be 17.5MW

1.4 TIMING

The Beenup Mineral Sands Mine is due to be commissioned in July 1994 and power supply to the site will be required at that time. To meet this deadline SECWA is aiming to obtain environmental approval by December 1991.

Construction of the line is expected to take place during dry summer periods. Survey and clearing would be carried out during November 1992 - May 1993 and construction during November 1993 - May 1994.

Although construction can technically proceed during winter months, difficulty with access, the presence of dieback and the potential for its spread during winter are reasons for the restricted construction periods.

1.5 RELEVANT LEGISLATION

Legislation pertaining to the proposed development and to this CER includes:

- Environmental Protection Act, 1986;
- Wildlife Conservation Act, 1950-1980;
- Aboriginal Heritage Act, 1972-1980;
- Conservation and Land Management Act, 1984;
- State Energy Commission Act, 1979;

- o State Planning Commission Act, 1985;
- o Bush Fires Act, 1954-1981;
- o Agriculture and Related Resources Protection Act, 1976-1981;
- o Soil and Land Conservation Act, 1945-1982; and
- o Town Planning and Development Act, 1928.

1.6 THE IMPACT ASSESSMENT PROCEDURE

The Environmental Impact Assessment procedure is a formalised process designed to provide information to the Environmental Protection Authority (EPA) and the public about proposed developments which have the potential to generate significant environmental effects.

The Environmental Protection Act, 1986 was proclaimed on 20 February 1987 and the proposal will be assessed under this legislation. A summary of the assessment process used for this project is provided on Figure 2.

Following referral of a proposal to the EPA, the Authority determines the level of environmental assessment required and, in conjunction with the Proponent, develops guidelines for the appropriate environmental report. In the case of the Beenup Power Supply proposal, the EPA required that a Consultative Environmental Review (CER) be produced. The guidelines for the document are given in Appendix A.

1.7 SCOPE AND PURPOSE OF REPORT

This CER is intended to be a brief document, summarising the evaluation of supply alternatives for the Beenup Mineral Sands Mine and presenting the rationale behind the selection of the preferred supply alternative. Where appropriate, specialist information and technical documents are provided in appendices or supporting documents.

Throughout the report reference is made to corridors and easements. It is important to recognise that although approval is being sought for a 1km wide corridor, the actual easement required for the line is only 40-60m wide. Once the line route (and associated easement) has been determined, SECWA will relinquish all interest in the balance of the corridor.

The structure of the report is as follows:

- Executive Summary;
- Introduction;
- The Need for the Proposal;
- Evaluation of Alternatives;
- Assessment of Supply Alternatives;
- Determination of Preferred Option;
- Affected Environment;
- Description of Proposed Development; and
- The Environmental Consequences of the Proposal.

Supporting Documents 1 and 2 detail the corridor selection studies undertaken to identify the corridor options presented in this report. These documents will be made available during the review period.

The report does not contain tables and matrices detailing how the corridor options were selected. This is because the corridors have been selected using a new methodology which utilises the Dames & Moore computer based Geographic Information System (GIS) known as GIMS (Geographical Information Managing System). A summary of the methodology is presented in Appendix B.

SECWA used the GIS to combine and analyse all the relevant environmental, social, economic and technical data. The use of GIS technology to identify corridors differs from the traditional corridor selection procedure in that the identified corridor represents the optimum corridor for the study area based on the priorities assigned to relevant issues. This minimises the need to undertake extensive manual and often subjective comparisons of numerous and complex corridor networks.

2.0 NEED FOR THE PROPOSAL

The present requirement for a power supply is to provide a secure and reliable supply of electricity to the proposed Beenup Mineral Sands Mine. The mine will be commissioned and operated by Mineral Deposits Ltd (MDL), a wholly owned subsidiary of Broken Hill Proprietary Company Limited (BHP) and a member of BHP-UTAH Minerals International.

BHP commenced exploration in the Augusta area in 1986 and identified the Beenup deposit in 1988. Since then the deposit has been defined and environmental approval for the proposed mine obtained. An Environmental Review and Management Programme (ERMP) was prepared by MDL (MDL, 1990) and released for public review in April, 1990. In December 1990 the EPA released its assessment report (EPA Bulletin 483) and concluded that Beenup Mineral Sands Mine proposal is environmentally acceptable subject to MDL's commitments (MDL, 1990) and the EPA's recommendations.

In addition to providing power to the mine site, the transmission line may provide a short-term power supply for the Augusta area and thus supplement power supplies derived from Margaret River. In the long-term the proposed line will be capable of supplying other development power loads in the area and depending on the location of the development, will reinforce the existing power supply system from Picton to Margaret River. At present the distribution of electricity is via 22kV lines originating from substations at Margaret River and Busselton.

3.0 EVALUATION OF ALTERNATIVES

Five general alternatives were identified and evaluated. These alternatives were:

- o No Action Alternatives;
- o Alternative Technologies;
- o On-site generation;
- o Alternative Supply Voltages; and
- o Overhead Supply Alternatives.

The following sections summarise the evaluation of each alternative.

3.1 NO ACTION ALTERNATIVES

The "no action" by SECWA would consist of not proceeding with the construction of the transmission line due to economic or environmental reasons. This action would require MDL to reassess the on-site generation alternative and address the economic and environmental problems associated with that alternative.

The "no action" by MDL provides two scenarios. Firstly, if MDL decided not to proceed with the mine, no new power supply would be required for Beenup. However, the deposit is recognised as valuable and any decision not to proceed with mining is only likely to defer the commissioning of a mine and the future need for a power supply.

The second scenario involves MDL taking "no action" with on site generation. This would leave overhead connection to the transmission system as the only viable alternative.

Any of the "no action" alternatives would result in significant delays to the commissioning of the mine, with a direct impact on the economic growth of the region.

3.2 ALTERNATIVE TECHNOLOGIES

Wind Generation

Beenup is located in a portion of the State that has an excellent wind resource, but it is the nature of wind energy that precludes its consideration as a sole source of energy supply.

This wind is very variable in its strength and direction and the technology has not been developed sufficiently for this option to be used as a sole source of energy supply. Conventional diesel generation would still be required during calm wind conditions.

A further problem is the lack of suitable meteorological data for wind energy evaluation. This is being addressed by the planned installations of wind stations in the area by SECWA but at least twelve months' data would be needed before wind could be evaluated as an alternative source.

A new transmission line may provide access to a potentially good wind resource but the resource is not expected to be useful to the Beenup mine's power needs because of its intermittent nature.

Underground Cable

The broad requirements for the underground cable option were investigated by SECWA. The advantages of underground cables include reduced visual impact and clearing requirements, however, the following issues also needed careful consideration:

- Cost - The capital cost of an underground cable circuit can be expected to be in the range of seven to fifteen times the cost of an equivalent overhead line at 132kV depending on length and circumstances.

- Ancillary Equipment - The underground cable option for a circuit of this length requires the installation of additional equipment such as reactors located at both ends of the line as well as about halfway along the route, and specialised terminal equipment to prevent overvoltages during operation.

- Reliability - Overhead transmission line failures are easily identified and are usually repairable within hours. Underground cable failures are not so easily identified and repairs could take days to complete.

- o Environmental - During construction, the environmental impacts of an underground cable circuit would be similar to those from pipeline construction, which requires a continuous line of trenching and backfilling between terminal points. Access to an underground line for repairs and regular maintenance would be required throughout its length in contrast to the overhead system which normally requires structure access only.

The principal environmental benefits of undergrounding a transmission circuit involve reduction of visual impacts and vegetation clearing, although allowance must be made for ancillary facilities on or adjacent to the route.

The cost of underground cable is considered to be prohibitive.

3.3 ON-SITE GENERATION

3.3.1 Introduction

The on-site generation alternative was evaluated by MDL during minesite feasibility studies. Solar and wind power technologies are not sufficiently advanced to be reliable sources of power for the mine site and were eliminated on this basis. The only reliable on-site power generation available to MDL was diesel or gas-fired generators. Because gas is not supplied to the region the only practical alternative is diesel powered generation.

Diesel powered generators are a common means of power supply within Western Australia. Many remote towns and industry use this power source where connection to an existing power grid is not viable. There are, however, a number of problems associated with this form of power generation, some of which are:

- o the ongoing maintenance requirements are expensive;
- o diesel fuel is expensive and subject to fluctuating prices;
- o the noise from the generators would need to be suppressed and may contribute to the overall noise levels associated with mining activity; and
- o the on-site storage of diesel would increase the risk of spillage and potential contamination of groundwater.

The following sections summarise the results of studies which assessed the economic and environmental viability of on-site generation.

3.3.2 Description of On-site Generation

On-site power generation would require the installation of seven large diesel engines, six of which would be running at all times.

3.3.3 Maintenance

The possibility of on-site generators breaking down is high. This would lead to prolonged machinery stoppages which in turn would result in loss of mine production. Many hours of production time would be in jeopardy each time there was a site generation problem which is in contrast to a situation involving a reliable SECWA supply, where experience indicates that such stoppages would be minimal. In addition to the breakdowns and stoppages, MDL would be required to stockpile spares to carry out maintenance work and have available specialised labour who would otherwise have no duties to perform within the Beenup operation.

3.3.4 Economic Assessment

A straightforward comparison of capital and operating costs for both options was considered prior to the preparation of the Environmental Review and Management Programme. At that time (in the pre-Iraq conflict situation) the purchase price of diesel fuel caused the cost of on-site power generation to be unattractive when compared with the cost of SECWA power supply. Since that time the fuel purchase price has increased considerably, making on-site generation even less attractive than before. Also considered were the future price increase on fuel compared with the relatively well controlled SECWA tariff increases over an extended period of time. This reflects the volatile price of diesel against a more stable coal price paid by SECWA.

3.3.5 Environmental Assessment

Noise

The operation of an on-site power station with six large diesel engines running would be the source of considerable noise, far in excess of any other source of noise likely to be made on-site. These engines would be required to run 24 hours a day, seven days a week. This duration and level of noise is not considered to be in line with other noise control philosophies that have been applied to the Beenup site, and certainly not in the interest of the local community.

Emissions

The continual operation of the six large engines described above, would be the source of atmospheric pollution. It is expected that very stringent environmental controls would apply, adding to the cost of installing diesel engines.

Transport

Diesel fuel would be required for the generators. This would be transported to the site requiring two trucks per day, seven days per week throughout the year. This traffic would be in addition to the trucks hauling mineral sands to Bunbury.

Social issues

The installation of on-site generators at Beenup would, apart from all of the adverse affects commented on above, provide no benefits to members of the local community. The use of an overhead power supply provided by SECWA to Beenup would reinforce the SECWA grid as discussed in Section 2.0. This is considered to be an important long-term benefit to the local community.

Environment Disturbance

The one major advantage of on-site generation would be the lack of need to develop a major powerline into the Beenup site and the consequent avoidance of the environmental impacts caused by the line.

3.4 ALTERNATIVE SUPPLY VOLTAGES

22kV

The existing distribution system in the vicinity of the mine is a 22kv system. However, it is not feasible to supply the mine at this voltage level because the load and distance from the nearest substation, that is, Margaret River, is too great. Even if it were feasible, substantial reinforcement of the distribution and transmission systems into Margaret River would be required.

33kV

To supply the mine at this voltage level would require the establishment of a 33kV system to the Beenup mine. However, the 33kV system would be on the limit of voltage stability and voltage collapse is likely. No spare capacity would be available for future expansion or development without building an additional line.

66kV

Two options were considered for supplying the Beenup mine at 66kV. They were:

- Margaret River to Beenup; and
- Capel to Beenup.

In both cases, a new 66kV line is required from Picton in order to avoid unacceptable voltage depressions on the 66kV system under certain line outage conditions.

With the 66kV options, a total of 20MVAr of capacitors needs to be installed at Beenup in order to maintain the Beenup voltage within acceptable limits. This compares with 6MVAr of capacitors required for the 132kV options which were considered. The additional equipment required for 20MVAr of capacitors increases the capital cost associated with this option.

In addition to the above, the transmission losses incurred with the 66kV options are approximately three times greater than for the 132kV options.

In summary, the 66kV options are not recommended as they are economically and technically inferior to the 132kV options.

132kV

Three options were considered for supplying the Beenup load at 132kV. They are:

- o Manjimup to Beenup;
- o Picton to Beenup via Great North Road; and
- o Picton to Beenup via Margaret River.

All three options are feasible and perform in a similar manner. As outlined above, their performance is superior to the 66kV options.

220kV or 330kV

In comparison to their supply capabilities, the relatively small Beenup load does not justify a supply at 220kV or 330kV, the cost of which would be enormous. As the supply would have to originate from Muja, these voltage levels would result in a transmission system that would have a far greater impact on the environment than the options described above.

Direct Current (DC)

SECWA did not consider a DC transmission line for this project due to the high cost of DC terminal installation. The present system operates alternating current (AC) and the additional expenditure required to operate the line at DC for no substantial benefit could not be justified.

3.5 BEENUP CORRIDOR SELECTION STUDIES

3.5.1 Introduction

Following the evaluation of the alternatives as discussed in the previous sections, it was concluded that overhead connection to the existing transmission system was the preferred supply alternative. SECWA commenced studies to identify route options on a regional basis. These studies identified four corridor concepts, namely:

- o Manjimup to Beenup - transmission line operating at 132kV;
- o Picton to Beenup via Sues Road - transmission line operating at 132kV;
- o Picton to Beenup via Great North Road - transmission line operating at 132kV; and
- o Picton to Beenup via Margaret River - transmission line operating 132kV.

These corridor concepts identified a study area which was subsequently divided into 3 portions as shown on Figure 3. Maps 1, 2 and 3 show the corridor options in detail.

SECWA commissioned two route selection studies to identify corridor options from Manjimup to Beenup and Busselton to Beenup. The studies were completed for the study areas shown on Maps 2 and 3.

The following sections provide an outline of the route selection procedure undertaken for these studies, the major components of which were:

- Preliminary Corridor Selection - including the identification of issues, the establishment of a Geographical Information System (GIS) database and liaison with the Department of Conservation and Land Management (CALM) and local shires which resulted in the identification of a preliminary corridor options;
- Public Consultation and Final Corridor Selection - involving an extensive public information and consultation programme which identified additional corridor options;
- preparation of the CER - which utilised the GIS database, public comment and advice from relevant authorities to assess the options and identify the impacts of the preferred corridor for assessment by the EPA.

3.5.2 Selection Criteria

SECWA has a number of generic corridor selection criteria (i.e. applicable to all corridors) which are developed to minimise the potential impact of the line and which address the issues associated with line construction and maintenance. These criteria and the associated issues are provided in Table 1.

TABLE 1

SUMMARY OF MAJOR ISSUES AND CORRIDOR SELECTION CRITERIA

Issues associated with Corridor Selection	*Associated Criteria*	*Data Origin*	*Feature Mapped*	*Philosophy/Criteria*
Impact on conservation areas, National Parks and recreation areas.	. Gazetted National Parks and Reserves . System 2 report	. Topographic maps . System 2 Report . Cadastral maps	. National Parks and gazetted areas (present and proposed)	Construction and maintenance of transmission lines is not compatible with areas of high conservation value and/or recreational usage.
The impact on agricultural land uses	. Agricultural activity	. Landsat Thematic Mapper Satellite Image	. Cleared areas	By defining the boundaries between agriculture and areas of native vegetation it is possible to delineate corridors which minimise impacts associated with traversing agricultural areas.
The impact of vegetation clearing along the corridor	. Vegetation type	. Beard (1981) vegetation map . Landsat Thematic Mapper Satellite Image	. Vegetation type . Cleared areas	The combination of vegetation type and cleared areas enables the delineation of corridors which require minimal vegetation clearing, hence reduced impact on native vegetation and cost of construction.
The potential soil erosion associated with construction and maintenance of the transmission line	. Erosion risk	. Dames & Moore land capability map . Existing soils/ land capability	. Soils, slope and aspect maps	To identify and avoid areas of high erosion risk. To determine protective measures and rehabilitation requirements for corridor options.
The effect of a transmission line on the visual amenity of the region	. Tourism . Residential areas	. Topographic and local tourist maps	. Tourist lookouts/roads . Recreation areas . Residential areas	Areas with high scenic value and areas with high visitation by tourists, residents and travellers should be avoided.
Concern over the perceived health risk of transmission lines	. Residential areas	. Topographic maps	. Buildings/towns	With the low building density in the Study Area it should be possible to select a corridor which avoids areas of human habitation. This policy also overcomes problems with visual amenity and radio and television reception.
The effect on agricultural, local, domestic and military aviation activities	. Landing strips . Bombing ranges	. Topographic and cadastral maps	. Landing strips and . Bombing ranges	Transmission lines should be located to meet air safety standards.
The potential to conflict with mining activities and mineral resources	. Mineral Resources	. Mines Department Tenement maps	. Mineral tenements	Poorly located transmission lines can sterilise valuable mineral resources. Selected corridors should avoid areas of known mineral resources.
The possible conflicts associated with obtaining easements over private land	. Land Ownership	. Cadastral maps	. Land tenure	There is preference for locating the corridor on existing easements or on government owned land.
Land use boundaries	. Land use	. Cadastral maps . Landsat Thematic Mapper Satellite Image	. Boundaries of land use	Location of corridors along land use boundaries minimises the disruption of land use activities and reduces visual intrusion.
Impact of Line on Forest Management Activities	. Management units	. CALM maps	. Forest Management blocks	Location of line along management boundaries minimises disruption to forest activities.

3.5.3 Manjimup to Beenup

A detailed preliminary corridor selection study between Manjimup and Beenup was undertaken by Dames & Moore during the period July 1990 to November 1990.

The objective of the study was to tentatively identify what appeared to be the most appropriate corridor from available geographic data.

The scope of work included the identification of the major issues associated with corridor selection between Manjimup to Beenup.

Based on the study area characteristics and discussion with CALM and local shires, seven significant issues were identified during a scoping process as requiring special consideration during the corridor route selection study. These were:

- the potential conflict between the proposed transmission line and objectives of the CALM who manage the State Forest areas (including dieback risk);
- the potential conflict between a proposed transmission line and the lifestyles sought by many residents;
- the importance of retaining as much vegetation as possible to reduce potential erosion problems and to maintain the water quality in the many catchments potentially affected by the line;
- the potential health risks associated with electro-magnetic fields around high voltage power lines;
- the potential impact on the many major tourist destinations and picnic areas popular within the area; and
- the impact on agricultural production, both broadacre pasture and more intensive horticultural production.

The GIS was then used to assign priorities which reflected SECWA's route selection criteria and local issues specific to the study area. An optimum corridor was identified based on the ratings and weightings applied during the study, a full description of which is provided in Supporting Document 1.

The corridor options which were presented as possible options during the public consultation period are shown on Map 3.

3.5.4 Picton to Beenup

The Manjimup to Beenup corridor selection study identified a number of potential constraints for the siting of corridors for a 132kV transmission line. SECWA therefore commissioned a second study to identify and assess corridor options from Picton to Beenup. Initial desktop studies identified the following corridor concepts:

- Picton to Busselton - with the new 132kV line running parallel to the existing 66kV line (this section would be common to all options);
- Busselton to Margaret River - again following the existing 66kV line to Margaret River substation;
- Margaret River to Beenup - a new corridor to be selected between Margaret River and Beenup; and
- Busselton to Beenup - a new corridor to be selected between the existing 66kV line and Beenup.

The issues associated with identifying new corridor options between Busselton/Margaret River and Beenup were similar to those detailed in Sections 3.5.2 and 3.5.3. Again, the objective of the study was to tentatively identify what appeared to be the most appropriate corridor from available geographic data.

The study was completed in June 1991 and a full description of the criteria used and tentative corridors identified is provided in Supporting Document 2.

In summary, the study identified the following corridor options which were assessed with the Manjimup option:

- The Sues Road Option
  Identified when preference is given to following Sues Road, a proposed haul road for transporting mineral sands from Beenup to Bunbury.

- The Great North Road Option
  Identified as the optimum route by the GIS when preference is given to minimising social and environmental impacts.

- The Margaret River (Witchcliffe) Option
  Identified as the optimum route by the GIS minimising social and environmental issues when preference is given to following the existing 66kV line to the Margaret River substation.

These options are shown on Map 2.

The Sues Road Option was identified as an option during the studies but was eliminated from further detailed consideration due to the following points:

- the planned alignment of Sues Road contains bends which would be difficult to follow with the transmission line. It is estimated that of the 19km of Sues Road followed, only 12km of the route could take advantage of the existing clearing along Sues Road;
- the line route would impact on the Whicher Range Nature Reserve and the line route across the Whicher Scarp would be of greater visual impact than the alternative Great North Road Option;
- SECWA was concerned with the potential impact of the transmission line on tourism if Sues Road becomes a major access to the region; and
- the option would require clearing of approximately 48ha of virgin (uncut) forest near the Blackwood River.

4.0 DETERMINATION OF PREFERRED OPTION

4.1 PUBLIC CONSULTATION

Following the completion of the preliminary corridor selection studies, SECWA embarked on an extensive public consultation programme consisting of organised meetings with local shires, public information sessions, organised public meetings and erection of public displays in prominent positions.

Details of the public consultation programme are summarised in Appendix C.

The public consultation programme confirmed that the major issues associated with the construction, operation and maintenance of a transmission line through the region were:

- interference with agricultural land uses;
- conflict with residents lifestyles;
- health risks; and
- devaluation of private land.

SECWA incorporated the community comments into the next stage of the corridor selection procedure which was to take account of the community views and prepare a more detailed description of each option. The community comments resulted in a number of changes. These are shown on Maps 2 and 3 and outlined below. A detailed description is given in the following section (Section 4.2.).

- Of the corridors presented to the community for the Manjimup Option the preferred corridor shown on Map 3 was identified following community consultation.
- For the Margaret River to Beenup corridor, SECWA moved the original corridor east to pass predominantly through State Forest in response to community concerns.
- The Great North Road Option was amended to include Jamieson Road thereby further avoiding conflict with agricultural land uses.

4.2 DESCRIPTION OF OPTIONS

As described above, three preliminary route options were identified by SECWA and discussed in the community during a public consultation programme.

The general philosophy of the route selection process has been to minimise the social, environmental and economic impacts on private properties and State forests. This is accomplished by paralleling existing SECWA power lines on private properties and roads and tracks in forest areas. Conservation parks, nature reserves and scenic areas are avoided or the intrusion minimised where alternative routes are not available.

One corridor was identified from the Manjimup substation and two corridors were selected which originate at the Picton substation. The routes are described in the following sections and shown in detail on Maps 1, 2 and 3. Corridor statistics on land uses and clearing requirements are provided in Table 2.

4.2.1 Picton-Capel-Margaret River-Beenup

This corridor option is shown in detail on Maps 1 and 2. The total distance of this route is 130km and comprises of the following links:

Picton to Capel Link

The route parallels the existing steel pole line between Picton to Capel (Map 1). The new line would be located with a 20m separation to the existing line. To minimise the conflict with dwellings and distribution power lines some deviations may be necessary.

The route is generally clear of urban development south of Bunbury and along the coastal road. Access is good although some swamp areas are traversed by the route.

Some conflict with dwellings occurs in the vicinity of the Boyanup Road crossing where houses are located on both sides of the existing line. A minor deviation may be required in this area.

The route continues past the Westralian Mineral Sands mine site along the original alignment to cross the Bussell Highway immediately south of Mangles Road intersection. A large private airstrip is located to the west of the highway and the new line would have to be located so as not to intrude into the airfield approach and take-off flight paths.

The only viable route which avoids the urban areas and the proposed road developments at Capel is located to the north of the town. The new line would be installed between the two existing 66kV lines. The route continues to cross reclaimed land to Capel substation located approximately 4km south of the town along the Bussell Highway. There is no immediate provision to turn the new line into Capel substation.

Capel to Margaret River Link

The route generally parallels in the existing 66kV wood pole line in a southwest direction to Margaret River. Initially the new line would be located 20m to the west of the existing line as it skirts the southeastern edge of the Ludlow Plantation. The route traverses swamps at the Bussell Highway crossing and avoids permanent open water to the east of the existing line. A number of dwellings located in the Ludlow/Hithergreen Road area may require a minor route deviation.

The swamps and dwellings can be avoided if the abandoned railway reserve to the southeast of can be utilised for the new line. A tentative corridor for this option is shown on Maps 1 and 2. The use of this reserve would be subject to negotiations with Westrail. The original alignment parallel to the existing line would be regained where the railway reserve crosses under the line.

The route would regain the west side of the existing line in the vicinity of the Busselton cemetery and a house located in that area. The golf course, club buildings and a number of dwellings in the area on Gate Road would require a minor deviation, shown on Map 2, from the existing line route. The proposed relocation of Busselton airfield and the associated flight path clearance requirements would be taken into account.

The route would continue along the east side of the existing line to Margaret River. This would avoid two line crossings as the existing line leaves the original alignment for connection to Busselton Substation approximately 6km to the north.

The land use on the coastal plain generally consists of open grazing land with remnant areas of natural forest. An area traversed by the route between Payne and Price Roads is used for intensive agriculture and the existing line conflicts with irrigation practices. The new line would be sited to minimise the impact on agricultural land use. On higher ground south of Gale Road the land use returns to grazing and larger areas of uncleared forest.

The existing line skirts the Margaret Plantation and the town airfield. The new route would be located to the east side of the existing line so as not to conflict with the established facilities. The route passes approximately 0.5km east of the present SECWA substation and town boundary. Provision is made to terminate the new line into the substation at Margaret River, sometime in the future.

Margaret River to Beenup Link

The present 66kV transmission system terminates at the Margaret River Substation. Power to Augusta and consumers in the area is supplied by overhead low voltage (22kV and below) lines. The corridor was changed from the initial tentative corridor to avoid conflict with property owners, subdivisions and existing dwelling and farming facilities.

The preferred corridor traverses southeast across private properties, Rosa Brook Road, the southern section of Bramley Forest block, Wallis Road and Witchcliffe Forest block. An optimum line route would be selected in the Forest Blocks to avoid areas of high quality timber and to minimise the clearing requirements of the new line. The corridor then passes due south through the eastern half of the Witchcliffe Forest Block to cross Brooks and Rosa Glen Roads and Chapman Reserve. The Blackwood River Reserve is crossed approximately 2km west of the Great North Road.

The corridor avoids the extensive dairy farming facilities located at both the Brooks Road and the Warner Glen Bridge areas.

The corridor continues due south by following the Great North Road and the Scott River Road to the mining site.

4.2.2 Picton-Capel-Great North Road-Beenup

This option is shown on Maps 1 and 2. The distance of this option is 114km and comprises of the following links:

Picton to Capel Link

This part of the route is identical to the previous link of the Picton-Capel-Margaret River-Beenup option.

Capel-Great North Road Link

The first part of this route to the south of Busselton is identical to the previous link. The route deviates southwards into the new corridor at Jamieson Road. An actual line route located on the east side of the road would minimise conflict with the intensive agriculture carried out in that area as well as a number of established dwellings. The corridor enters the Vasse Plantation and runs parallel with Rapids Road and the Great North Road. Minor deviations are necessary to avoid conservation parks, nature reserves and scenic areas located within the State Forest.

Great North Road-Beenup Link

The corridor crosses the Blackwood River 2km west of the Great North Road and follows the route established for the previous option to Beenup.

4.2.3 Manjimup to Beenup

The following section describes some of the issues which have dictated the position of the Manjimup to Beenup corridor and identifies areas where environmental planning and management will be required to reduce potential impacts. The route is approximately 90km long and is shown on Map 3.

Manjimup to Vasse Highway Link

From Manjimup substation the corridor traverses privately owned, agricultural land before entering the Channybearup forest block. It is across this private land that the line has the potential to impact on the three residences which are located within 1km of the corridor. Careful placement of the centreline within the undulating topography and using the numerous blocks of remnant vegetation as backdrops would significantly reduce the potential visual impact. A line would not be closer than 500m to any of the residences.

Once in Channybearup forest block the corridor generally follows Palings Road, a forest haul road, to the junction of Seven Day Road. It is along this section that the corridor passes through regrowth Karri forest. Careful planning and selection of the centreline entering the forest would be required to reduce the potential visual impact associated with clearing State Forest. This section of the corridor is restricted to the north because of private land and a proposed resort located on Lefroy Brook. Areas to the south of the corridor include very high quality Karri forest and higher topography, increasing the potential visual impact.

After Palings Road, the corridor follows a ridge and where ever possible avoiding Karri forest and drainage lines, for approximately 22km before dropping off the Darling Plateau near the Vasse Highway. Also located along this ridge and paralleled by the corridor is Waistcoat Road, a limited access forest haul road.

The corridor along this section is restricted to the north and south by headwaters of major drainage lines, i.e. the Donnelly River to the north. These drainages are generally vegetated with high quality Karri forest. This section also crosses the Beavis East and Beavis West Forest Blocks, areas which are nominated for listing with the Australian Heritage Commission.

The next section of the corridor passes from the Darling Plateau, down the Darling Scarp, and onto the Scott Coastal Plain. The corridor follows a small valley off the Scarp and consequently the surrounding topography has the effect of reducing the potential visual impact of the line. The partly cleared valley also allows for an alignment to be selected which follows the edges of State Forest, reducing the potential visual impact of a cleared linear route proceeding up the Scarp.

On the Scott Coastal Plain, the corridor crosses the Vasse Highway at right angles and between two bends, which reduces the potential visual impact considerably. The corridor then enters Storry Forest block before crossing the Donnelly River and Barlee Brook. These river crossing are in areas where the drainage channel is well defined and topographic relief is low, reducing the erosion potential associated with the construction and operation of the line, and reducing construction costs.

The remainder of the corridor traverses State Forest, following wherever possible, existing forest access tracks, before crossing five kilometres of cleared land and terminating at the minesite. Within the State Forest the edges of the corridor cross Paget and Chester Nature Reserves as shown on Map 3.

4.3 PREPARATION OF CER

SECWA referred the project to the EPA in August 1990, following which the EPA set the level of assessment for the project as CER (Consultative Environmental Review). Appeals against the level of assessment were dismissed by the Minister for the Environment on 30 October 1990.

Guidelines for the preparation of the CER were received from the EPA on 29 November 1990. A copy of these guidelines is provided in Appendix A.

The guidelines were subsequently amended by the EPA on 6 May 1991, so that in Section 4, "Evaluation of Alternatives", the first sentence should read:

> "An evaluation of alternative transmission line corridors and other options such as on-site generation of power at the minesite should be provided."

TABLE 2

CORRIDOR OPTIONS STATISTICS

	Corridor Option	*Length (km)*	*Vegetation Clearing (km)*	*No. of Drainages Crossed*	*No. of Buildings within 500m of Centreline*	*Predominant Land Uses Percent (%)*		*Recreation Areas within Corridor*	*Private Land and Other*[1]	*(%)*
A	Picton to Sabina River (Common to Options B, C and D)	44.5	11.0	30	45	Agriculture State Forest	(94) (6)	Preston River Capel River Ludlow State Forest	Private Other	94 6
B	Sabina River to Margaret River	46.5	13.5	20	42	Agriculture State Forest	(92) (8)	Busselton Golf Course Heritage Trail Margaret River	Private Other	92 8
C	Margaret River to Beenup	39.0	23.0	29	8	Agriculture State Forest	(40) (60)	Whichcliffe Block Chapman Brook Blackwood River Brockman Highway	Private Other	40 60
D	Sabina River to Beenup via Great North Road	70.0	52.0	30	13	Agriculture State Forest	(36) (64)	Heritage Trail Rapids Conservation Park Mowen Conservation Park Blackwood Conservation Park Brockman Highway	Private Other	36 64
E	Manjimup to Beenup via Waistcoat Road	90.0	80.0	23	5	Agriculture State Forest	(11) (89)	Bibbilmun Track Seven Day Road Donnelly River Vasse Highway	Private Other	11 89

Notes: 1. Other - Vacant Crown Land, State Forest or other Crown Land.

5.0 AFFECTED ENVIRONMENT

5.1 INTRODUCTION

This section provides a description of the environment potentially affected by the construction, operation and maintenance of the proposed electricity supply alternatives. The study area showing the viable supply alternatives is provided on Figure 3.

A detailed inventory of the existing environment for the study area, defined by the corridor selection studies, was collected and collated for use both in the corridor selection phase and the impact assessment phase of the project. A description of the inventory is provided in Supporting Documents 1 and 2. The inventory was stored on a Geographic Information System (GIS) and accessed to identify potential impacts of the corridor options identified during the public consultation stage and to assist in the identification of the preferred corridor option.

5.2 BIOPHYSICAL ENVIRONMENT

5.2.1 Climate

The study area experiences a temperate mediterranean climate characterised by cool, wet winters and warm, dry summers. The seasonal rainfall results from westerly frontal systems bringing moist air from the ocean.

Mean monthly minimum temperatures are lowest in winter and range from 8.1°C (Margaret River), 8.2°C (Busselton) to 11.0°C (Cape Leeuwin). Mean monthly maximum temperatures peak in summer with Cape Leeuwin recording 23.5°C, 27.6°C at Busselton and 28.1°C at Margaret River.

Average annual rainfall is 838mm at Busselton, 1,197mm at Margaret River and 1,020mm at Cape Leeuwin. Rain falls predominantly in winter with most of the rainfall being received between April and October.

The most prevalent winds at Margaret River are south-easterlies and south-westerlies. South-easterlies are most common in summer and autumn, especially at 0900 hours. South-westerlies occur most often in winter and spring at 1500 hours. North-westerly winds also occur at these times.

5.2.2 Geomorphology

As described in the resource inventory (Supporting Documents) there are five geomorphic regions affected by the corridor options:

- the coastal area between Bunbury and Busselton lies on the extreme southern end of Quaternary sands of the Swan Coastal Plain;
- the coastal strip on the west edge of the study area on the Leeuwin-Naturaliste Ridge;
- the Margaret River Plateau;
- the Blackwood Plateau including the Whicher Range; and
- the Scott Coastal Plain.

5.2.3 Surface Hydrology

The surface hydrology features of the study area, which are likely to be affected by the corridors, can be broadly divided into two classes:

1. Defined drainage lines; and
2. Wetlands.

Defined Drainage Lines

Most of the well defined drainage lines occur on the Darling Plateau. The major drainage potentially affected by the transmission line are the Blackwood River, the Donnelly River and Margaret River. The hydrology of the region and associated water quality is very sensitive to salinity and sediment loads produced by activities within the catchment. Clearing for forestry and/or transmission lines can, if not managed properly, increase salinity and sediment loads through changing the water balance and increasing erosion through surface runoff.

Wetlands

The vast majority of wetlands found in the study area occur in the poorly drained geomorphic units of the Blackwood Plateau, the Swan Coastal Plain, and the Scott Coastal Plain.

Small, localised wetlands also occur on the Darling plateau near drainage lines, and are often associated with groundwater soaks or springs.

These wetlands can be potentially affected by the transmission line both directly through foundation or road access construction, and indirectly through drainage changes resulting from line construction.

5.2.4 Vegetation

Vegetation

The vegetation of the study area has been mapped at a scale of 1:250,000 by Smith (1973) and at a scale of 1:1,000,000 by Beard (1981) as belonging to the Nornalup, Chapman, Boranup and Scott River Systems with a small area near Busselton belonging to the Spearwood Dune System.

The principal vegetation units represented in the study are:

- The Spearwood System

  Between the north coastal plain and the sea, coastal sand dunes and low limestone ridges give raise to the Spearwood System. Tuart (*Eucalyptus gomphocephala*) tall woodland and tall forest occur on sandy soil overlying a low limestone ridge. South of the Sabina River the Tuart drops out and remnant *E. cornuta* open forest occurs. Peppermint is the main understorey species in the tuart woodland; it also occurs on the coastal dunes towards Dunsborough as low open forest and open forest

- Chapman System

  The Chapman System is the characteristic vegetation unit of the Blackwood Plateau. The general cover consists of jarrah-marri forest, frequently stunted by poor drainage conditions. *Eucalyptus megacarpa* and *E. patens* may occur locally in the Bridgetown System while low woodlands of *Melaleuca preissiana* and *Banksia* spp. occupy damp sites. Where there has been dissection, a yellowish clay loam is exposed on pediments and carries scrub of small stunted jarrah, numerous shrubs and the grass tree *Kingia australis*. On the slopes of the Whicher Scarp, there are expanses of very sandy lateritic gravel, on which jarrah forms woodland with *Eucalyptus haematoxylon* and *Banksia* spp. In the north-west, under the lee of the Leeuwin-Naturaliste Ridge, *Eucalyptus cornuta* forms forest on acid grey earths.

- Nornalup System

  Extends from the Donnelly River Valley, north-west of Manjimup, south and south-east to Irwin Inlet. Karri (*Eucalyptus diversicolor*) forest is found mainly on red earths. Jarrah (*E. marginata*) and marri (*E. calophylla*) are prominent where soils are lateritic or sandy respectively. On poorly drained lower slopes there is often a sequence from yarri/blackbutt (*E. patens*) or bullich (*E. megacarpa*) to thickets then to reeds with increasing wetness.

- The Boranup System

  The Boranup System covers the Leeuwin-Naturaliste Ridge and the coastal dunes of the Scott River Plain. Vegetation is an intrinsic mosaic controlled by the factors of soil and exposure. On the exposed western slopes of the Ridge is heath of *the Pimelea ferruginea* association. With decreasing exposure, peppermint (*Agonis flexuosa*) and/or *Banksia* spp. dominate a range of structural types (low forest, low woodland or open low woodland). Jarrah (*Eucalyptus marginata*) may associate in the low forest on leached sands, and once off the coastal limestone develops into jarrah-marri forest. In the lee of the main Ridge brown sands support karri tall forest. Forests of pure marri (*E. calophylla*) and woodlands of *E. cornuta* and *E. megacarpa* also occur on the brown sands.

- The Scott River System

  On the extensive stretches of seasonally swampy flats between the forests of the Chapman and Nornalup Systems, and the coastal sand dunes of the Boranup System, there is largely jarrah-*Banksia* low woodland with *Melaleuca* and an understorey of small shrubs and sedges. With a still higher water table, sedgeland occurs, and where water is trapped by dunes, there are small rush- and sedge-filled swamps and lakes. Isolated hummocks of lateritic material support jarrah in forms from forest to low woodland, and sandy ridges support *Banksia* low woodland. At and to the north of the Scott River there is a unique *Viminaria* scrub on sheet laterite.

- Cleared Land

  Where land has been cleared for agricultural and urban purposes, pasture, with or without an overstorey of remnant trees as described in the vegetation systems above, occurs.

5.2.5 Fauna

The study area consists of a mixture of cleared pastureland and native vegetation (including State Forest, Nature Reserves, National Parks and remnant vegetation on private properties). No specific field surveys for fauna have been undertaken for this project. However, several fauna surveys have been undertaken in the study area. SECWA will complete a fauna survey prior to the commencement of clearing and construction.

Mammals

A total of 28 native mammal species have been recorded (five macropods, four possums, four dasyurids, the southern brown bandicoot (*Isoodon obesulus*), the numbat, the echidna (*Tachyglossus aculeatus*), the dingo (*Canis familiaris dingo*), two rodents and nine bats).

Some species are widespread, namely the western grey kangaroo (*Macropus fuliginosus*) and two bats (*Pipistrellus tasmaniensis* and *Eptesicus regulus*). Many others are widely distributed but are locally confined to particular habitats. Several species previously observed in the region are now thought to be extinct within the area, including *Bettongia lesueur, Macrotis lagotis, Phascogale calura* and *Potorous tridactylus*.

Few of the mammals recorded in the surveys (How *et al.*, 1987; McEvoy, 1990; Ninox Wildlife Consulting, 1990) have changed conservation status during the last forty years or more. The number has declined slowly, however, and contraction of ranges for mammals has occurred commonly. How *et al.* (1987) attribute the contraction in range to a combination of the accumulated effects of changed fire regimes, land clearance for agriculture, predation, competition and disease. McEvoy (1990) found that habitat discontinuities and isolation may also have contributed to the changed status of mammals. Further clearance of land would undoubtedly continue the existing trend of habitat loss which is occurring throughout the south-west of Western Australia.

Birds

Some 144 species of birds have been recorded in the southern forest region although this includes some coastal species. The karri is generally less well-endowed with species than the jarrah forest and the marginal woodlands.

Several species are considered to be rare although only one, the ground parrot (*Pezoporus wallicus*), has not been sighted in recent time.

Reptiles

Christensen *et al,* (1985) recorded 32 reptiles species in their surveys although at least several more species have previously been recorded or may extend into the area from adjacent areas. This is quite a small number for a large diverse area and is attributed to the cool moist climate. The greatest diversity of species is observed in the margins of the main forest belt. Sandy soils and areas of bare ground are the favoured habitats.

Geckoes, legless lizards and dragons are poorly represented in the area. One turtle, the oblong turtle (*Chelodina oblonga*) is common throughout the region. Snakes are poorly represented (9 species) and skinks well represented (19 species).

There is no evidence based on soil types, habitats or other information to suggest that there may be rare or restricted reptiles in the study area. To the contrary, the herpetofauna may be both species-poor and scarce in numbers.

Amphibians

Some 15 species of frogs were recorded by Christensen *et al,* (1985) although several more are thought to occur in the region. Many of the species appear very tolerant of change in their environment as evidenced by their common occurrence in farmland.

CALM has advised SECWA that two endangered species of frogs occur within the study area. The frogs, about the size of a thumbnail, are *Geocrinia alba* ssp. nov. and *G. vitellina* ssp. nov. *G. Alba* is confined to a few sites in Witchcliffe and Karridale, and in damp sites along the Blackwood River. *G. vitellina* is confined to small seepages on a few creeks north of the Blackwood River. These areas are subject to special management plans prepared by CALM and are avoided by the preferred corridors as shown on Maps 2 and 3.

Rare and Endangered Fauna

The latest listing of rare species was published in the Government Gazette in November, 1990. Any of these whose known or likely range extends into the area affected by the transmission line are listed in Table 3.

TABLE 3

RARE AND ENDANGERED FAUNA IN STUDY AREA

Scientific Name	*Common Name*
Mammals	
Bettongia penicillata	woylie
Myrmecobius fasciatus	numbat
Bettongia lesueur	boodie
Macrotis lagotis	dalgyte
Phascogale calura	red tailed wambenger
Potorous tridactylus	long-nosed potoroo
Macropus eugenii	tammar wallaby
Pseudocherius peregrinus	common ringtail possum
Dasyurus geoffroii	chuditch - Bramley Forest Block
Birds	
Falcunculus frontatus	crested shrike - tit
Emblema oculata	red eared firetale
Pezoporus wallicus	ground parrot
Falco peregrinus	peregrine falcon

Introduced Fauna

The major introduced species in the study area are mammals. Their distribution and abundance is documented by Christensen *et al,* (1985). Table 4 lists species, with comments on their distribution.

TABLE 4

INTRODUCED MAMMALS

Scientific Name	*Common Name*	*Status*
Rattus rattus	black rat	near water, human habitation
Mus musculus	mouse	widely dispersed
Oryctolagus cuniculus	rabbit	near farmland
Felis catus	cat	widely dispersed
Vulpes vulpes	fox	widespread
Mustela putoris	ferret	rare
Capra hircus	feral goat	in pockets
Sus scrofa	feral pig	spreading
Equus caballus	horse	in pockets

Aquatic Life

Twelve native species and five introduced species of freshwater fish have been collected in the area (Christensen *et al,* 1985). With the exception of the mullett (*Mugil cephalus*) and the pouched lamprey (*Geotria australis*) all the native species are endemic to the south west region. Several species occur in forest streams only, and have a very restricted range. Others which extend into the brackish estuaries appear more widespread.

The marron (*Cherax tenuimanus*) a large native freshwater crustacean and a few smaller crustacea, occur in the region. The marron is the major target of a small recreational fishing activity.

5.3 SOCIO-ECONOMIC ENVIRONMENT

The study area, which stretches between Bunbury and Augusta, approximately 200km and 320km south of Perth, is shown on Figure 3. Traditionally, the area's main industries have been dairy farming, beef cattle farming and timber production. However, the discovery of heavy mineral sands in the area in the 1940s-1950s, the rapid development of a wine-making industry and the growth of tourism have led to a broadening and diversification of its economic base. The region has also proved popular to many people seeking an alternative lifestyle or a place to retire.

5.3.1 Local Government

The seven local government authorities directly affected by the transmission line options are:

- Bunbury City;
- Dardanup Shire;
- Capel Shire;
- Busselton Shire;
- Manjimup Shire;
- Nannup Shire; and
- Augusta-Margaret River Shire.

5.3.2 Human Populations Affected

The population of the study area is principally located in the major towns of Bunbury, Busselton, Margaret River, Augusta, Nannup and Manjimup. Projected population figures for the area show that population is expected to continue its present linear growth rate until 2001. Areas of residential growth could reasonably be expected to occur predominantly near existing town sites and coastal areas. Census data (1986) indicate that population is largely middle-aged and that the dominant family types within the study are couples with dependent children or couples without children.

The communities potentially affected by the transmission lines include farmers and small lot lifestylers, particularly if the Picton Options are pursued. The number of properties affected by each option are:

- Manjimup Option - 18 properties (5 buildings);
- Picton-Great North Road Option - 126 properties (58 buildings); and
- Picton-Margaret River Option - 179 properties (103 buildings).

The number of buildings within 500 metres of the nominal centreline for each option are shown in brackets.

5.3.3 Land Use

An inventory of land uses in the study area was collected for the corridor selection study and a description of the major land uses is provided in the Supporting Documents. This inventory was used to assist in the selection of the corridor options and for determining the land uses impacted by each corridor segment.

The land uses potentially affected by the corridor options include the following:

- agriculture;
- State Forest;
- tourism activities; and
- transport.

The land uses affected by each supply alternative are detailed in Table 2.

5.3.4 Economic Profile

The predominant industry employers are (in order of importance):

- agriculture, forestry, fishing and hunting;
- wholesale and retail trade;
- community services;
- manufacturing; and
- construction.

Within agriculture, livestock products (including dairy farming) has the highest gross value in the Shire of Augusta-Margaret River, while livestock slaughterings (e.g. beef cattle farming) has the highest gross value in the Shire of Busselton.

5.3.5 Transport

The major roads within the study area are the Vasse and Bussell Highways. A disused railway system also occurs in the study area. The approval of the Jangardup and Beenup mineral sands mines was dependent on resolution of transport issues associated with heavy haulage of mineral sands product to Bunbury. As a result, the Main Roads Department has recently (February 1991) submitted a Public Environmental Review outlining the Sues Road to Capel mineral sands road option (Main Roads Department, 1991).

5.3.6 Community Infrastructure and Services

Bunbury, Busselton, Margaret River, Nannup and Augusta are the principal population centres within the study area. These centres also contain most of the existing infrastructure and community services which exist in the area. All the facilities which could be expected to be associated with medium towns (e.g. hospitals and other medical facilities, emergency services, cultural and natural resources, sporting facilities, etc.) are present.

5.3.7 Ethnography and Archaeology

No surveys for Aboriginal sites of archaeological or ethnographic significance have been specifically carried out for this project. The area undoubtedly contains important sites, e.g. the Devil's Lair reserve. A survey for sites of Aboriginal significance will be carried on the approved corridor.

5.3.8 Heritage

A search of the Register of the National Estate (Western Australia Heritage Committee, pers. comm.) found the following places and areas were listed and could be impacted by the corridor options:

- Ludlow Wonnerup Area — 6,500ha, 3km northeast of Busselton;
- The Broadwater Reserve — 400ha, 6km west of Busselton;
- Whicher Range Area — 6,000ha 20km southeast of Busselton (Part of State Forest 33);

- o Alexandra Bridge (1987) On Brockman Highway, over the Blackwood River, 10km northeast of Karridale; and
- o Strickland Block.

Areas which are entered in the Interim List of the Register of the National Estate and potentially impacted by the corridor options include:

- o Blackwood River Conservation Park;
- o Milyeannup Nature Reserve;
- o Rapids Conservation Park;
- o Mowen Conservation Park;
- o Chester Nature Reserve;
- o Beavis (East and West) Block; and
- o Giblett Forest Block.

These locations are shown on Maps 2 and 3. As a result of the long history of European settlement within the southwest, many items of heritage interest also exist mostly in townsites.

5.3.9 Visual Resources

A detailed inventory of potential transmission line visibility and landscape resources was prepared during the corridor selection phase of the project (Supporting Documents). This inventory was used for the initial corridor selection phase of the project and was examined to determine the potential line visibility for each corridor option.

The length of corridor visible from sensitive viewpoints for each corridor option was calculated from the GIS database.

In general, line corridors within State Forest have a limited impact on the landscape due to the restricted range from which the corridor is visible. Exceptions to this occur when the line traverses valleys or areas of high slope.

Where the corridor segments traverse agricultural land the area from which the proposed transmission line can be seen increases.

5.3.10 Recreation

The southwest region of Western Australia, which includes the study area, is a major destination for tourists and recreationalists and the karri forest, although a relatively small portion of the South West, is a focus for many national and international travellers. People are attracted to features such as the inlets, beaches, coastal landscapes, extensive sand dunes, rivers and specific recreation roads.

The primary routes for recreation access within the region are the South Western, Brockman, Vasse and Muir Highways. Throughout the region there is an extensive network of Shire and CALM roads. Many minor forest roads and access tracks are only trafficable to four-wheel-drive vehicles and trail bikes.

The major landscape types which occur in the study area and can be classed as recreational resources are summarised as follows:

- the river systems, particularly the few which flow throughout the year;
- the Darling and Whicher Scarps; and
- the diverse forest types which afford a range of scenic attractions.

A wide range of recreation activities are undertaken within the study area. Popular pursuits include pleasure driving and sightseeing, picnicking, fishing (coastal and inland), maroning, hiking, four-wheel driving and camping. There are many commercial tourist operations within the area which utilise both natural and man-made resources. Such activities include four-wheel drive safari, canoeing, hiking, horse riding forest tours and farm accommodation.

5.3.11 Conservation

There are a number of Nature Reserves and National Parks occurring in the study area.

The Nature Reserves are vested in CALM for the purpose of wildlife conservation and study. The reserves are areas in which wildlife values may not be commercially exploited and where forms of recreation which damage natural ecosystems are not permitted.

The National parks are also vested in CALM for the purpose of wildlife and landscape conservation, scientific study, preservation of features and recreation. The construction, maintenance and operation of a transmission line is not compatible with the objectives of areas classified as National Parks.

6.0 DESCRIPTION OF PROPOSED DEVELOPMENT

6.1 LINE EASEMENTS

The transmission line would be located within a line easement. Although approval will be sought for a 1km wide corridor, the actual easement required for the line is only 40-60m wide. Once the final line route has been determined, SECWA would relinquish all interest in the remainder of the corridor.

An easement in general terms means the granting of certain rights to SECWA including the right of entry to survey, clear, construct and maintain the line. SECWA does not obtain title to the land and ownership always remains with the registered land proprietor.

Once the line is constructed and put into service the land within the easement usually resumes its previous role, provided this is compatible with the operational requirements of the line.

Some restrictions must be imposed on certain activities within the easement to ensure public safety and line security. These will be described and detailed in an Easement Agreement document prepared for each affected landowner.

Compensation for the easement would be negotiated with the registered land proprietor. This would be based on valuations provided by the Valuer General's Office.

Compensation would also be negotiated with land holders for any loss of production caused by the line construction and future operational activities.

Owners would also be offered seedlings to replace any trees removed from the property. These trees would be established in a new area remote from the easement.

6.2 LINE STRUCTURES AND INFRASTRUCTURE

The estimated transmission line lengths are shown on Table 2. The line would be constructed on 4-leg steel lattice towers (or concrete poles - not illustrated) similar to that shown on Figure 4. The towers would range between 20 and 30m in height, depending on clearance requirements and the typical span between the towers would be 300-400m. The minimum ground clearance for the conductors would be 6.7m.

Permanent access tracks to the tower bases would be constructed and maintained for line inspections and maintenance purposes in State forest or crown land. Where the tracks cross existing fences, steel gates would be installed.

A substation would be constructed on land owned by MDL at the Beenup Minesite. The other end of the line would connect to either the existing substation at Manjimup or the substation at Picton, both having provision for additional line connections.

6.3 LINE CONSTRUCTION

The contractors employed by SECWA to construct the line would use a tension stringing method for the erection of conductors and earthwires. The technique and equipment have been used previously on transmission line projects in Western Australia.

The proposed transmission line would consist of lattice steel single circuit tower or concrete poles and overhead steel cored aluminium conductors. Erection of the line has 3 distinct stages namely:

- foundation construction;
- line structure erection; and
- the stringing of conductors.

The first two stages require heavy vehicle access to each of the tower sites to transport foundation and tower materials. The stringing stage requires access along the route to pay out the haul wires.

The method involves the running out of up to five kilometres of a special anti-twist haul wire over a section of the line. This haul wire is then lifted up into running blocks mounted on the towers. By means of a winch, the haul wire is tensioned and used to pull in turn the conductors and earthwires along the section. By carefully adjusting the winch tension, the conductors are prevented from touching the ground. On completion of the stringing operation, the conductors and earthwires are fully tensioned and clamped into place on the towers.

The running out of the haul wire would require a vegetation free area between the towers. This area or construction zone normally accommodates a permanent access track along the line.

6.4 LINE MAINTENANCE

Line maintenance would comprise the following activities:

- periodic visual inspection of conductors, insulators and towers from the ground;
- cleaning and replacement of line components as required;
- maintenance of vegetation profile; and
- visual monitoring of easement condition to identify problems such as erosion and weed infestation.

Permanent access to the line structures would be required for maintenance and an all weather access track will be constructed where necessary.

7.0 ENVIRONMENTAL CONSEQUENCES

The following sections on environmental consequences describe types of impacts that could be expected for each resource in the natural, human and cultural environments, and potential initial and residual impacts. For the purposes of this document, environmental impact has been defined as a modification in the status of the environment, as it presently exists or is anticipated to be, from the proposed action.

Environmental impacts can be positive (beneficial) or negative (adverse). They can occur either as a primary result of the action (direct) or as a secondary result (indirect). They can be permanent or long-lasting (long-term), or temporary or of short duration (short-term). Impacts can vary in degree or magnitude from no change, or only slightly discernible change, to a total change in the environmental condition.

The following sections deal with generic impacts and mitigation anticipated along the whole length of the transmission line. Specific impacts for each corridor option and associated commitments are also provided. Dieback hygiene, vegetation clearing and electromagnetic fields are discussed separately.

7.1 GENERIC TRANSMISSION LINE EFFECTS

The following section discusses the potential impacts likely to occur along the entire length of the transmission line options. These impacts have been referred to as generic impacts since they relate to transmission lines in general and not just the lines relating specifically to the Beenup mine. The generic mitigation measures recommended to minimise these impacts are summarised in Section 9.0.

7.1.1 Natural Environment

7.1.1.1 Air Quality and Meteorology

Impacts to air resources would be short-term, resulting from transmission line construction activities. Impacts would be similar for any alternative corridor.

Transmission line construction would cause temporary increases in particulate matter and gaseous emission. Use of unpaved roads and removal of vegetation during construction may generate dust, which would be controlled through the use of standard construction dust mitigation procedures. Vehicle exhaust would produce short-term increases in sulphur and nitrogen oxides emission. In general, greater amounts of construction activity would result in higher emissions, thereby increasing impacts.

Because of the temporary and localised nature of emissions, potential air quality impacts would not be significant. Operation of the transmission line after construction would produce negligible quantities of ozone and nitrogen oxides; it is unlikely that these would be significant. Transmission line construction would have no impact on climatology in the area.

7.1.1.2 Earth Resources

The major concern for earth resources was soil erosion hazard. Locations were identified where the disturbance of soils considered to have high to severe water or wind erosion hazards might result in increased erosion rates. All known mining operations have been avoided by the corridor options and no effects to mineral resources are anticipated.

The assessment of potential impacts to soils was based on:

- the highest wind or water erosion hazard potential mapped along the proposed corridors; and
- the type of construction/operation access anticipated for the project.

The primary impact of construction and project-related activities is to potentially increase the rate of wind and water erosion. Those areas with high to severe erosion hazard potentials are the most susceptible to significant adverse impacts due to the project. With the adherence to the measures listed in Section 9.0, impacts to soils are expected to be lessened. The areal limits to construction activities, suppressing of fires, and minimising disturbance to vegetation, drainage channels, and streambanks should reduce erosion impacts.

In areas where impacts to soils are expected to be high, the following commitments were developed by SECWA:

- o wherever possible, no new access would be constructed;
- o no widening or upgrading of existing access road;
- o permanently close construction access roads not required for maintenance;
- o new access roads will follow the landform contours;
- o line would be re-routed to avoid sensitive features; and
- o towers would be placed at maximum feasible distance from major drainage crossings.

With the adoption of the above commitments the long-term impacts to soils are anticipated to be low for the preferred corridor.

7.1.1.3 Biological Resources

Types of impacts that could potentially occur to biological resources as a result of construction and operation of the proposed project can be briefly summarised as follows:

- o effects on rare or endangered species or critical habitats thereof;
- o effects on relatively undisturbed, rare or unique vegetation types, species, communities or area;
- o creation of barriers to the migration or movement of wildlife species;
- o alteration of the diversity of biotic communities or population numbers of plant of animal species; and
- o increased potential for wildfires.

Commitments to reduce these impacts are provided in Section 9.0.

7.1.2 Human Environment

7.1.2.1 Land Use

Impacts identified along the preferred corridor would result from direct physical interference with existing and future land uses, and also parks, preservation, and recreation resources. The duration of impact was also considered, i.e. short-term, construction-related effects versus long-term, operations effects.

Potential impacts to existing or proposed land uses were identified wherever construction, operation and/or maintenance of the proposed project would:

- o displace, alter, or otherwise physically affect any existing agricultural use or activity;
- o displace, alter, or otherwise physically affect any area designated as tentatively suitable for timber production; and
- o alter or otherwise physically affect any established, designated or planned recreational, educational, or scientific facility, use area or activity.

7.1.2.2 Socio-economics

Socio-economic impacts can be adverse or beneficial, and short or long-term in nature. Effects may be experienced by property owners along the transmission line route, residents of nearby communities, and taxpayers in areas crossed by the route. The primary socio-economic issues associated with transmission line projects are:

- o construction-period impacts with area communities;
- o social and economic impacts along the selected route; and
- o fiscal effects with local shires.

The influx of the construction labour force is expected to have a beneficial impacts on area communities. The project will benefit local communities by increasing retail sales or generating employment. These impacts are short-term, lasting only for the duration of construction in the area.

Project impacts to land use can result in social and economic impacts where economical land uses are displaced. Of particular public concern with this project are the effects on livestock grazing and timber production from the route selected.

Construction of the transmission line would require approximately 60 to 65 workers.

Since the construction work would be contracted out, it is not possible to determine the geographic origin of the work force. It is expected that unskilled labour would be hired locally, and the project would therefore contribute to local economies during the construction period.

The demand for temporary accommodations along the route would depend upon the workers' places of origin. Some may stay in motels or boarding houses in the communities nearest the construction sites.

7.1.3 Cultural Resources

Direct adverse physical impacts to archaeological sites occur during ground disturbing activities associated with constructions, such as the preparation of tower pads, equipment yards, pulling sites and access roads. Indirect adverse impacts can result after construction due to increased erosion or to improved access which makes sites more vulnerable to accidental or deliberate disturbance. Physical disturbance of an archaeological site, whether it is direct or indirect, causes a permanent loss of information and is an offence under the Aboriginal Heritage Act (1972-1980).

To identify sites of cultural significant SECWA would commission a survey of the archaeological and ethnographic sites within the corridor prior to construction. The results of the survey would be provided to the WA Museum and SECWA would relocate the proposed line structures to avoid destruction of identified sites.

7.2 VEGETATION CLEARING

7.2.1 Impact

The clearing of State Forest and remnant vegetation for the transmission line would have an impact on the biological resources of the region. This impact would be directly related to the clearing within the 40m wide easement, and the felling of taller trees able to fall on the line from outside of the easement. To reduce this impact the corridors have been preferentially selected to follow areas where clearing has already occurred, i.e. roads (including haul roads and forest tracks) and existing easements.

The approximate clearing requirements for each option are:

- Picton to Beenup via Margaret River - 190ha;
- Picton to Beenup via Great North Road - 252ha; and
- Manjimup to Beenup - 320ha.

From satellite imagery used during the corridor selection studies and stored in the GIS database the area of remnant vegetation within the study areas shown on Maps 2 and 3 is estimated to be 350,875ha.

In 1982, Attiwill noted in a review of conservation and management of Karri forest for the EPA, that:

> "Beavis, Giblett, Strickland (forest blocks) and Beedelup National Park together amount to about 7500ha which included more than 4000ha of fine karri forest ....."

Of the 4000ha of karri forest identified by Attiwill, only 60ha would be impacted by clearing within the easement and selective felling of tall trees outside of the easement (up to 60m from the centreline). Of this 60ha approximately 40ha was cut-over between 1931 and 1940. This estimated area for clearing can be further reduced if the area already cleared for Waistcoat Road is taken into account.

The estimated clearing for the transmission line within Karri Forest is less than 0.02% of the Karri forest within the Beavis, Giblett, and Strickland forest blocks, and the Beedelup National Park.

In the process of the corridor selection study, Karri forest was mapped and stored on the GIS database. The preferred corridor selected from Manjimup for which SECWA is seeking approval, crosses the minimum amount of mature Karri forest possible for the study area. Because the GIS assesses the entire study area before selecting the optimum route it can be concluded that, based on available information obtained from published and unpublished sources and incorporated in the GIS database, no other corridor option would impact on less Karri forest.

In general, the clearing of vegetation from the easement would follow the following procedure:

- clear all marketable timber from the easement 40 metres wide;
- clear all vegetation (but allowing regrowth shown on Figure 5) from a central strip varying in width from 12 metres (at the tower locations) to 30 metres (at mid span locations);
- remove all marketable timber products, stockpiling separately at landings for removal;

- o push all debris (unmarketable scrub from the 30 metre total clearance and tops left after sawlogs are removed, roots, etc.) into a central windrow;
- o burn debris, pushing up windrows until burning is complete;
- o if necessary, remove any unburnt material from the easement to nominate disposal points;
- o power rake cleared area to even grades, raking along contour lines to agricultural finish;
- o restore all natural drainage lines, including clearing and repair of all road culverts or floodways; and
- o repair and regrade haul road for line construction vehicles.

The advantages of using existing haul roads are:

- o less physical clearing is necessary because the already cleared road (usually 20m) falls within the forty metres easement for much of its length;
- o existing drainage flows can be maintained throughout construction;
- o it is not necessary to construct a new maintenance track for the completed line, with the attendant call for gravel extraction thus minimised or entirely obviated;
- o the dieback risk of importing new road materials is reduced or entirely obviated; and
- o the road, on completion of the line, becomes a shared facility useable by SECWA, CALM and their respective contractors.

As discussed, the clearing requirements would be dependent on the possibility of trees falling on the line. SECWA clears all tall trees within the 40m easement as standard practise. Because trees up to 50m high occur in the study area, SECWA has developed two clearing prescriptions:

- o clearing in forest <20m high; and
- o clearing in forest >20m high.

7.2.2 Clearing Within Easement

The 40m easement would be required to be cleared of all vegetation as described in the previous section. Vegetation would be able to regenerate, however this regeneration would be controlled to reduce the bushfire risk associated with high fuel loadings.

Mid-span Location

The minimum height of the conductors at mid span is 6.7 metres. To avoid flash-over risks, a clearance of 2.7 metres is required between the conductor and the vegetation. Figure 5 shows the proposed clearing profile for the mid-span location.

The conductors are capable of swinging up to 45 degrees from vertical in high wind situations, thus describing an arc with a 14.5 metre radius. At the 45 degree point the conductor is fourteen metres from the centre line horizontally and (still allowing a 2.7 metre flash-over clearance) it would be possible to have vegetation 8 metres high at this point.

Since the understorey trees, mainly peppermint, rarely exceed this height, it may be feasible to leave vegetation other than upper canopy trees in the outer 6 metres of the 40 metre easement. This will be further investigated when approval for a corridor is obtained.

The advantages of this, would be:

- 30% less clearing of understorey which is visually more acceptable;
- a saving of up to 10% on overall clearing costs (even though upper canopy is removed selectively the saving comes in the substantial reduction of remaining debris);
- 30% less width of easement to maintain to groundlevel; and
- wind protection for the flanking trees which could otherwise be more liable to wind throw on the newly exposed edge. The figures given are based on the worst case; that of the line at mid-span and at its slackest.

Line Structure Locations

The same calculations made at the towers would indicate that no understorey vegetation, even directly under the conductors, could cause flash-over as the species represented do not grow high enough.

However the risk of fire below the conductors cannot be ignored, and the clearance of understorey higher than 4m for at least six metres either side of the centre line is essential even at the towers. The proposed clearing profile for Tower locations is shown on Figure 5.

This results in the scalloped clearance shown on Figure 5a, with the cleared ground surface further reduced to 40% less than full clearance of the easement.

It is envisaged that within State Forest CALM would undertake the felling and removal of timber, while SECWA contractors would push the remaining vegetation into windrows for disposal by burning. Stumps would be left and windrowing of vegetation would be carried out using a bulldozer blade raised 5-10cm above the surface. This would leave the topsoil and root stock intact, encouraging quick regeneration and minimising potential soil erosion.

On private properties the clearing within the easement will be similar, however SECWA would fell and remove the timber in consultation with the landowner.

7.2.3 Clearing in Forest <20m High (Outside of Easement)

Most of the forest impacted by the corridor is Jarrah/Marri woodland with average heights of 20m. In these areas selective felling of trees able to fall onto the line from outside of the 40m easement, would be carried out in conjunction with foresters from CALM.

On the Great North Road and Margaret River options, removal of trees outside the 40 metre easement would be necessary only in the Blackwood River Valley, where conditions favour more vigorous growth patterns. For the bulk of the corridor the trees would not exceed the 17 metres height limit.

7.2.4 Clearing in Forest >20m High (Outside of Easement)

Tall forest, greater than 20m high, occurs within the study area and is impacted by the corridors. These forests typically occur on the deeper soils found between the Vasse Highway and Manjimup and include Karri.

There is no Tuart forest impacted by the corridors.

Specific clearing prescriptions have been developed for these areas. Within the 40m easement the clearing would follow that described in Section 7.2.2. Outside of the easement all trees greater than 20m high and able to fall on the line would be clear-felled. This is based on the assumption that all trees can fall regardless of age and condition. The proposed clearing profile is shown on Figure 5b.

Most of the karri encountered on the Manjimup option is estimated to be around 50 metres maximum, being regrowth forest. No other trees on the three options exceed this height.

All tall forest occurs on CALM land and felling and removal of timber would be carried out by CALM. Remaining vegetation would be windrowed and burnt by SECWA contractors. Areas outside the easement would be silvicultured and managed by CALM to SECWA's requirements (refer Section 7.2.6).

7.2.5 Easement Maintenance

The easement would be maintained for the life of the line in accordance with the vegetation profile shown on Figure 5.

The reduced vegetation clearing described in Section 7.2.2 would result in less maintenance, but, more importantly, the removal of debris would enable the cleared centre strip to be maintained by annual slashing if necessary.

The understorey that remains would not reach sufficient height to cause a flash-over. The upper canopy trees would be pushed out rather than cut so there would be no regrowth from stumps.

There would however, be germinating seed of the upper canopy trees, and it would be necessary to selectively remove this regrowth.

The regrowth material would be cut as saplings, every two to five years (depending on species) and dragged to the centre clearance, to be collected by a commercial shredder/chipper. This material would be used as a mulch or soil stabiliser.

The maintenance road would be a permanent feature, serving in state forest areas, both SECWA and CALM. It is expected that the easement would also be used for fire management purposes.

7.2.6 Silviculture Outside of Easement

Silviculture is the practice of growing and managing trees to achieve certain objectives, in this case line security.

A detailed silvicultural plan would be developed for the areas outside of the easement by SECWA in consultation with CALM, prior to the operation of the line commencing. The aim of the plan would be to maintain the vegetation profile shown on Figure 5b. It is envisaged that the plan would be implemented by CALM and consist of the following principle components:

- o specification of maximum tree heights permitted within zones determined by distance from the easement;
- o identification and removal of existing trees able to fall and impact on the line;
- o development of a monitoring programme to monitor regrowth on a regular basis; and
- o the subsequent felling and removal of trees identified during the monitoring programme as able to fall onto the line.

7.3 DIEBACK HYGIENE

7.3.1 Introduction

The spread of dieback disease caused by Phytophthora species, including *Phytophthora cinnamomi*, has been linked to the movement through native vegetation of vehicles and, more particularly, heavy earthmoving machinery. Safeguards to prevent or minimise the spread of dieback into dieback-free areas of native vegetation and croplands during transmission line clearing have been established in consultation with CALM. These safeguards are outlined below and include restrictions on construction clearing following heavy rain, washdown of vehicles before moving from dieback to dieback free areas and a workforce awareness programme.

7.3.2 Dieback Hygiene - Committed Mitigation

To minimise the risk of spreading dieback disease, CALM requires the following precautions to be taken:

- o all clearing operations shall be completed in accordance with dieback hygiene requirements specified by CALM.

The following hygiene requirements have been specified by CALM and shall be met by the Contractor.

- o when working in areas not infected by dieback, the Contractor may be required to cease operations temporarily in sensitive areas in the event of rainfall. Recommencement of operations will be subject to the approval of a Forest Officer in Charge;
- o all Contractor's personnel, including staff not fully employed on the contract, sub-contractor and others, shall be instructed on hygiene requirements by CALM before they commence clearing the route;
- o the Contractor's supervisor shall liaise with CALM's Officer-in-Charge for the section in which he is working, so that the following items can be defined:
  - roads and tracks which crews may be permitted to use and to gain access to the line route;
  - the location of dieback along the proposed route;
  - the locations along the proposed route where all vehicles, plant and equipment must be cleaned before entering dieback free areas; and
  - the necessity for a cleaning down unit to be stationed at the boundary between dieback infected areas and areas not infected by dieback, to clean vehicles and equipment as they enter the uninfected areas. Vehicles shall be raised on a platform, e.g. rubber-belting or wood ramp during the clean-down procedure, to specifications satisfactory to CALM.

Signs defining the boundaries between dieback free, dieback infected and uninterpretable areas will be erected by CALM.

Before clearing and construction commences, all vehicles, plant and equipment shall be inspected and cleaned to the satisfaction of the CALM's Officer-in-Charge of the relevant District, or such other officer as he may delegate.

The Contractor shall provide all equipment for cleaning vehicles. This may be in the form of:

- o mobile washing unit consisting of a tank of suitable capacity, coupled to a high pressure, low volume pump and hose with jet nozzle, all mounted on a suitable vehicle, and, compressor unit fitted with air hose and jet nozzle mounted on or part of a suitable vehicle, to the satisfaction of CALM; and

- all washing down water shall be dosed with sodium hypochlorite. The required minimum dosage shall be 250ml of chemical for 500L of water. The sodium hypochlorite dosage is to be renewed every 24 hours, and whenever water is added to the tank.

The Contractor shall submit a list of all persons who will be directly engaged in the clearing. This shall include part-time personnel, such as relief driver's pay officers and plant maintenance personnel and any other persons who may be associated with the work. Only those persons who have been instructed in the control of dieback shall be permitted in the area of operation.

It may be in the Contractor's interest to work all the dieback infected areas and the uninfected areas separately, so as to minimise the washing of plant and vehicles.

7.3.3 Supervision and Monitoring

Following discussion between CALM officers and SECWA, the following commitments with regard to construction, supervision and site monitoring have been agreed. These commitments are:

- a dieback 7-way test will be conducted by CALM officers;
- SECWA would work to priorities agreed by CALM;
- mapping of dieback disease status in areas of native vegetation would be arranged by CALM prior to construction commencing;
- wherever possible the work sequence would be carried out be dieback disease classes. If this is not possible, washing down of vehicles and equipment moving between these classes would be required;
- nominated officers from CALM and SECWA would supervise all aspects of the line construction to ensure that the commitments and guidelines outlined in this report are followed; and
- if these commitments and guidelines are breached than all parties involved would be investigated, and where necessary, dismissed from site.

7.4 ELECTROMAGNETIC FIELDS

Wherever electricity is transmitted and used it produces electric and magnetic fields. This applies equally to electricity usage in the street, in the home, at work or in public places. Sources of electric and magnetic fields include: high-voltage powerlines; street distribution lines; electrical equipment in factories, shops and offices; appliances in the home, and household wiring.

Electric and magnetic fields are concentrated close to the source, such as a powerline, and reduce as distance from the source increases.

Electric fields are produced by the voltage of the power supply and extend from the source to earth. These fields are basically constant for a particular source and do not vary with changing load on the source.

The electric fields produced from powerlines outside a house contribute little to the electrical field within the house as the intervening building structure and vegetation provide shielding to the field. Electrical fields generated by household appliances are very low owing to the low voltage of the household supply.

Magnetic fields are produced by the flow of an electric current. The current and hence the magnetic field vary with the demand on the source, be it an electrical appliance, or a powerline. As with electric fields the strength of the magnetic field diminish rapidly with distance from the source. An essential difference between the two types of fields is that magnetic fields are not significantly reduced by buildings or vegetation.

Sources of magnetic fields in homes are the fields from external powerlines, household wiring and household appliances.

The debate over the health issue prompted the Environmental Protection Authority to have a review carried out on high voltage powerline fields and the effects on human health in 1987 (Scott and Furphy, 1987). This review concluded that although a link between electromagnetic fields and human health is inconclusive, field levels of power installations in Western Australia will not constitute a threat to public health. This conclusion was based upon levels set by various international radiation protection organisations and comparisons with field measurements of SECWA installations which were well below the recommended levels set by these organisations.

The International Non Ionising Radiation Committee (INIRC) was established in 1977 by the International Radiation Protection Association (IRPA) in conjunction with the World Health Organisation. One of the tasks for INIRC was to evaluate the health risks of human exposure to electromagnetic radiation. INIRC has produced guidelines for human exposure to electromagnetic fields from powerlines.

The guidelines, reproduced in Table 5, are based upon an objective analysis of currently available knowledge.

TABLE 5

IRPA/INIRC LIMITS OF EXPOSURE TO
50/60Hz ELECTRIC AND MAGNETIC FIELDS
(INTERIM GUIDELINES)

Exposure Characteristics	*Electric Field Strength (kV/m)*	*Magnetic Flux (mT)*
OCCUPATIONAL		
Whole working day	10	0.5
Short-term	30[1]	5[2]
For limbs	-	25
GENERAL PUBLIC		
Up to 24 hours/day[3]	5	0.1
Few hours per day[4]	10	1

Notes:
1. Short-term occupational exposure to electric field strengths between 10 and 30kV/m is permitted provided the electric field strength (kilovolt/metre) multiplied by the duration of exposure (hours per work day) does not exceed 80.
2. Maximum exposure duration is 2 hours per work day.
3. This restriction applies to open spaces in which members of the general public might reasonably be expected to spend a substantial part of the day, such as recreational areas, meeting grounds and the like.
4. These values can be exceeded for a few minutes per day provided precautions are taken to prevent indirect effects.

To allow comparison of the limits of exposure set by IRPA/INIRC to the West Australian situation, results of powerline field surveys are contained in the Scott and Furphy report. The survey was carried out by Dr J. Livingstone and Professor W. Humpage of the Energy Systems Centre at the University of Western Australia.

Table 6 sets out the field levels expected within the easement of the proposed 132kV line to Beenup.

TABLE 6

ELECTRICAL AND MAGNETIC FIELD LEVELS
WITHIN THE EASEMENT OF A SECWA 132kV SINGLE CIRCUIT TRANSMISSION LINE

Distance from Centreline (m)	*Electric Field (kV/m)*	*Magnetic Field (mT)*
0	1.21	.00785
5	2.03	.00581
10	1.01	.00296
15	0.42	.00159
20 (boundary of easement)	0.24	.00096

Source: SECWA calculations.

Comparison of the tables shows the recommended safe exposure levels for the general public of 5 kilovolts per metre (kV/m) for electric fields and 0.1 milli tesla (mT) under normal conditions would not be exceeded. The levels at the boundary pf the SECWA easement, which is the nearest point a residence could be built, are 0.24kV/m and 0.00096mT which are well below the recommended levels.

The electric and magnetic field distribution for a 132kV Single Circuit Transmission line are shown on Figure 7.

SECWA, as part of its policy on EMF, designs, constructs and operates all its equipment and facilities in accordance with the guidelines on Table 5. Together with IRPA/INIRC, SECWA concedes that further research is required to determine questions raised in recent epidemiological research.

7.5 SPECIFIC MITIGATION

Using the nominal centreline of the preferred corridors during the public consultation period, impacts were identified which were specific to conditions found along the corridor options and not sufficiently dealt with by the generic commitments. The following sections detail the specific mitigation required for each corridor option. The preferred corridor is the Manjimup to Beenup Corridor. However, specific mitigation is also presented for the other options to allow assessment and subsequent approval of those options, if the Manjimup option is determined to be not preferred.

7.5.1 Manjimup to Beenup Corridor

Agricultural Land

On agricultural land, the easement would be aligned with field boundaries to the greatest extent practicable and the line structures would be set near paddock boundaries, service roads etc., to reduce the impact to farm operations and agricultural production.

For areas where line structures are potentially visible to local residents, the structures would be located wherever possible, to take advantage of vegetation backdrops and terrain to reduce viewing the structures on the skyline.

Wherever possible access for construction and maintenance would be via existing roads/tracks. If new access is required it would be constructed in accordance with generic mitigation procedures and in consultation with affected landowners.

Seven Day Road and Bibbulmum Track

Where the line crosses Seven Day Road and the Bibbulmum Track the alignment would be surveyed to minimise visual impact by crossing at right angles and using vegetation and/or topography to screen from view. Wherever possible screening vegetation would be planted to minimise visual impact. Clearing would be in accordance with Section 7.2.

Boundary of Beavis East Block

North of Waistcoat Road is the Beavis East Block, nominated for interim listing with the Australian Heritage Commission (AHC). The line would be located along the southern edge of Waistcoat Road to minimise the impact on the AHC area.

Strict adherence to all generic committed mitigation listed in Section 9.0 would be enforced along this section. Clearing would be carried out in accordance with Section 7.2 however no clearing would be undertaken north of Waistcoat Road (Beavis East Block).

Beavis East Block and Beavis West Block

A section of the line parallels the Waistcoat Haul Road and through Beavis East Block, which is nominated for interim listing with the AHC.

For State Forest areas nominated for interim listing with the AHC and crossed by the corridor, SECWA is considering a number of options to minimise the impact of the transmission line. These options include underground cables and, very tall structures which would pass the line over the forest canopy.

The underground cable option has been discussed in Section 3.2 and the issues and constraints with underground cables are still valid for the AHC area.

Very Tall Line Structures would be approximately 110m high to clear the maximum tree height found along the corridor (estimated maximum). These structures would impact on local airspace and would be potentially visible from a large area including the Donnelly river and Manjimup.

The use of underground cable or very tall line structures would significantly increase the cost of constructing, operating and maintaining the transmission line. The estimated costs for the underground cable option is in the order of $3.3m and for the tall structure option, $2.6m. It must be stressed that these figures are indicative only. SECWA recognises the value of the mature karri forest found in Beavis East and West Block's and have developed specific clearing prescriptions for the area as described in Section 7.2. The commitments for clearing through Beavis East and Beavis West Block include:

- clearing only those areas specified in Section 7.2 - prescription for clearing;
- tall trees able to fall on the line from outside the easement (up to 60m from the centre line) would be selectively felled in consultation with CALM and removed by CALM; and
- SECWA would monitor vegetation growth to identify and remove any vegetation high enough to cause flash-over or able to fall on the transmission line.

About 60ha within the Beavis East and West Blocks would be impacted by clearing within the easement and selective felling of tall trees outside of the easement (up to 60m from the centreline). Of this 60ha approximately 40ha was cut-over between 1931 and 1940. This estimated area for clearing can be further reduced if the area already cleared for Waistcoat Road is taken into account.

SECWA would prepare, to the satisfaction of CALM, a detailed construction and operation programme for Beavis East block and Beavis West block prior to the commencement of clearing. This programme would fully assess the underground cable option.

Darling Scarp

Areas of high slope on the Darling Scarp which traversed by the transmission line would be prone to erosion and increased risk of dieback spread.

In areas of high slope the following management techniques would be employed to minimise the potential erosion risk and the risk of dieback spread. These techniques include:

- o wherever possible no new access would be constructed in areas of high slope;
- o construction access roads not required for maintenance would be rehabilitated;
- o new access/maintenance roads would be designed to follow the landscape contours;
- o tower structures would be placed to avoid sensitive features, including outcrop and drainage lines; and
- o towers would be placed the maximum feasible distance from drainage features.

Donnelly River

The transmission line would cross the Donnelly River at right angles and line structures would be placed at the maximum feasible distance from the river bank. Where access roads are required, the road base would be designed so as not to impede surface drainage. Vegetation clearing would be similar to that shown on Figure 7.

Storry Forest Block

CALM has indicated to SECWA concern about the possible occurrence of rare flora within the Storry Forest Block, west of the Vasse Highway. SECWA commissioned a rare flora survey in May 1991 (Dames & Moore, 1991) which concluded that significant species found in the zone of the transmission line route in May 1991, and others which are likely to occur there, are all low in stature. Consequently, construction and maintenance of a transmission line through the zone should have limited direct impact on them if care is taken to minimise disturbance. Measures that would minimise disturbance include:

- o avoidance of the wetland areas;
- o spanning significant species sites (not erecting towers within them);

- o locating the access track outside significant species sites;
- o not digging, clearing or grading any part of significant species sites;
- o restricting traffic across significant species sites to that required for laying out the conductor; and
- o maintaining clearance levels at heights well above those of significant species.

In recognising the limitations with an autumn survey SECWA has made a commitment to complete a spring survey to confirm the presence/absence of rare flora along the corridor within Storry Block. The results of the survey will be made available to relevant authorities, and where necessary the line route would be altered to avoid sensitive areas.

Paget Nature Reserve

Approximately 7km of the Manjimup to Beenup Corridor passes within 500m of the Paget Nature Reserve (Map 3). Public concern about the impact of road construction on drainage flows into the reserve has lead SECWA to formulate the following commitment:

Within the catchment area for Paget Nature Reserve SECWA would construct access to the transmission line using the following guidelines, to the satisfaction of CALM:

- o wherever possible SECWA would use local road base to provide colouring sympathetic to the area, and to reduce the possibility of introducing dieback;
- o the access road would closely follow the existing ground profile to minimise cut and fill requirements, visual impact, erosion and disruption to surface water movement;
- o the access road crown would encourage drainage to the edge of the track; and
- o culverts would be installed where the gradient of the profile is locally too steep (creeks and drainages).

7.5.2 Great North Road Option

Intensive Agriculture - Jamieson Road

SECWA has recognised the importance and value of the intensive agriculture occurring on the Abba fertile flats soils along the portion of the Great North Road Option which parallels Jamieson Road.

In recognition of the value of these soils to agriculture, SECWA has extended the corridor further east to make use of the Jamieson Road reserve. The following commitment is provided by SECWA to minimise the impact of the line on agricultural practises in this area.

SECWA would locate the line structures and access roads to follow or run parallel to existing road reserves and paddock boundaries or within the Jamieson Road reserve.

Rare Flora - Treeton Forest Block

CALM has notified SECWA about the occurrence of rare flora within the Treeton Forest Block, which may be impacted by the construction of the transmission line.

SECWA makes the commitment to:

- Undertake a comprehensive survey of vegetation within any of the corridors identified in this report, prior to the commencement of surveying and clearing. The survey of the vegetation would identify locations of rare flora and the line would be re-routed or mitigation measures formulated in consultation with CALM to avoid or minimise the potential impact on rare flora.

Rapids and Mowen Conservation Parks

The corridor for the Great North Road Option runs parallel to the eastern boundary of the Rapids Conservation Park and the western boundary of the Mowen Conservation Park (Map 2). The parks are vested in the National Parks and Nature Conservation Authority and are managed as National Parks. The two areas have been affected by past management practises and impacted by surrounding logging.

SECWA's proposed transmission line would not directly impact or traverse these areas and to minimise potential indirect impacts, the following commitment is made:
Where the transmission line passes within one (1)km of the Rapids and Mowen Conservation Parks SECWA would:

- construct access roads and locate line structures so as not to impeded the drainage patterns of the area;
- maintain a buffer of screening vegetation between the line and the Park boundary to reduce visual impact; and

- o implement a construction supervision programme with officers from SECWA and CALM supervising construction activities to ensure no direct impact occurs to the Parks.

Margaret River Catchment Area

SECWA has a generic commitment to reduce the potential for soil erosion along the transmission line (Section 7.1.1.2). For the portion of the line route which crosses the Margaret River Catchment Area, SECWA is prepared to make the following commitment:

- o with the Margaret River Catchment Area SECWA would:
  - use wherever possible existing access tracks;
  - undertake clearing so as to leave root stock intact; and
  - liaise with WAWA and CALM about clearing requirements and vegetation rehabilitation.

The Blackwood River Crossing

This crossing is common to both the Margaret River and Great North Road options and is the most sensitive point on each.

The River is picturesque and highly valued for both its scenic and recreational qualities. These values are recognised in the proposed conservation park (CALM, 1987) and in its listing by the Australian Heritage Commission.

The corridor selected for these two options crosses the river between one and two kilometres west of Great North Road (Map 2). At this point the river flows between banks of varying height. The river itself is also subject to considerable level fluctuations, so that in the drier months, when it is most used for recreational purposes, it is in a rich, enclosed valley.

There are some minor tracks leading in to the top of the riverbank on both sides, but at relatively specific points from which the views are across the river rather than up and down it. A line across the river 100 metres up or down stream of this point would not be visible from these roads so the major concern is from users of the river itself.

It would not be possible to disguise conductors which cross the river against a backdrop of open sky. Because, the banks are high, however, it should be possible to set the towers back so they are not visible. The actual crossing would utilise the high ground for engineering reasons, and to maximise the clearance of the conductors at mid-span over the river itself.

Field observation suggest that if the towers are set back to the full 400 metre span, they would not be visible from the river where there is a high bank. The suggested crossing point also crosses the area listed by the AHC at a relatively narrow point, around 300 metres wide including the river. This point was selected to allow the placement of towers outside of the conservation park.

The vegetation in the river valley is both tall and relatively lush. Through the 40 metre easement it would be necessary to remove all the upper canopy trees, and it may be necessary also to take some of the flanking trees. The undergrowth trees are mainly peppermint, and of the species *Agonis linearifolia* which are unlikely to exceed four metres in height. Even in the ideal conditions of the river valley, the undergrowth could be left in place below the conductors without risk of flashover. The proposed clearing profile for the Blackwood River crossing is shown on Figure 7.

This vegetation would also screen the towers from people using the river. A forty metre gap in the upper canopy would be hardly noticeable as the upper canopy is absent in some of the lower areas of wetland flanking the river.

To ensure that the potential impacts associated with a line crossing the Blackwood River are minimised, SECWA proposes to undertake the following commitment:

- SECWA would prepare to the satisfaction of CALM a construction and management plan for the area impacted by the proposed crossing of the Blackwood River Conservation Park. This plan would be prepared prior to clearing and construction commencing. The plan would detail which vegetation (if any) would be removed in part or in full.

Augusta - Margaret River Heritage Trail

Where the line crosses the Heritage Trail tower structures would be placed the maximum possible distance from the track to reduce visual impact. Access from the Heritage Trail along the easement would be restricted using a combination of low vegetation screening and fencing. The fencing would be constructed from local forest materials to maintain landscape quality.

7.5.3 Margaret River Option

Although the following commitments are listed in this section, some are applicable to other corridor options. All commitments will be listed in Section 9.0 and will be applicable to the preferred option.

Compensation

SECWA is not legally bound to compensate for easements for lines less than 200,000 volts as stated in Section 45 of the State Energy Commission Act, 1979. However, SECWA has advised all landowners potentially affected by the line that compensation will be provided.

SECWA makes the following commitments to any landowner affected by the final approved line route:

- compensation for the easement would be negotiated with the registered land proprietor based on valuations provided by the Valuer Generals Office;
- compensation would also be negotiated with landholders for any loss of production caused by the line construction and future operational activities; and
- owners would be offered seedlings to replace any trees removed from the property.

This commitment applies to all landholders potentially affected within the other corridor options identified.

Proximity to Buildings

The line between Picton and Margaret River (parallel to the existing 66kV line) passes close to many existing buildings (<100m). To reduce the potential impact on local residents close to the line SECWA has made the following commitment:

- the line would be routed so that no existing buildings are located within the easement; and
- residential buildings would be located as far as possible from the centreline.

Use of Rail Easements

The option to use the existing railway easement as shown on Map 1 would provide advantages by reducing vegetation clearing and avoiding homes located east of the Ludlow Forest. If any of the line options from Picton are approved, SECWA is prepared to make the following commitment:

- SECWA would fully investigate the potential for using the rail easement and commence detailed discussions with Westrail. If the option to use the rail reserve is feasible SECWA would prepare a report detailing the potential impacts and proposed mitigation for this section.

Busselton Golf Course/Airstrip

SECWA would align the new line to minimise the impact on the Busselton golf course and minimise the intrusion into the airspace required for the proposed airstrip.

Margaret River Townsite

SECWA recognise the potential impact of the line on the future development of Margaret River townsite and is prepared to make the following commitment:

- If there is any potential impact of the line on future development of Margaret River SECWA would liaise with the local community and relevant authorities to manage and minimise those impacts.

Bramley and Witchcliffe Forest Blocks

SECWA makes the commitment to produce a report to the satisfaction of CALM and relevant authorities, which details a comprehensive construction and operation programme for Bramley and Witchcliffe Forest Blocks. This plan would include discussion on issues relevant to these areas and provide specific mitigation commitments aimed at reducing potential impacts

Noxious Weeds

SECWA would comply with the regulations and requirements of the Agricultural Protection Board (APB) at all times.

8.0 CONCLUSIONS

SECWA has presented a number of corridor options within the CER. Each option was initially identified by a comprehensive corridor selection procedure which uses a computer based Geographic Information System (GIS) to combine and analyse all the relevant environmental, social, economic and technical data.

The use of GIS technology to identify corridors differs from the traditional corridor selection procedure in that the identified corridor represents the optimum corridor for the study area based on the priorities assigned to relevant issues. This minimises the need to undertake extensive manual and often subjective comparisons of numerous and complex corridor networks.

Following the initial identification of the corridor options an extensive public consultation programme was established by SECWA. The feedback and comments received during these consultations have assisted SECWA in optimising and fine-tuning the original corridors proposed. Also identified during the public consultation was the preference for SECWA to use the Manjimup to Beenup corridor.

The outcome of the studies was the identification of three viable corridor options, namely:

- Manjimup to Beenup;
- Picton to Beenup via Great North Road; and
- Picton to Beenup via Margaret River.

All of these options are considered as viable options by SECWA. The report therefore presents commitments and mitigation procedures for all three options to demonstrate that the constraints and impacts associated with each option can be effectively managed.

Each of the corridor options has significant constraints associated with it. These can be summarised as follows:

- Picton-Beenup via Great North Road - impacts on 126 private properties and 58 buildings, and environmental impact on The Rapids, Mowen and Blackwood Conservation parks;

- Picton-Beenup via Margaret River - impacts on 179 private properties and 103 buildings, and passes through the hinterland of Margaret River frequented by tourists. The visual impact of this line is the highest of the three options; and
- Manjimup to Beenup - limited social impact (only 18 private properties) but requires the most clearing of the options (320ha). This option also passes through Karri forest, some of which is listed with the Australian Heritage Commission.

The Manjimup option is considerably shorter than the other options - 90km compared with 131km for Margaret River Option and 114.5km for the Great North Road option.

The clearing of approximately 60ha of Karri forest within the areas listed with the AHC represents a significant impact for the Manjimup option. SECWA believes that a detailed construction and operation programme developed to the satisfaction of CALM can minimise the impact on these areas.

SECWA's preferred corridor option, as submitted in this report to the EPA is the Manjimup to Beenup corridor. Second preference is the Picton to Beenup via Great North Road option and third preference is for the Picton to Beenup via Margaret River option.

This preference is based on a number of criteria which can be summarised as follows:

- the Manjimup is the shortest of the three options and the indicative costs of construction show the economic benefits for this corridor:
  - Manjimup Option $12.5m;
  - Great North Road Option $15.0m; and
  - Margaret River Option $17.0m;
- all corridors cross areas listed with the Australian Heritage Commission. SECWA is confident that the impacts on these areas, particularly for the Manjimup option can be reduced to an acceptable level;
- only 20ha of the Karri forest to be impacted by the Manjimup Option has not been previously logged;
- approximately 70km of the Manjimup corridor follows existing forest haul roads and tracks which further reduces the clearing requirement;

- o the vegetation clearing prescriptions developed and presented in the CER will reduce the environmental and social impacts associated with clearing in State Forest to an acceptable level; and
- o approximately 77km of the Manjimup corridor is completely within State Forest. It therefore affects only 18 private properties.

SECWA acknowledges that further detailed discussion with CALM and the EPA is required before clearing for construction can commence within the State Forest. However, this discussion and planning can only be proceeded with and finalised after approval for the Manjimup corridor has been obtained.

9.0 LIST OF COMMITMENTS

9.1 GENERIC COMMITMENTS

The following commitments have been developed by SECWA to reduce the potential impact of transmission line construction and maintenance within Western Australia. They apply to all corridors and would be implemented at the appropriate time and to the satisfaction of the landowner and/or relevant authority.

GC1 - Areal Limits of Construction

The areal limits of construction activities will be predetermined by SECWA in consultation with landowners, with activity restricted to and confined within those limits. All construction vehicle movement outside the right-of-way will be restricted to predesignated roads.

GC2 - Personnel Instruction

Prior to construction, all supervisory construction personnel will be instructed by SECWA and CALM officers on the protection of cultural and ecological resources and will be briefed on all agreed stipulations.

GC3 - Complaints Register

A programme for handling and resolving complaints will be established by SECWA prior to commencement of construction and will be administered by a designated person in consultation with CALM, Local Shires and other relevant authorities.

GC4 - Fire Suppression

SECWA shall instruct the contractor to do everything reasonably within their power to prevent and suppress fires on or near the lands to be occupied under the right-of-way, including making available such construction and maintenance forces as may be reasonably obtainable for the suppression of such fires. SECWA will also comply with Bushfire Board requirements.

GC5 - Restoration

The contractor shall build and repair such roads, fences and trails as may be destroyed or damaged by construction work and shall build and maintain necessary and suitable crossings for all roads, trails and fences that intersect the works constructed, maintained or operated. This would be completed under SECWA supervision and in consultation with affected landowners.

GC6 - Archaeology/Ethnography Survey

Prior to construction, SECWA will commission a survey made by an agency or contractor, of archaeological, paleontological, and historical sites within the area to be occupied by the line easement. The results of this survey will be provided to the WA Museum. SECWA, will relocate the proposed transmission line facilities in order avoid destruction of archaeological, paleontological or historic values.

GC7 - Rehabilitation

All construction and designated access roads, framing sites, and material storage sites will be restored to their natural state insofar as is practical. All construction roads will be completely obliterated (returned to the natural contour) and "put to bed" by harrowing or drilling and reseeding (if required) or simply where practical let it return to its natural state, as specified by the private landowner or CALM. The method of restoration will normally consist of returning disturbed areas back to their natural contour, cross drains installed for erosion control, placing drains back in the road and filling ditches.

GC8 - Waste Disposal

SECWA will instruct the contractor to remove or dispose of all waste caused by its activities in a manner satisfactory to the landowner. The term "waste" as used herein means all discarded matter, including but not limited to human waste, garbage, oil drums, petroleum products, ashes and equipment. Construction areas will be maintained in a sanitary condition at all times and garbage and refuse at these sites will be disposed of on a daily basis. Hazardous or toxic waste-generated or used on site will be disposed of in a manner consistent with health authority guidelines.

GC9 - Vegetation Removal

All litter and debris, including vegetative cover accumulated through land clearing, will be disposed of in accordance with the landowner requirements.

GC10 - Access

No new access will be constructed where existing access is available. This will minimise ground disturbance and limit new or improved access ability.

GC11 - New Road Alignments

The alignment of any new access roads will follow landform contours, provided that such alignment does not additionally impact resource values. This would minimise ground disturbance and/or reduce scarring.

GC12 - Line Structure Locations

Structures will be placed so as to avoid sensitive features (e.g. rare flora, water courses, etc.) and/or to allow conductors to clearly span the features, within limits of standard line structure design. This would minimise the amount of sensitive features disturbed and/or reduce visual contrast.

GC13 - Road Crossings

At highway, road or trail crossings, line structures are to be placed at maximum feasible distance from the crossing.

GC14 - Camp Sites

Camp sites will be selected in consultation with relevant authorities to comply with the following requirements:

- o no camp sites shall be located in vested reserves, e.g. National Parks and Flora and Fauna Reserves;
- o camp sites shall not be located on the flood-plains of major rivers or streams;
- o wherever possible and practical, camp sites shall be located adjacent to stockpile site; and
- o wherever possible and practical, camp sites shall be located adjacent to, or as close as possible to, existing access roads.

Every effort shall be made to establish camps in areas with the following characteristics:

- o soil conditions are suitable for sewage effluent disposal;
- o no excavation is required prior to camp establishment;
- o some form of environmental degradation exists in the area; and
- o minimal visual impact would result from the establishment of a camp site.

GC15 - Erosion of Soils

In areas where impacts to soils are expected to be high, the following commitments were developed by SECWA:

- o wherever possible, no new access would be constructed;
- o no widening or upgrading of existing access road;
- o permanently close construction access roads not required for maintenance;
- o new access roads will follow the landform contours;
- o line would be re-routed to avoid sensitive features; and
- o towers would be placed at maximum feasible distance from major drainage crossings.

9.2 SPECIFIC COMMITMENTS

SC1 - Agricultural Land

On agricultural land, the easement will be aligned with field boundaries to the greatest extent practicable and the line structures will be set near paddock boundaries, service roads etc., to reduce the impact to farm operations and agricultural production.

For areas where line structures are potentially visible to local residents, the structures will be located wherever possible, to take advantage of vegetation backdrops and terrain to reduce viewing the structures on the skyline.

SC2 - Seven Day Road and Bibbulmum Track

Where the line crosses Seven Day Road and the Bibbulmum Track the alignment will be surveyed to minimise visual impact by crossing at right angles and using vegetation and/or topography to screen from view. Wherever possible screening vegetation will be planted to minimise visual impact. Clearing will be in accordance with Section 7.2.

SC3 - Boundary of Beavis East Block

Strict adherence to all generic committed mitigation listed in Section 9.0 will be enforced along this section. Clearing will be carried out in accordance with Section 7.2 however no clearing will be undertaken north of Waistcoat Road (Beavis East Block).

SC4 - Beavis East Block and Beavis West Block

The commitments for clearing through Beavis East and Beavis West Block include:

- o clearing only those areas specified in Section 7.2 - prescription for clearing;
- o tall trees able to fall on the line from outside the easement (up to 60m from the centre line) will be selectively felled in consultation with CALM and removed by CALM; and
- o SECWA will monitor vegetation growth to identify and remove any vegetation high enough to cause flash-over or able to fall on the transmission line.

SECWA will prepare, to the satisfaction of CALM, a detailed construction and operation programme for Beavis East block and Beavis West block prior to the commencement of clearing. This programme will fully assess the underground cable option.

SC5 - Darling Scarp

For the Darling Scarp, SECWA makes the commitment to use the following management techniques to minimise the potential erosion risk and the risk of dieback spread. These techniques include:

- o wherever possible no new access will be constructed in areas of high slope;
- o construction access roads not required for maintenance will be rehabilitated;
- o new access/maintenance roads will be designed to follow the landscape contours;
- o tower structures will be placed to avoid sensitive features, including outcrop and drainage lines; and
- o towers will be placed the maximum feasible distance from drainage features.

SC6 - Donnelly River

SECWA makes the following commitment for the crossing of the Donnelly River. The transmission line will cross the Donnelly River at right angles and line structures will be placed at the maximum feasible distance from the river bank. Where access roads are required, the road base will be designed so as not to impede surface drainage. Vegetation clearing will be similar to that shown on Figure 7.

SC7 - Storry Forest Block

To minimise vegetation disturbance within the Storry Forest Block SECWA makes the commitment to adopt the following measures when locating line structures and access roads:

- o avoidance of the wetland areas;
- o spanning significant species sites (not erecting towers within them);
- o locating the access track outside significant species sites;
- o not digging, clearing or grading any part of significant species sites;
- o restricting traffic across significant species sites to that required for laying out the conductor; and
- o maintaining clearance levels at heights well above those of significant species.

SC8 - Paget Nature Reserve

Approximately 7km of the Manjimup to Beenup Corridor passes within 500m of the Paget Nature Reserve (Map 3). Public concern about the impact of road construction on drainage flows into the reserve has led SECWA to formulate the following commitment:

Within the catchment area for Paget Nature Reserve SECWA will construct access to the transmission line using the following guidelines, to the satisfaction of CALM:

- o wherever possible SECWA will use local road base to provide colouring sympathetic to the area, and to reduce the possibility of introducing dieback;
- o the access road will closely follow the existing ground profile to minimise cut and fill requirements, visual impact, erosion and disruption to surface water movement;
- o the access road crown will encourage drainage to the edge of the track; and
- o culverts will be installed where the gradient of the profile is locally too steep (creeks and drainages).

SC9 - Intensive Agriculture - Jamieson Road

SECWA will locate the line structures and access roads to follow or run parallel to existing road reserves and paddock boundaries or within the Jamieson Road reserve.

SC10 - Rare Flora Survey

SECWA makes the commitment to undertake a comprehensive spring survey of vegetation within any of the corridors identified in this report, prior to the commencement of surveying and clearing. The survey of the vegetation will identify locations of rare flora and the line will be re-routed or mitigation measures formulated in consultation with CALM to avoid or minimise the potential impact on rare flora.

SC11 - Rapids and Mowen Conservation Parks

Where the transmission line passes within one (1)km of the Rapids and Mowen Conservation Parks SECWA will:

- o construct access roads and locate line structures so as not to impeded the drainage patterns of the area;
- o maintain a buffer of screening vegetation between the line and the Park boundary to reduce visual impact; and
- o implement a construction supervision programme with officers from SECWA and CALM supervising construction activities to ensure no direct impact occurs to the Parks.

SC12 - Margaret River Catchment Area

For the portion of the line route which crosses the Margaret River Catchment Area, SECWA is prepared to make the following commitment:

- o within the Margaret River Catchment Area SECWA will:
  - use wherever possible existing access tracks;
  - undertake clearing so as to leave root stock intact; and
  - liaise with WAWA and CALM about clearing requirements and vegetation rehabilitation.

SC13 - The Blackwood River Crossing

To ensure that the potential impacts associated with a line crossing the Blackwood River are minimised, SECWA proposes to undertake the following commitment:

- o SECWA will prepare to the satisfaction of CALM a construction and management plan for the area impacted by the proposed crossing of the Blackwood River Conservation Park. This plan will be prepared prior to clearing and construction commencing. The plan will detail which vegetation (if any) will be removed in part or in full.

SC14 - Augusta - Margaret River Heritage Trail

Where the line crosses the Heritage Trail line structures will be placed at the maximum possible distance from the track to reduce visual impact. Access from the Heritage Trail along the easement will be restricted using a combination of low vegetation screening and fencing. The fencing will be constructed from local forest materials to maintain landscape quality.

SC15 - Compensation

SECWA makes the following commitments to any landowner affected by the final approved line route:

- o compensation for the easement will be negotiated with the registered land proprietor based on valuations provided by the Valuer Generals Office;
- o compensation will also be negotiated with landholders for any loss of production caused by the line construction and future operational activities; and
- o owners will be offered seedlings to replace any trees removed from the property.

This commitment applies to all landholders potentially affected within the other corridor options identified.

SC16 - Proximity to Buildings

The line between Picton and Margaret River (parallel to the existing 66kV line) passes close to many existing buildings (<100m). To reduce the potential impact on local residents close to the line SECWA have made the following commitment:

- o the line will be routed so that no existing buildings are located within the easement; and
- o wherever possible, the closest residential building will be a minimum of 100m from the centreline.

SC17 - Use of Rail Easements

The option to use the existing railway easement as shown on Map 1 would provide advantages by reducing vegetation clearing and avoiding homes located east of the Ludlow Forest. If any of the line options from Picton are approved, SECWA are prepared to make the following commitment:

- o SECWA will fully investigate the potential for using the rail easement and commence detailed discussions with Westrail. If the option to use the rail reserve is feasible SECWA will prepare a report detailing the potential impacts and proposed mitigation for this section.

SC18 - Busselton Golf Course/Airstrip

SECWA will align the new line to minimise the impact on the Busselton golf course and minimise the intrusion into the airspace required for the proposed airstrip.

SC19 - Margaret River Townsite

SECWA recognise the potential impact of the line on the future development of Margaret River townsite and are prepared to make the following commitment:

- o If there is any potential impact of the line on the future development of Margaret River SECWA will liaise with the local community and relevant authorities to manage and minimise those impacts.

SC20 - Bramley and Witchcliffe Forest Blocks

SECWA makes the commitment to produce a report to the satisfaction of CALM and relevant authorities, which details a comprehensive construction and operation programme for Bramley and Witchcliffe Forest Blocks. This plan will include discussion on issues relevant to these areas and provide specific mitigation commitments aimed at reducing potential impacts.

SC21 - Noxious Weeds

SECWA will comply with the regulations and requirements of the Agricultural Protection Board (APB) at all times.

SC22 - Fauna Survey

SECWA will complete a fauna survey for the approved corridor prior to the commencement of clearing and construction to identify habitats potentially affected by the line. Where possible, line structures will be placed to avoid sensitive habitats.

SC23 - Silviculture Outside of Easement

A detailed silvicultural plan would be developed for the areas outside of the easement by SECWA in consultation with CALM, prior to the operation of the line commencing. The aim of the plan would be to maintain the vegetation profile shown on Figure 5b. It is envisaged that the plan would be implemented by CALM and consist of the following principle components:

- specification of maximum tree heights permitted within zones determined by distance from the easement;
- identification and removal of existing trees able to fall and impact on the line;
- development of a monitoring programme to monitor regrowth on a regular basis; and
- the subsequent felling and removal of trees identified during the monitoring programme as able to fall onto the line.

SC24 - Dieback Management

SECWA make the following commitments to control the spread of dieback:

- a dieback 7-way test will be conducted by CALM officers;
- SECWA would work to priorities agreed by CALM;
- mapping of dieback disease status in areas of native vegetation would be arranged by CALM prior to construction commencing;
- wherever possible the work sequence would be carried out be dieback disease classes. If this is not possible, washing down of vehicles and equipment moving between these classes would be required;
- nominated officers from CALM and SECWA would supervise all aspects of the line construction to ensure that the commitments and guidelines outlined in this report are followed; and
- if these commitments and guidelines are breached than all parties involved would be investigated, and where necessary, dismissed from site.

10.0 REFERENCES

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Figures

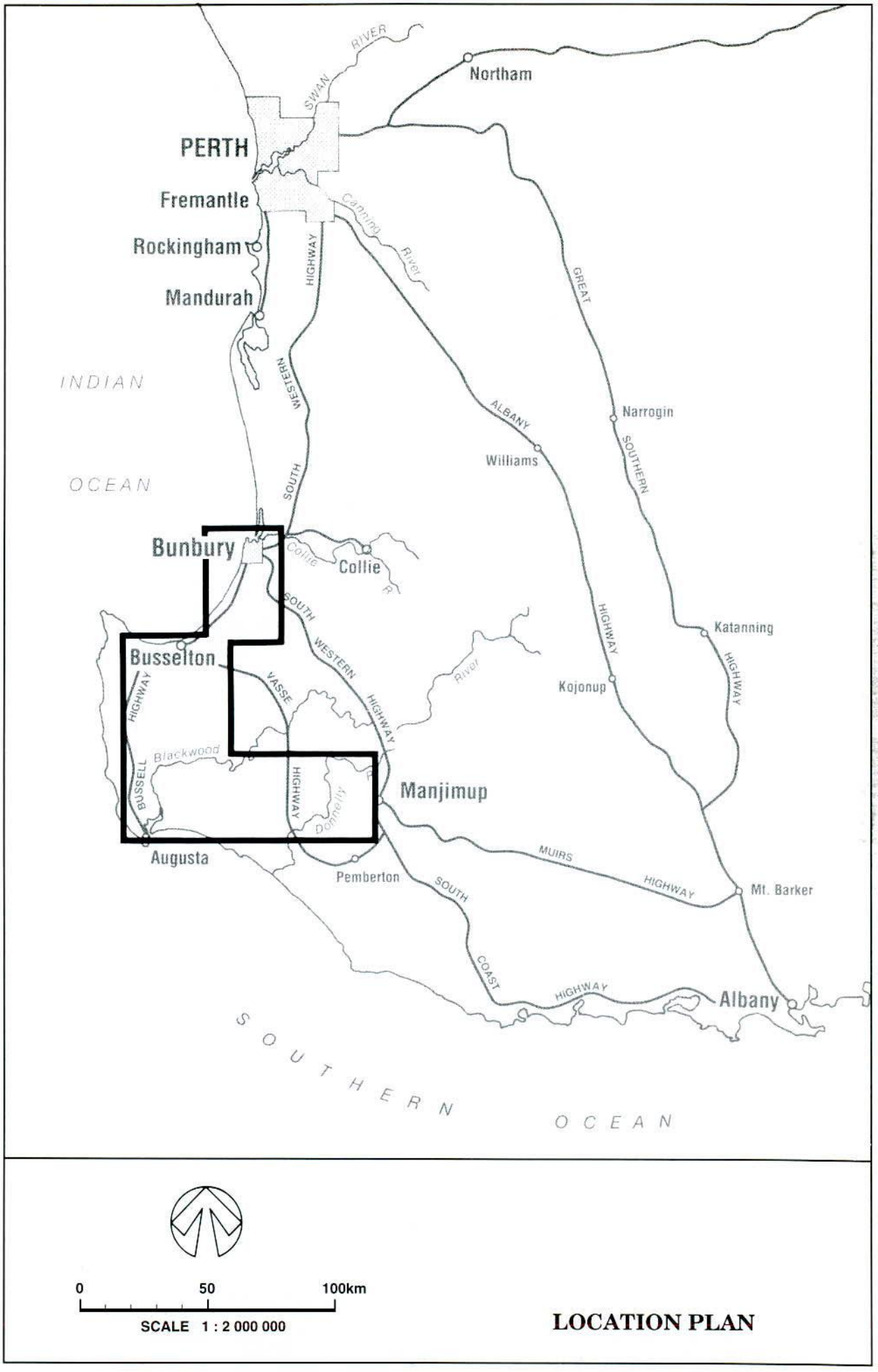
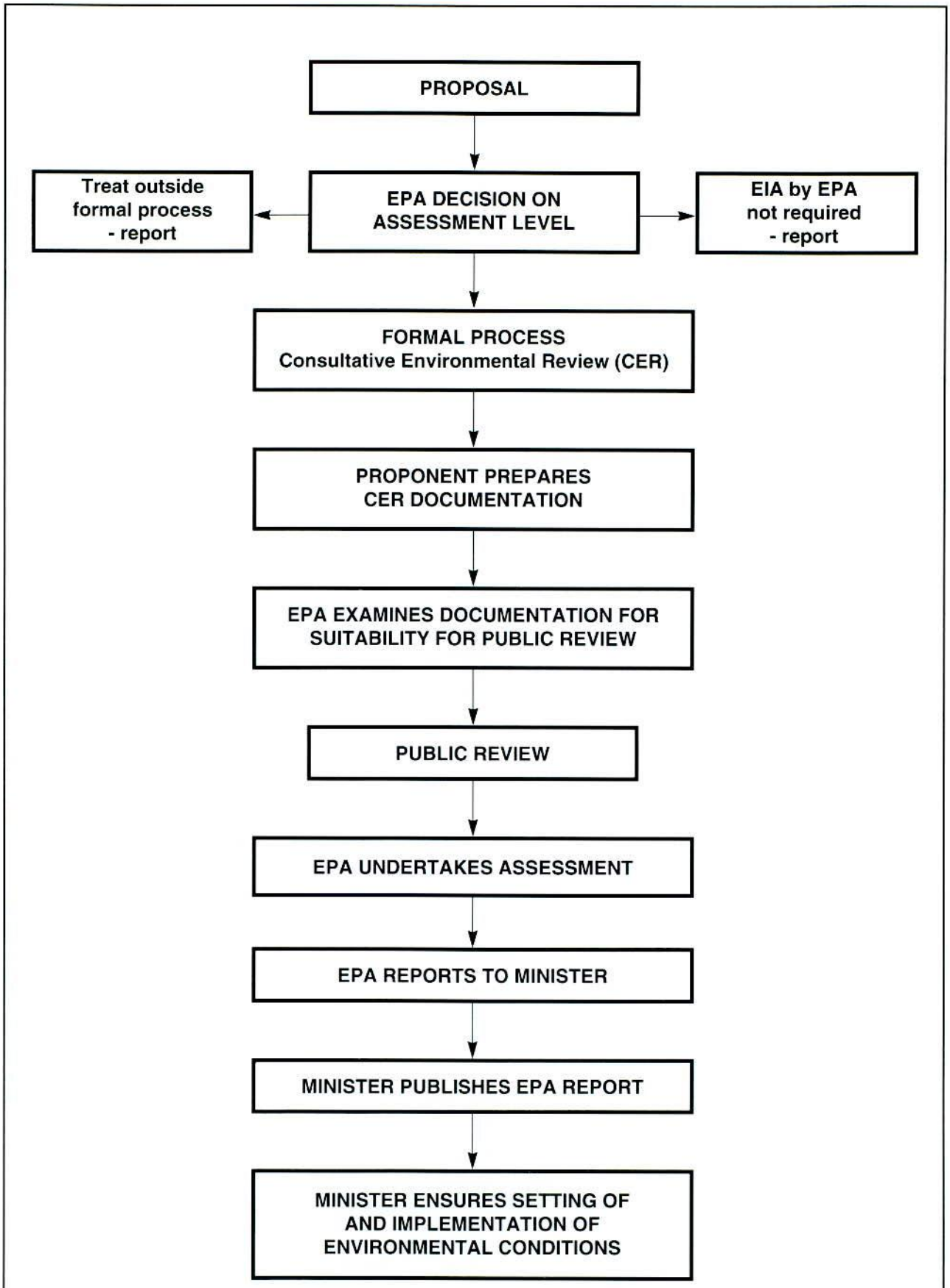


FIGURE 1
DAMES & MOORE



SOURCE: EPA (1987a)

ENVIRONMENTAL IMPACT ASSESSMENT PROCESS

FIGURE 2
DAMES & MOORE

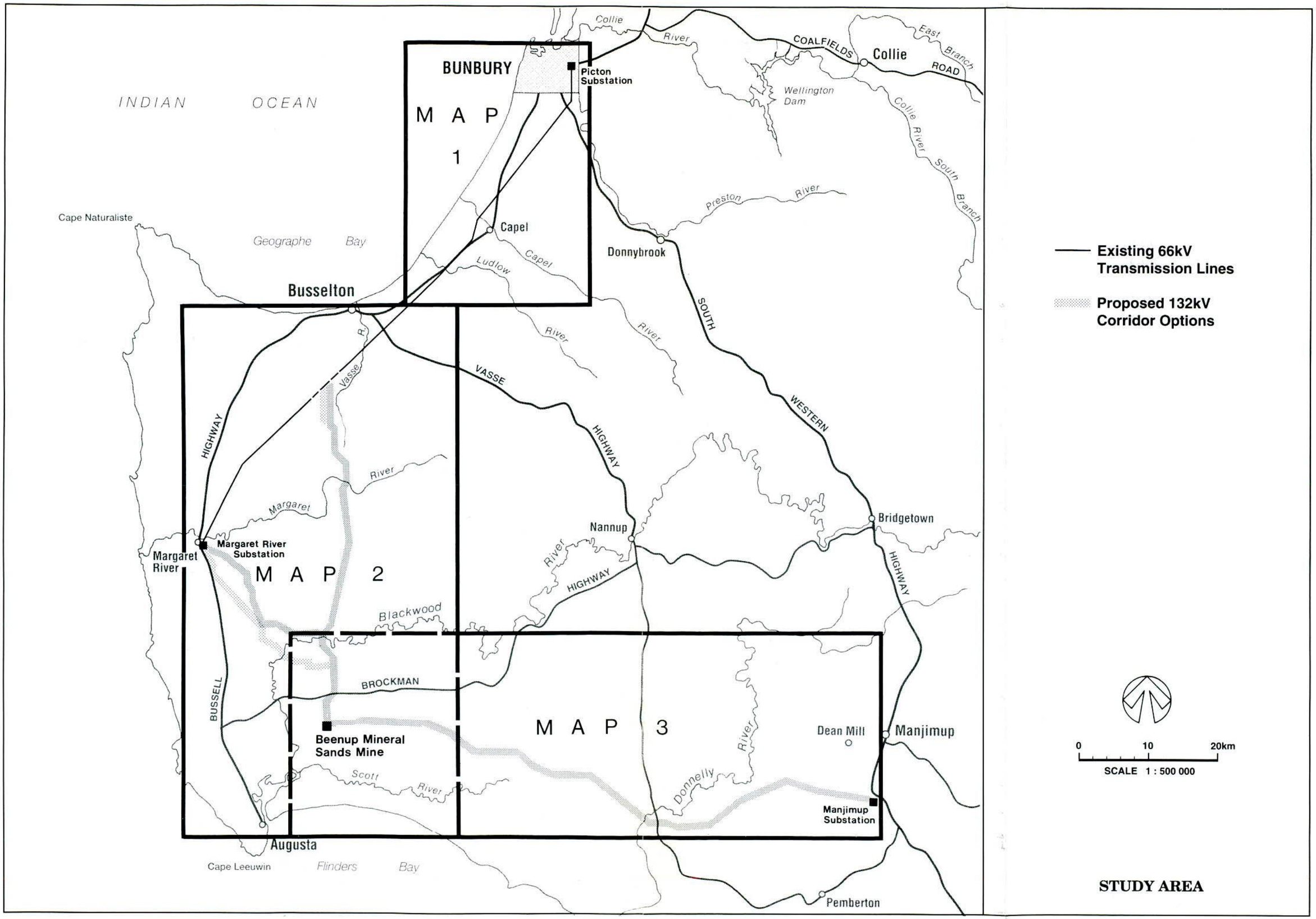
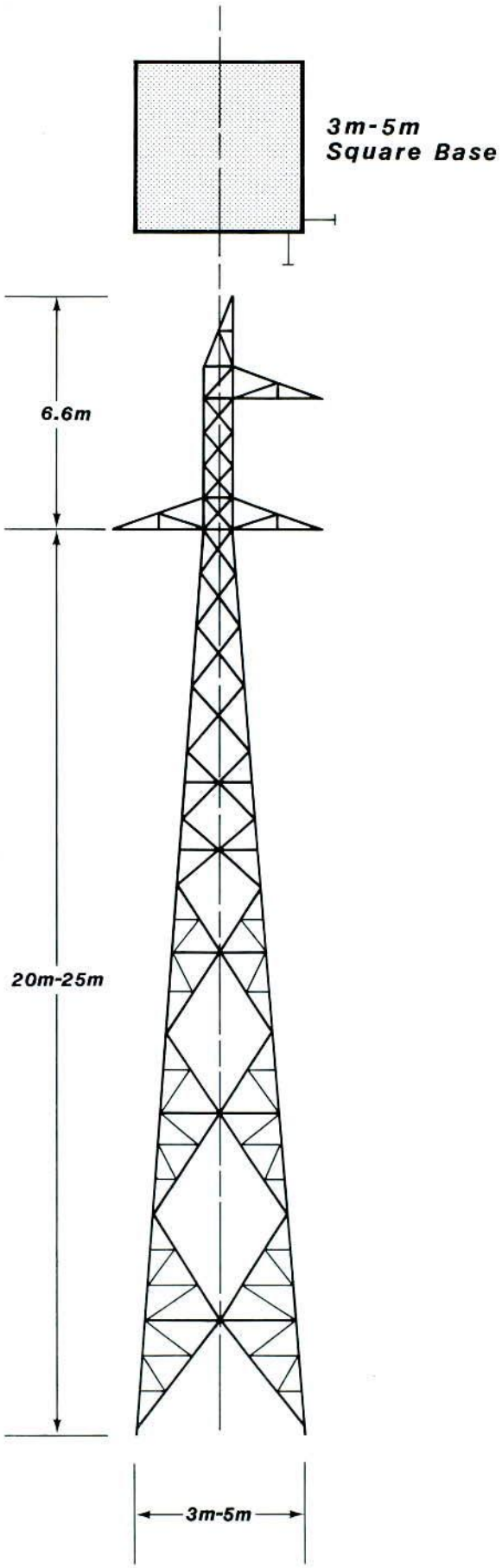
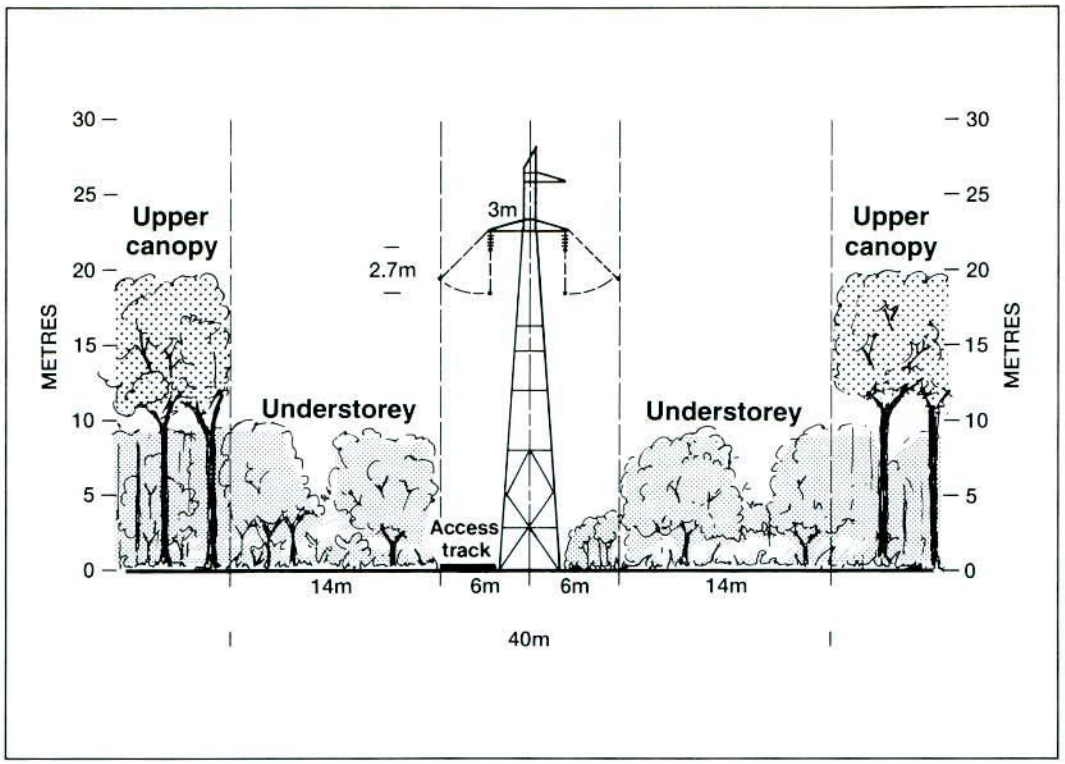


FIGURE 3
DAMES & MOORE

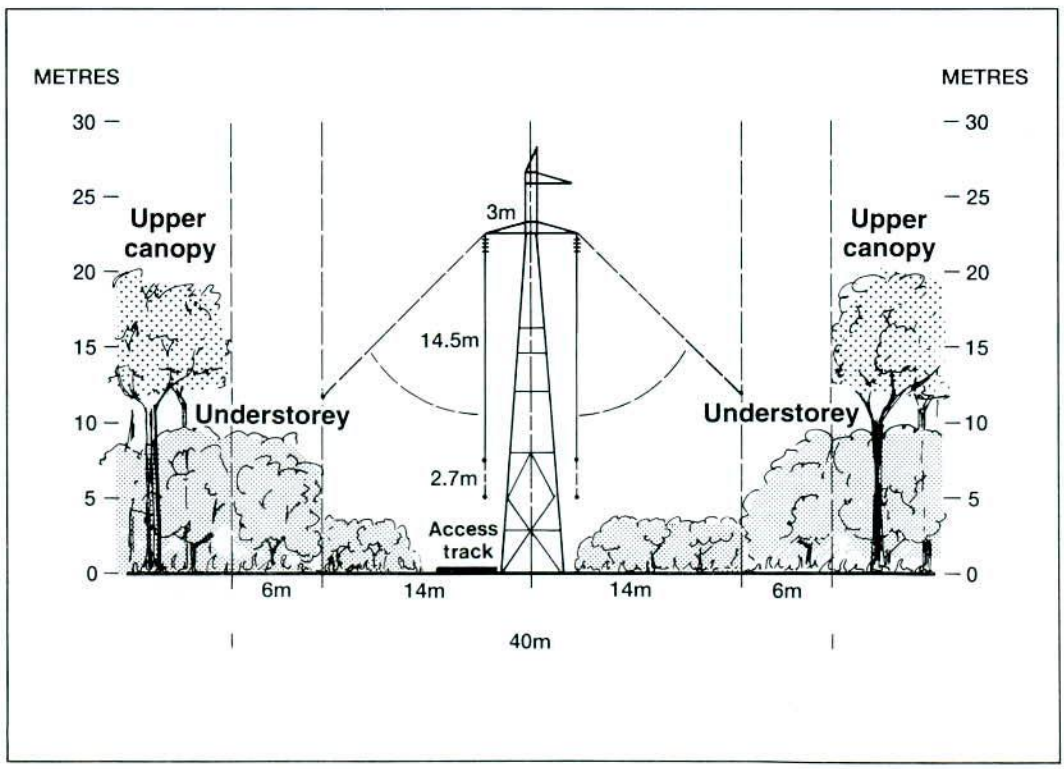


TYPICAL 132kV LATTICE STEEL TOWER

FIGURE 4
DAMES & MOORE



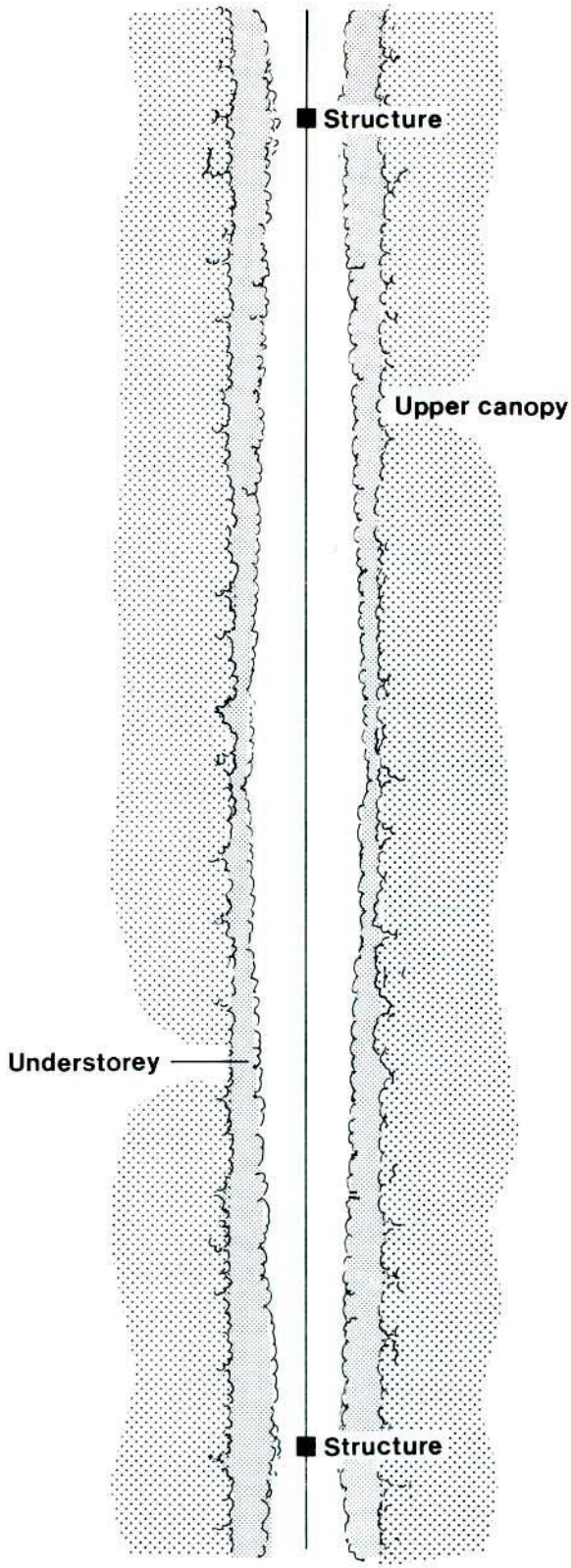
TOWER LOCATION



MID SPAN LOCATION

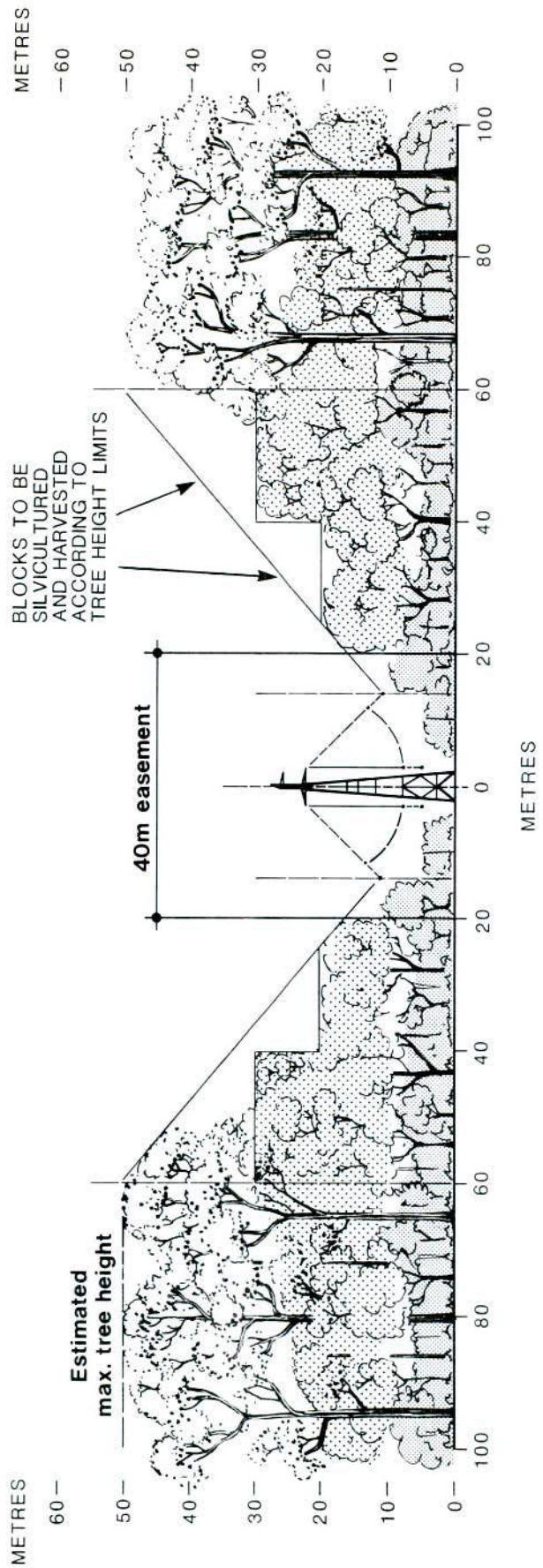
PROPOSED CLEARING PROFILE
132kV SINGLE CIRCUIT TRANSMISSION LINE

FIGURE 5
DAMES & MOORE



PROPOSED CLEARING
PLAN VIEW

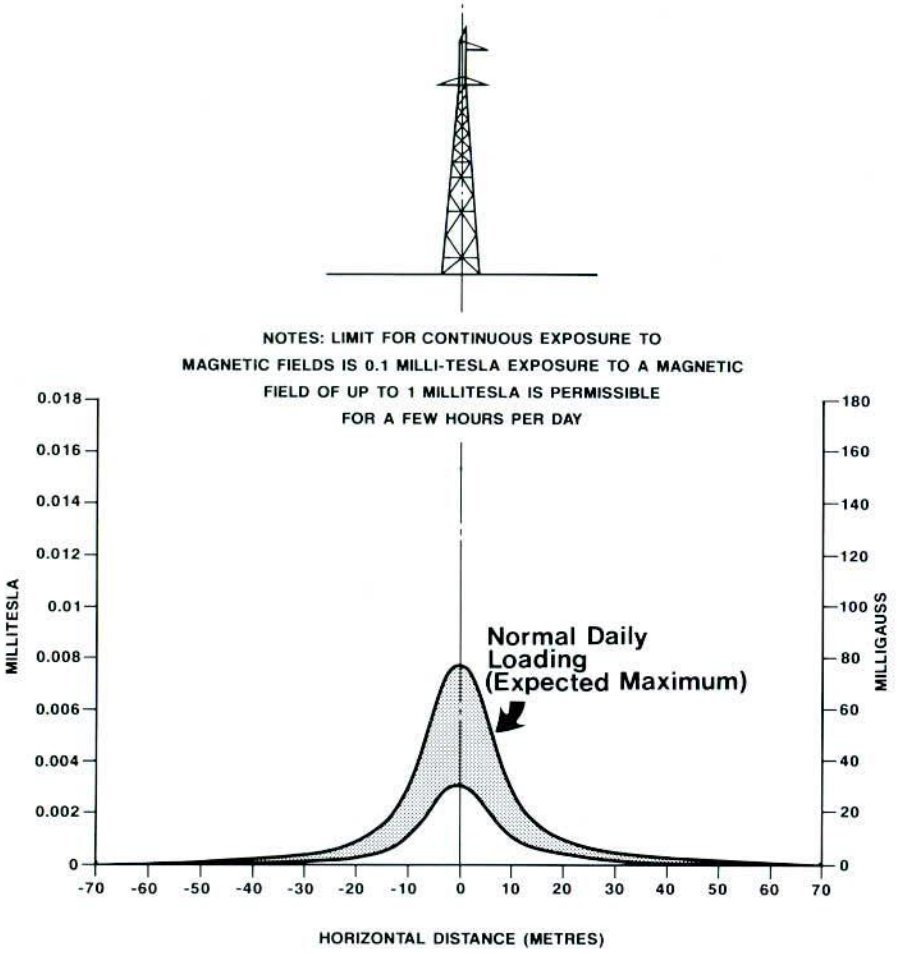
FIGURE 5a
DAMES & MOORE



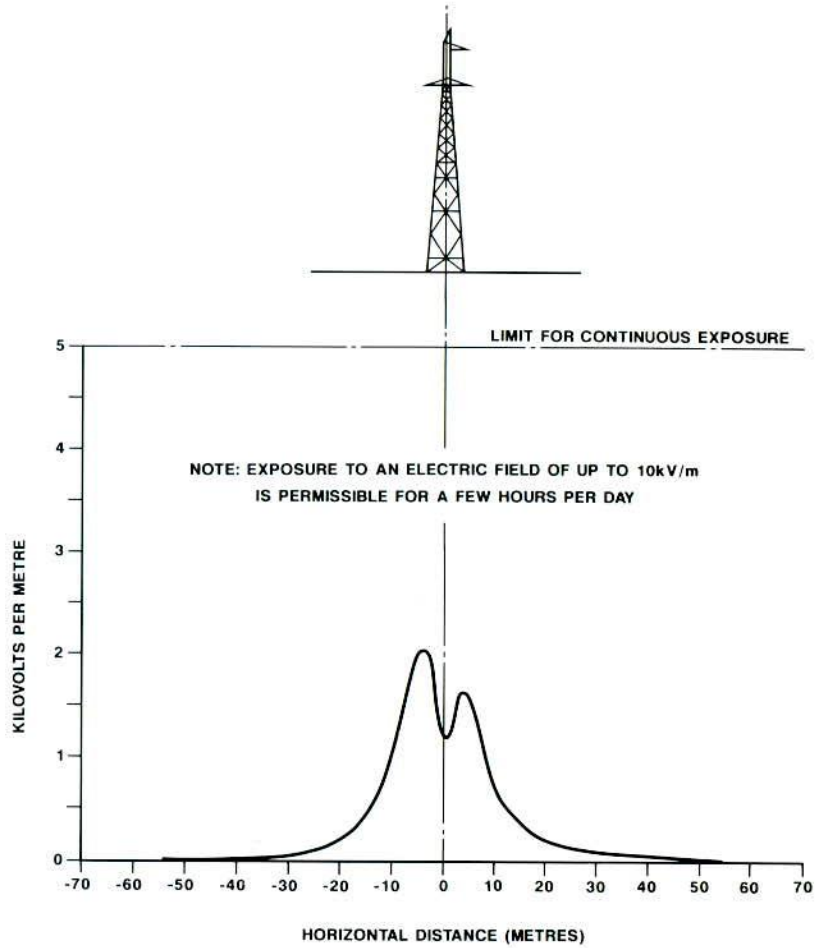
PROPOSED CLEARING PROFILE
OUTSIDE OF 40m EASEMENT

FIGURE 5b
DAMES & MOORE

ELECTRIC AND MAGNETIC FIELD DISTRIBUTION



MAGNETIC FIELD INTENSITY DISTRIBUTION



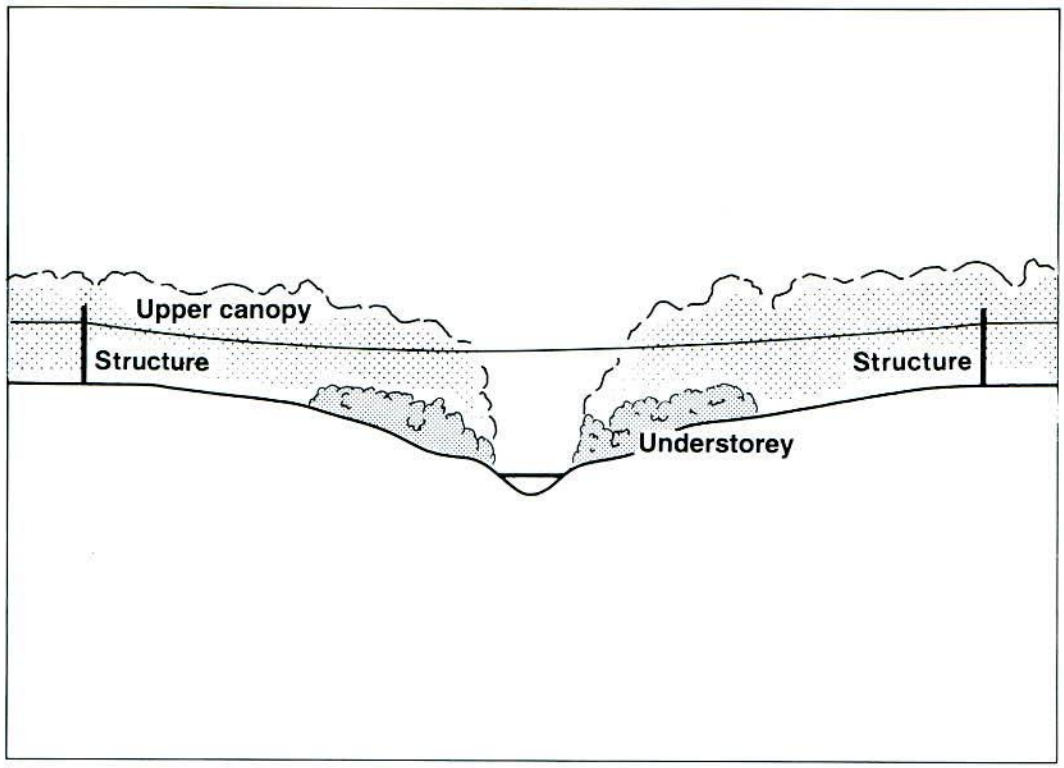
ELECTRIC FIELD INTENSITY DISTRIBUTION

NOTES:-

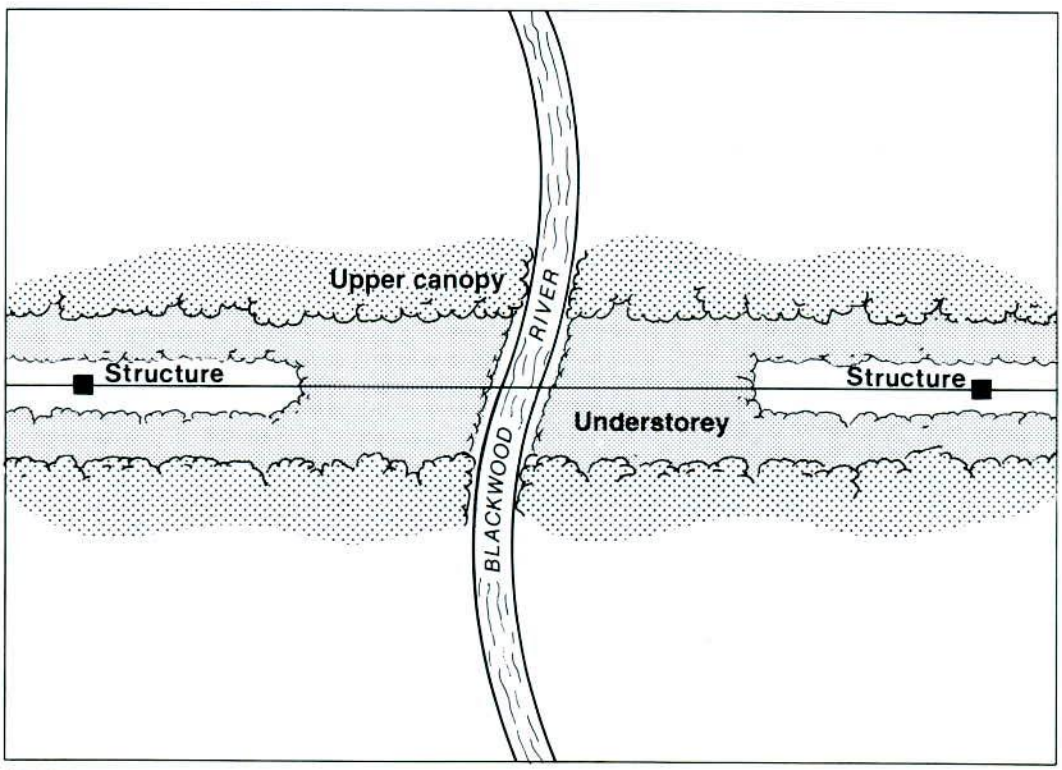
1. The exposure limits shown are in accordance with the guidelines approved by the international radiation protection association in May 1989 for areas with public access

2. The field intensities are measured 1m above ground level at Mid-Span (i.e. Midway between towers), which is the worst case

FIGURE 6
DAMES & MOORE



SCHEMATIC SECTION



SCHEMATIC PLAN

PROPOSED CLEARING PROFILE
BLACKWOOD RIVER
132kV SINGLE CIRCUIT TRANSMISSION LINE

FIGURE 7
DAMES & MOORE

Department of Environmental Protection

AUDIT TABLE

Environmental Audit Branch

PROJECT: Transmission Line, Manjimup to Mineral Sands Mine, Beenup (Assessment 813, Statement 350)
PROPONENT: Western Power Corp

5 March 1999

Note:

• Audit Code • Subject	• What action must be taken • How action must be taken and/or objective of action • Objective • Evidence that action has been taken	• Project phase • When action to be taken • Where it is to be taken	• To requ' ments of • On Advice from	Status
350:M1 The Proposal	Action Fulfil the commitments (which are not inconsistent with the conditions or procedures contained in the Minister's statement) How As per attachment to the Minister's Statement	Overall	EPA	
350:M2.1 Implementation	Action Adhere to the proposal How In accordance with any designs, specifications, plans or other technical material submitted by the proponent to the Environmental Protection Authority	Overall	EPA	
350:M2.2 Minor amendments	Action Seek approval for modifications to the proposal How Submit a written request to the EPA detailing changes to designs, specifications, plans or other technical material	Overall	Min Env EPA	
350:M3 Transfer of proponent	Action Seek approval for transfer of ownership, control or management of this project How Letter to the Minister for the Environment together with the new proponent's acceptance of the Minister's Statement Evidence Letter from original proponent and endorsed Statement from new proponent	Overall Before any transfer sale etc	Min Env EPA	
350:M4.1 Clearing in National Estate Value Forest	Action Minimise clearing in areas with national estate values How As required	Overall	EPA	
350:M4.2:1 Clearing in National Estate Value Forest	Action Design the location of the centreline of the transmission line at the Donnelly River crossing How To take maximum advantage of the cleared area on the southern side of Palings Bridge	Pre-clearing Design	EPA	20/1/95 Cleared
350:M4.2:2 Clearing in National Estate Value Forest	Action Design the location of the centreline of the transmission line at the Donnelly River crossing How To take maximum advantage of the cleared area on the southern side of Palings Bridge	Pre-construction Design	EPA	5/2/98 Cleared
350:M4.3:1 Clearing in National Estate Value Forest	Action Construct the transmission line crossing at the Donnelly River to the requirements of M4-2 How As required	Clearing Clearing	EPA	5/2/98 Cleared
350:M4.3:2 Clearing in National Estate Value Forest	Action Construct the transmission line crossing at the Donnelly River to the requirements of M4-2 How As required	Construction	EPA	5/2/98 Cleared
350:M4.4:1 Clearing in National Estate Value Forest	Action Design the location of the centreline of the transmission line crossing the area proposed for listing on the Interim List of the Register of the National Estate in Gray Forest Block so as to be 1) within the clearfelled area of 1984 N-E of the creek crossing 2) along the forest track in the uncut area south-west of the creek crossing such that clearing of older large Karri trees is minimised. How So as to achieve the objective of M4-1	Pre-clearing Design	EPA	20/1/95 Cleared

• Audit Code • Subject	• What action must be taken • How action must be taken and/or objective of action • Objective • Evidence that action has been taken	• Project phase • When action to be taken • Where it is to be taken	• To requ' ments of • On advice from	Status
350:M4.4:2 Clearing in National Estate Value Forest	Action Design the location of the centreline of the transmission line crossing the area proposed for listing on the Interim List of the Register of the National Estate in Gray Forest Block so as to be 1) within the clearfelled area of 1984 N-E of the creek crossing 2) along the forest track in the uncut area south-west of the creek crossing such that clearing of older large Karri trees is minimised. How So as to achieve the objective of M4-1	Pre-construction Design	EPA **CALM**	5/2/98 Cleared
350:M4.5:1 Clearing in National Estate Value Forest	Action Construct the transmission line crossing in Gray Forest Block to the requirements of M4-4:1 and M4-4:2 How As per M4-4:1 and M4-4:2	Clearing Clearing	EPA	5/2/98 Cleared
350:M4.5:2 Clearing in National Estate Value Forest	Action Construct the transmission line crossing in Gray Forest Block to the requirements of M4-4:1 and M4-4:2 How As per M4-4:1 and M4-4:2	Construction	EPA	5/2/98 Cleared
350:M5.1:1 Management of Forest Clearing Generally	Action Design the location of the centreline of the transmission line within the approved transmission line corridor How Such that the amount of new clearing is minimised, in consultation with CALM	Pre-clearing Design	EPA **CALM**	20/1/95 Cleared
350:M5.1:2 Management of Forest Clearing Generally	Action Design the location of the centreline of the transmission line within the approved transmission line corridor How Such that the amount of new clearing is minimised, in consultation with CALM	Pre-construction Design	EPA **CALM**	5/2/98 Cleared
350:M5.2:1 Management of Forest Clearing Generally	Action Construct the transmission line in accordance with the approved designs (M 5-1) How Such that the amount of new clearing is minimised	Clearing Clearing	EPA	5/2/98 Cleared
350:M5.2:2 Management of Forest Clearing Generally	Action Construct the transmission line in accordance with the approved designs (M 5-1) How Such that the amount of new clearing is minimised	Construction	EPA	5/2/98 Cleared
350:M6.1 Stewart Road	Action Design the location of the centreline of the transmission line within the area cleared for Stewart Road such that the amount of new clearing is minimised How As required	Pre-clearing Design	EPA	20/1/95 Cleared
350:M6.2:1 Stewart Road	Action Construct the transmission line in accordance with the approved designs (M 6-1) How As required	Clearing	EPA	5/2/98 Cleared
350:M6.2:2 Stewart Road	Action Construct the transmission line in accordance with the approved designs (M 6-1) How As required	Construction	EPA	5/2/98 Cleared
350:M7.1 Visual Resource Management	Action Design the location of the centreline of the transmission line in the vicinity of the Vasse Hwy How In consultation with CALM	Pre-clearing Design	EPA **CALM**	20/1/95 Cleared
350:M7.2:1 Visual Resource Management	Action Construct the transmission line in accordance with the approved plans (M7-1) How As required	Clearing	EPA	5/2/98 Cleared
350:M7.2:2 Visual Resource Management	Action Construct the transmission line in accordance with the approved plans (M7-1) How As required	Construction	EPA	5/2/98 Cleared
350:M8 Time limit on approval	Action Request extension of 5 year approval How By application to the Minister for the Environment if project is not substantially commenced by 23/3/99	Pre-clearing If not substancially commenced by 23/3/99	EPA	30/10/97 No longer relevant {Clearing commenced January 1995} - Audit Branch

• Audit Code • Subject	• What action must be taken • How action must be taken and/or objective of action • Objective • Evidence that action has been taken	• Project phase • When action to be taken • Where it is to be taken	• To requ' ments of • On advice from	Status
350:M9 Compliance Auditing	Action Prepare periodic "Progress and Compliance Reports" to help verify the environmental performance of this project (using for reference the audit element (ie codes) identified in this Audit Table) How Address all relevant conditions in terms of how they have been met: eg. "Phase 1 Pre-clearing Report" to address all Phase 0 and Phase 1 elements; "Phase 2 Clearing/Construction Report" to address all Phase 0 and Phase 2 elements; etc. Evidence Progress and Compliance Reports	Overall Upon completion of Phases 1, 2, 3 & 4 then annually over Phase 5 until revoked by DEP	EPA	27/8/97 Satisfactory {PCR received for: 1 Pre-clearing (January 1995) , 2 Clearing Pre-construction (11/1/96) and Construction (10/7/96) phases } - Audit Branch
350:P1 Clearing profiles	Action Enforce the clearing methods and profiles described in Sections 6.1.2.1, 6.1.2.2, 6.1.2.3, 6.1.2.4 of the CER during construction and operation of the transmission line	Overall	EPA	
350:P2 Soil erosion	Action In areas where soil impacts are expected to be high, apply the following measures: How Construct no new access where possible; do not widen or upgrade existing access road; permanently close access not required for operation and maintenance; position poles to avoid sensitive features; place poles at maximum feasible distance from major drainage crossings; and implement a clearing methodology developed to minimise the risk of soil erosion	Overall	EPA	
350:P3.1 Fauna survey	Action Complete a fauna survey for the approved corridor prior to commencing clearing and construction to identify habitats potentially affected by the line How So as to work toward sensitive design of line placement	Pre-clearing Design	EPA	20/1/95 Cleared
350:P3.2 Fauna survey	Action Locate poles to minimise impact to farm operation and agricultural production How In accordance with the findings of the fauna survey (P3-2)	Pre-construction Design	EPA	5/2/98 Cleared
350:P4.1 Agricultural land	Action Minimise impact to farm operations and agricultural production How Design the easement to be to the greatest extent possible aligned to field boundaries, and poles set near paddock boundaries, service roads etc	Pre-clearing Design	EPA	20/1/95 Cleared
350:P4.2 Agricultural land	Action Minimise visibility of the poles on the skyline How Relocate to take advantage of vegetation backdrops and terrain	Pre-construction Design	EPA	5/2/98 Cleared
350:P5 Restoration	Action Build and repair, and maintain suitable crossings for roads, fences and trails that may be destroyed or intersected with by construction work How Under SECWA supervision in consultation with affected registered land proprietors	Overall	EPA	10/10/94 Not audited {Low level audit} - Audit Branch
350:P6.1 Warren Water Reserve	Action Obtain a clearing permit from WAWA prior to clearing in the reserve	Pre-clearing	EPA **WAWA**	20/1/95 Cleared
350:P6.2 Warren Water Reserve	Action Reforest an area of equivalent size to the area cleared. How Location of area to be nominated by WAWA.	Post-construction	EPA **WAWA**	
350:P7.1 Archaeology/Ethnography survey	Action Undertake a survey of archaeological, paleontological and historical sites within the area to be occupied by the line easement. How Provide results to the WA Museum	Pre-clearing Design	EPA **WA Museum**	20/1/95 Cleared
350:P7.2 Archaeology/Ethnography survey	Action Modify design plans if archaeological, paleontological or historical survey locates points of value How So as to avoid destruction of points of value	Pre-clearing	EPA **WA Museum**	20/1/95 Cleared
350:P8.1 Dieback	Action Conduct a dieback 7-way test How By CALM officers	Overall	EPA **CALM**	
350:P8.2:1 Dieback	Action SECWA to work to priorities agreed by CALM to control the spread of dieback	Pre-clearing Planning	EPA **CALM**	20/1/95 Cleared
350:P8.2:2 Dieback	Action SECWA to work to priorities agreed by CALM to control the spread of dieback	Pre-construction Planning	EPA **CALM**	5/2/98 Cleared
350:P8.3 Dieback	Action Map dieback disease status in ares of native vegetation prior to construction commencing How To be arranged by CALM	Pre-clearing	EPA **CALM**	20/1/95 Cleared

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350:P8.4 Dieback	Action Carry out work sequence by dieback disease class or if not possible wash down vehicles and equipment moving between classes	Overall	EPA	
350:P8.5 Dieback	Action Nominate officers from CALM and SECWA to supervise all aspects of the line construction to ensure all commitments and guidelines are followed How Put into place before construction commences	Pre-clearing	EPA	20/1/95 Cleared
350:P8.6 Dieback	Action Investigate all parties involved and where necessary dismiss from site, if commitments and guidelines are breached	Overall	EPA	
350:P9 Seven Day Road and Bibbulmum Track	Action Minimise visual impact on Seven Day Road and the Bibbulmum Track How Cross the Road and Track at right angles and use vegetation and/or topography to screen the line from view	Pre-clearing Design	EPA	20/1/95 Cleared
350:P10.1 Giblett-Hawke Block Area	Action Only selectively fell diseased or damaged trees outside of the easement and those able to fall on the line	Pre-clearing Design	EPA	20/1/95 Cleared
350:P10.2 Giblett-Hawke Block Area	Action Retain stumps along the easement and minimise disturbance of the soil	Pre-clearing Design Pre-Clearing	EPA	20/1/95 Cleared
350:P10.3 Giblett-Hawke Block Area	Action Place poles so that only a minimum number are required within the old growth forest	Pre-construction Design	EPA	5/2/98 Cleared
350:P11.1:1 Donnolly River	Action Cross the transmission line over the Donnolly River at right angles and place poles at the maximum feasible distance from the river bank	Pre-clearing Design	EPA	20/1/95 Cleared
350:P11.1:2 Donnolly River	Action Cross the transmission line over the Donnolly River at right angles and place poles at the maximum feasible distance from the river bank	Pre-construction	EPA	5/2/98 Cleared
350:P11.2:1 Donnolly River	Action Design the road base for the crossing of the Donnally River so to not impede surface drainage where access roads are required	Pre-clearing Design	EPA	20/1/95 Cleared
350:P11.2:2 Donnolly River	Action Design the road base for the crossing of the Donnally River so to not impede surface drainage where access roads are required	Pre-construction Design	EPA	5/2/98 Cleared
350:P11.3:1 Donnolly River	Action Clear vegetation similar to that shown on Figures 9 & 11 in the CER for the crossing of the Donnolly River	Pre-clearing	EPA	20/1/95 Cleared
350:P11.3:2 Donnolly River	Action Clear vegetation similar to that shown on Figures 9 & 11 in the CER for the crossing of the Donnolly River	Clearing	EPA	5/2/98 Cleared
350:P11.4 Donnolly River	Action Maintain a 100m buffer either side of the Donnelly River within which minimal ground disturbance practices will be employed, stumps will be retained and heavy construction vehicles excluded.	Overall	EPA	
350:P12.1 Darling Scarp	Action Wherever possible construct no new access in areas of high slope How So as to minimise erosion risk and visual impact	Overall	EPA	
350:P12.2 Darling Scarp	Action Rehabilitate construction access roads not required to be kept for maintenance How So as to avoid scarring	Post-construction	EPA	
350:P12.3:1 Darling Scarp	Action Design new access/maintenance roads to follow the landscape contours	Pre-clearing Design	EPA	20/1/95 Cleared
350:P12.3:2 Darling Scarp	Action Design new access/maintenance roads to follow the landscape contours	Pre-construction Design	EPA	5/2/98 Cleared
350:P12.4:1 Darling Scarp	Action Place poles to avoid sensitive features, including outcrop and drainage lines and the Vasse Hwy	Pre-construction Design	EPA	5/2/98 Cleared
350:P12.4:2 Darling Scarp	Action Place poles to avoid sensitive features, including outcrop and drainage lines and the Vasse Hwy	Construction	EPA	5/2/98 Cleared

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350:P13 Storrey Forest Block	Action Locate poles and access roads to minimise vegetation disturbance in Storrey Block How So as to apply the following measures: Avoid wetland areas; span significant species sites; locate access track outside significant species sites; no digging clearing or grading any part of significant species sites; restrict traffic across significant species sites when laying out conductor; maintain clearance levels at heights well above those of significant species.	Overall	EPA	
350:P14.1 Rare Flora Survey	Action Undertake a comprehensive spring survey of vegetation within the corridor prior to commencing surveying and clearing How So as to identify locations of rare flora	Pre-clearing Prior to surveying	EPA	20/1/95 Cleared
350:P14.2:1 Rare Flora Survey	Action Re-route the line or formulate mitigation measures to avoid or minimise potential impact on rare flora How In consultation with CALM	Pre-clearing Design	EPA **CALM**	20/1/95 Cleared
350:P14.2:2 Rare Flora Survey	Action Re-route the line or formulate mitigation measures to avoid or minimise potential impact on rare flora How In consultation with CALM	Pre-construction Design	EPA **CALM**	5/2/98 Cleared
350:P14.3 Rare Flora Survey	Action Adopt the following measures to minimise disturbance to sites identified by the survey as containing significant species (as per the amended commitments Appendix B attached to the Minister's Statement) How Windrows to not be located within these sites; poles not to be erected within these sites; access tracks to be located outside these sites wherever possible; no digging and grading within these sites; wherever possible restrict traffic across these sites to that required for laying out the conductors .	Overall	EPA	
350:P15 Paget Nature Reserve	Action Sensitively (design/)construct the access road into the section of transmission line adjacent to the Paget Nature Reserve How Use local road base; follow existing ground profile; road crown to encourage drainage to edge of the track; culverts installed where gradent of the profile is locally too steep (creeks and drainages)	Overall	EPA	
350:P16 Weed control	Action Comply with Agricultural Protection Board requirements at all times	Overall		10/10/94 Not audited {Low level audit} - Audit Branch
350:P17 Fire suppression	Action Instruct contractor to do everything reasonably within their power to prevent and suppress fires on or near the lands to be occupied under the right of way How So as to include making available such construction and maintenance forces as may be reasonably obtainable for the suppression of fires. By inclusion in construction contract.	Overall	EPA	
350:P18 Rehabilitation	Action Restore all construction access roads and material storage sites to their natural state in so far is practical How All construction roads to be completely obliterated and put to bed by harrowing/drilling and seeding if required, or allowed to return to its natural state as specified by the land owner or CALM. Return disturbed areas back to their natural contour, install cross drains for erosion control, place drains back in the road and fill ditches.	Post-construction	EPA	
350:P19 Waste disposal	Action Instruct contractor to remove or dispose of all waste caused by its activities and to maintain construction areas in a sanitary condition at all times, to the satisfaction of the land proprietor. How (Wastes include but is not limited to human waste, garbage, oil drums, petroleum products, ashes and equipment.) Refuse to be disposed of on a daily basis. Hazardous or toxic waste to be disposed consistent with health authority guidelines. By inclusion in construction contract	Overall		

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350:P20 Camp sites	Action Select camp sites sensitively and in consultation with relevant authorities How So as to avoid vested or unvested (as per the amended commitments Appendix B attached to the Minister's Statement) reserves (National Parks and Flora and Fauna Reserves); flood plains of major rivers or streams. Wherever possible to be adjacent to stockpile sites and existing access roads. So as to be where: soil conditions are suitable for sewage effluent disposal; no excavation is required prior to camp establishment; some form of environmental degradation exists; and minimal visual impact would result.	Overall	EPA	
350:P21:1 Pole locations	Action Place structures to avoid sensitive features and/or to allow conductors to clearly span the features with limits of standard poles designs. How So as to minimise the amount of sensitive features disturbed and/or reduce visual contrast.	Pre-construction Design	EPA	5/2/98 Cleared
350:P21:2 Pole locations	Action Place structures to avoid sensitive features and/or to allow conductors to clearly span the features with limits of standard poles designs. How So as to minimise the amount of sensitive features disturbed and/or reduce visual contrast.	Construction Design	EPA	5/2/98 Cleared
350:P22:1 Road crossings	Action Place poles at maximum feasible distance from highway, road or trail crossings	Pre-construction Design	EPA	5/2/98 Cleared
350:P22:2 Road crossings	Action Place poles at maximum feasible distance from highway, road or trail crossings	Construction Design	EPA	5/2/98 Cleared
350:P23 New road alignments	Action Ensure alignment of any new road follows landform contours, provided it does not additionally impact resource values How So as to minimise ground disturbance and/or scarring.	Overall	EPA	
350:P24 Personnel instruction	Action SECWA and CALM to instruct all supervisory construction personnel on protection of cultural and ecological resources and will be briefed on all agreed stipulations	Overall	EPA	
350:P25 Areal Limits of Construction	Action Limit areas in which construction activities to take place How SECWA to predetermine areal limits of construction activities in consultation with land proprietors. All construction vehicle movement outside the easement to be restricted to predesignated roads.	Pre-clearing Design	EPA	20/1/95 Cleared
350:P26 Electromagnetic fields	Action Design and operate facilities within current health guidelines, and continue to monitor and sponsor research for review of its EMF policy.	Overall	EPA	10/10/94 Not audited {Low level audit} - Audit Branch
350:P27 Community liaison	Action Keep the local community and interested parties informed about the progress of the project	Overall	EPA	
350:P28 Maintenance	Action Ensure that all future maintenance work complies with the requirements of the dieback hygiene procedures developed in conjunction with CALM for this project (as per the amended commitments Appendix B attached to the Minister's Statement)	Post-construction	EPA	
350:P29 Commencement of work	Action Do not commence clearing activities until a firm written commitment has been received from the Mineral Deposits Limited	Pre-clearing	EPA	20/1/95 Cleared

Appendix A

APPENDIX A

EPA GUIDELINES

AN ENVIRONMENT WORTH PROTECTION

Commissioner
STATE ENERGY COMMISSION

ATTENTION: MR R TEH

Your ref:
Our ref: 226/78/3; 39154
Enquiries: Mr I Harvey

132 KV TRANSMISSION LINE - MANJIMUP TO PROPOSED BEENUP MINERAL SANDS MINE

Please find enclosed a copy of the Environmental Protection Authority's final guidelines for the above Consultative Environmental Review.

Should you need any further information, please contact Mr Ian Harvey whose direct line is 222 7083.

R A D Sippe
DIRECTOR
EVALUATION DIVISION

CORRESPONDENCE CONTROL RECEIVED 29 NOV 1990 SECWA

27 November 1990

enc

331IH BEENUP LINE:ma

Environmental Protection Authority

1 Mount Street Perth
Western Australia 6000
Telephone (09) 222 7000
Facsimile (09) 322 1598

PROPOSED 132 kV TRANSMISSION LINE FROM MANJIMUP TO PROPOSED BEENUP MINERAL SANDS MINE

CONSULTATIVE ENVIRONMENTAL REVIEW GUIDELINES

These guidelines provide a list of topics that should be included within the Consultative Environmental Review (CER).

They are not intended to be exhaustive and the proponent may consider that other topics should also be included in the document. The CER is intended to be a brief document; its purpose should be explained and the contents should be concise and accurate as well as being readily understood. Specialist information and technical description should be included where it assists in the understanding of the proposal. It may be appropriate to include ancillary or lengthy information in technical appendices.

The guidelines are as follows:

1 SUMMARY

The CER should contain a brief summary of:

- salient features of the proposal;
- alternatives considered;
- description of environment both physical and social and analysis of potential impacts and their significance;
- environmental and social monitoring and management programmes, safeguards and commitments; and
- conclusions.

2 INTRODUCTION

The CER should include an explanation of the following:

- identification of proponents and responsible authorities;
- background and objectives of the proposal;
- brief details of, and timing of, the proposal;
- relevant statutory requirements and approvals; and
- the scope, purpose and structure of the CER.

3 NEED FOR THE PROPOSAL

The CER should examine the justification for the proposal. Consequences of not implementing the proposal should be outlined.

4 EVALUATION OF ALTERNATIVES

An evaluation of alternative transmission line corridors should be provided. This evaluation should clearly indicate the environmental costs and benefits for each alternative and the rationale for choosing the preferred option.

5 DESCRIPTION OF PROPOSED DEVELOPMENT

Adequate information and technical data, including maps, diagrams, photographs etc, should be presented to allow a careful evaluation and review of the proposed development.

The social, technical and broad economic characteristics of the project and associated facilities, both public and private should be discussed.

Important principles which the Authority feels could be incorporated into this section include:

- forecast demand for electricity including potential future demand not associated with the mineral sands mine;

- time-scale of implementation and project life;
- transmission line alignment and construction techniques;
- access tracks, and infrastructure for all aspects;
- project elements, eg construction camp sites, water supply, power supply etc;
- the management structure and ownership of the completed development should be described so it is clear how the development will be managed and by whom, ie easement, transmission line, power supply;
- future development proposals to connect other areas to grid power; and
- decommissioning and rehabilitation of transmission line.

6 DESCRIPTION OF THE EXISTING ENVIRONMENT

This chapter should provide an appraisal of the environmental (including social systems) potentially affected by the project, including:

- physical characteristics, eg geomorphology, soils, hydrology etc;
- biotic characteristics, eg flora, fauna (with particular reference to any rare or endangered, uncommon or geographically restricted species);
- conservation areas (eg National Parks, Reserves);
- occurrence and extent of Jarrah dieback, *Phytophthora cinnamomi*; and
- social environment:
  - land tenure and constraints;
  - land use pattern (existing and future);
  - significant sites (Aboriginal, Ethnographic, Archaeological, Historic, Scientific, Educational);
  - existing infrastructure, powerlines, roads, towns etc;
  - landscape amenity/quality; and
  - recreational facilities (walking trails, etc).

7 DESCRIPTION OF ENVIRONMENTAL IMPACTS

This should present an assessment of the environmental impact of all facets of the proposal, based upon the description of the existing environment. Both construction and operational phases should be considered. Impacts should be quantified where possible and uncertainties highlighted. Criteria employed when making impact assessments should be quite clear.

An overview or synthesis should be attempted to show how the substation and transmission lines will interact with the total ecosystem and its elements, including people.

Important issues which the Authority feels should be incorporated in this section include:

- alteration of landscape amenity/quality, eg visual impact of transmission line from external viewpoints;
- compatibility with existing/future land uses (eg displacement/disruption of forestry/pastoral operations, Aboriginal land uses, recreational use etc)
- impact on local farming communities;
- biological impacts;
- impact of the introduction and/or spread of Jarrah dieback, *Phytophthora cinnamomi* both during and after construction;
- impact on significant sites;
- the impact of electromagnetic radiation (EMR);
- requirements for clearing of vegetation and justification for clearing requirements (relationship to the Draft Policy should be explained;
- impacts during construction, including local farming communities;
- impact upon Conservation Areas and Reserved Lands:
  - System 2 recommendations and areas;
  - other areas identified as having conservation value;
- impact on soil and landform stability, eg erosion hazards, drainage;
- hydrological impacts, eg water course/drainage line crossings, maintenance at natural drainage patterns, drainage from access tracks;
- potential for, and impact of weed invasion; and
- potential for bushfires.

8 ENVIRONMENTAL MANAGEMENT

Based on the detailed synthesis of environmental and social impacts presented in the previous chapter, the intended programme for the management of impacts (including monitoring) needs to be described.

The purpose of the overall management programme is to demonstrate the manner in which the potential environmental and social impacts can be avoided or ameliorated.

Major issues requiring attention would include:

- management of unavoidable impacts during construction and operation;
- amelioration of lesser impacts;
- staging and construction;
- landscaping and rehabilitation;
- monitoring and reporting; and
- authorities responsible for management should be clearly identified.

9 CONCLUSION

Conclusions on the overall impacts of the respective project options and the associated management requirements, need to be presented. On this basis, an assessment of the environmental and social acceptability of the respective options needs to be made and the environmentally preferred strategy identified.

10 GUIDELINES

A copy of the guidelines should be included in the document.

11 REFERENCES

All references should be listed.

12 APPENDICES

Where detailed technical or supporting documentation is required, this should be placed in appendices.

13 COMMITMENTS

A numbered list of all environmental and social management commitments should be given. A commitment should include:

- who makes the commitment;
- the nature of the commitment; and
- when the commitment will be carried out and to whose satisfaction.

14 PUBLIC PARTICIPATION AND CONSULTATION

A description should be provided of the public participation and consultation activities undertaken by the proponent in preparing the CER. This section should describe the activities undertaken, the dates, the groups and individuals involved and the objectives of the activities. A summary of the concerns raised should be documented. This section should be cross referenced with the 'Environmental Management' section which should clearly indicate how these concerns have been addressed.

Appendix B

APPENDIX B

METHODOLOGY FOR CORRIDOR SELECTION

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APPENDIX B

METHODOLOGY FOR CORRIDOR SELECTION

B1.0 INTRODUCTION

Corridor studies within Western Australia have traditionally involved descriptive lists of selection criteria, manual overlay techniques and subjective judgements. The approach generally resulted in rigidly defined corridor options that were difficult to objectively compare and did not necessarily optimise the constraints imposed by competing land uses. SECWA recognised the limitations imposed by this approach and commissioned this study using an alternative methodology formulated by Dames & Moore. The specifications for the new methodology required that it:

- involve a systematic, multi-disciplinary approach;
- involve a rational method of decision analysis;
- provide a quantitative assessment of impacts;
- was time and cost effective; and
- was flexible enough to allow regional and site specific analysis.

With proposed transmission lines in Western Australia often traversing large tracts of land, it was also essential that the methodology be capable of incorporating large volumes of complex social and environmental data that could be effectively retrieved for analysis. It was also essential that these data were up to date.

These methodological objectives were achieved by using a geographical information system developed by Dames & Moore. The system, known by its acronym, GIMS (Geographical Information Management System), is a computer-based tool that allows large volumes of spatial data to be stored, retrieved, modelled, analysed and displayed according to user-defined specifications. The spatial data are geographically referenced which enables different "map themes" to be combined, modelled or overlaid to produce composite maps (e.g. soils and geology, vegetation and topography).

The concept of GIMS therefore involves the conversion of conventional map data representing user-specified themes, into a computer form that enables multiple data sets to be modelled and analysed.

B2.0 TERMINOLOGY

The following list presents a brief summary of the terminology used in this report.

- Primary Data
  Raw data collected from maps, airphotos, satellite imagery and reports for the resource inventory.

- Secondary Data
  Data derived using analytical techniques available in GIMS.

- Resource
  A natural resource such as soil and vegetation type, represented by primary and secondary data.

- Issue
  A point or topic of importance to one or more interest groups directly or indirectly involved in the corridor selection process.

- Rating
  A numeric score assigned to primary and secondary data to reflect the sensitivity of a resource to the construction, operation and maintenance of the proposed transmission line.

- Resource Inventory
  A collection of primary and secondary data.

- Sensitivity
  A measure of the probable adverse response of each resource to direct and indirect impact associated with the construction, operation and maintenance of the proposed transmission line.

- Sensitivity Map
  Primary and/or secondary data map to which ratings (which reflect sensitivity) have been applied.

- Weighting
  A numeric score assigned to sensitivity maps to reflect the relative importance of an issue.

B3.0 IDENTIFICATION OF THE STUDY AREA

A corridor selection study involves the identification of corridor alternatives within a study area defined by the start and end points of the corridor. The width of the study area is selected to allow adequate scope for corridor alternatives to be defined through areas where the major social, economic and environmental issues affecting the selection process, vary.

The defined study area is used as a basis for assembling a resource inventory and for undertaking sensitivity analysis to identify alternative transmission line corridors.

B4.0 DEVELOPMENT OF A RESOURCE INVENTORY

The resource inventory is a collection of primary and secondary data that provide the basis for the selection and assessment of transmission line corridors. The primary data may include soils, vegetation type, geology, drainage, land use, transport corridors and any other data that may be required for the corridor selection process. Secondary data are data derived by GIMS using combinations of primary data and may include data themes such as visual impact, erosion risk and remnant vegetation.

The use of GIMS for modelling and corridor selection requires the data to be geographically referenced and available in a digital format. The input of remotely sensed data including satellite data (Landsat Thematic Mapper Data) and aerial photography allows for the primary data to be up-to-date and correct.

The inventory provides the basis for identifying and assessing corridor options within the study area. Once the corridors have been identified, the inventory can then be used to assess specific impacts and compare the alternatives.

B5.0 SELECTION OF CORRIDOR

The corridor selection procedure includes the identification of a range of environmental, social and economic issues that have an influence on the location of transmission line corridors within the selected study area. Because the process of corridor selection using GIMS is mathematical and involves analytical techniques, the identified issues and their subsequent importance are reflected in the assigned ratings and weightings.

In general terms, ratings are applied to primary and secondary data, such as soils, vegetation and visual impact, to reflect the sensitivity of the resource (represented by the data) to the routing of a transmission line corridor. These data and their assigned ratings are referred to as sensitivity maps.

The sensitivity maps can be weighted to reflect the perceived importance of the resource in the overall corridor selection study. The various weighted sensitivity maps are then combined in GIMS to produce a composite sensitivity map used for the selection of corridor alternatives.

B5.1 SENSITIVITY ANALYSIS

To identify corridor options, primary and secondary data within the resource inventory are assessed for sensitivity to the routing of a transmission line corridor. Sensitivity is the measure of the probable adverse response of each resource to direct and indirect impact associated with the construction, operation and maintenance of the proposed transmission line. Ratings are applied to reflect the sensitivity and the result is a sensitivity map for each resource.

Criteria used to determine sensitivity include the following:

- a measure of the rarity, high intrinsic value or worth, singularity or diversity of a resource (e.g. vegetation) within the study area;
- a measure of the degree to which the resource represents a potentially significant constraint to the transmission line e.g. erosion hazard, slope; and
- a measure of the level of potential conflict between the resource and activities associated with the construction, maintenance and operation of a transmission line, based on present and future land uses.

The issues and associated sensitivity maps are incorporated within GIMS which is then able to generate composite maps that delineate zones within the study area representing major constraints to corridor development (i.e. exclusion maps) and areas that presented varying degrees of opportunity for transmission line corridors (i.e. composite sensitivity maps).

There are three sensitivity levels representing the varying degrees of opportunity which can be defined as:

- Exclusion Areas
  Areas determined to be unsuitable because of unique, highly valued, complex or legally protected resources; significant potential conflict with current or planned use; areas posing substantial hazards to construction and operation of the line.

- High Sensitivity Areas
  Areas of potentially high environmental impact because of important, valued resources; resources assigned special status; some conflict with current or planned use; areas posing some hazard to construction and operation of the transmission line. In corridor selection, these areas are avoided where possible or, if avoidance is difficult or impossible, conflict with these areas is minimised.

- Low to Moderate Sensitivity
  Areas where the resource conflicts that have been identified through the regional environmental study process are minimal, or present little hazard to construction or operation of the transmission line.

B5.2 ASSIGNING WEIGHTINGS

It is necessary to assign weightings to the sensitivity maps because some are more important in determining the location of corridors than others. The determination of the relative importance of various sensitivity maps necessarily involves a degree of subjectivity.

Typically, a number of weighting scenarios are developed and input into GIMS. These scenarios identify corridor options which, dependent on the weightings, have either environmental, social or economic bias. By varying the weightings a sensitivity analysis is undertaken to determine the stability of corridor options.

B5.3 REVIEW OF CORRIDOR OPTIONS

Having completed sensitivity analyses on the primary data, and assigned weightings to the sensitivity maps, GIMS is then used to review the corridor options.

Corridors can be described as linear paths which:

- o avoid areas of exclusion and high sensitivity;
- o minimise potential land use conflicts; and
- o give preference to areas with low sensitivity.

Corridor options represent corridors selected using methods that incorporate various scenarios. These scenarios can allow the application of "worst case" or extreme events into the corridor selection process. For example, a scenario depicting corridor selection through an area where visual impact is the only major issue can be used to define a corridor option with the least visual impact for the study area. Other scenarios may include selecting corridor options based entirely on economic criteria or corridors selected with the least potential for soil erosion.

By incorporating different scenarios into the corridor option review, it is possible to identify how "sensitive" the corridor selection process is to variation of weightings.

There are three methods available in GIMS for reviewing the corridor options.

The first method involves the selection of alternative corridors from the composite sensitivity map used to identify the preferred corridor. The alternative corridors will, by definition, have a higher sensitivity score than the preferred corridor, and, because the selection process has been quantitative, it is possible to interrogate maps used during the process to determine why the score is higher. It is then possible to geographically locate the areas of higher sensitivity for further assessment.

The second method incorporates different scenarios by reviewing the weightings applied to the sensitivity maps. By changing the weightings assigned to the sensitivity maps used for the corridor selection, it is possible to define alternative corridors. For example, a high weighting applied to a remnant vegetation map will define a corridor that avoids all uncleared areas. Alternatively, a high weighting applied to agricultural land use will define a corridor that may pass entirely through native bushland.

The third method involves the assessment of corridors selected by methods other than GIMS. Straight line corridors selected using economic criteria only or existing transmission line corridors can be assessed for overall environmental impact using the data base stored within GIMS.

B5.4 SELECTION OF PREFERRED CORRIDOR(S)

The preferred corridor is selected using analytical processes available in GIMS, and represents the corridor with the least environmental and social sensitivity in accordance with the weightings that have been assigned. Other corridors with higher sensitivity ratings may also be selected by the process.

B6.0 PUBLIC CONSULTATION PROGRAMME

During a public review period it is possible to incorporate the values and concerns of residents and interested parties into the corridor selection procedure. This can be done in two ways:

- the concerns of residents can be reflected by assigning higher weightings to relevant sensitivity maps; these maps can then be used as input to the selection of a preferred corridor based on the issues and concerns as determined by the public; and
- publicly proposed corridor detours to avoid areas of perceived conflict can be assessed for sensitivity and quantitatively compared with the preferred corridor.

The use of GIMS in this process allows for the rapid evaluation of corridor options identified during the public review period.

* * *

Appendix C

APPENDIX C

PUBLIC CONSULTATION PROGRAMME

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APPENDIX C

PUBLIC CONSULTATION PROGRAMME

C1.0 INTRODUCTION

The State Energy Commission of Western Australia (SECWA) is proposing to construct and operate a 132 kilovolt (kV) transmission line between either the Picton or Manjimup substations and the proposed mineral sands mine at Beenup. The line would be constructed using steel lattice towers approximately 20-30 metres (m) in height with a typical span between the towers of 300-400m.

SECWA commenced a public participation programme in November 1990 to allow for public input into the planning process. The programme consisted of a number of components which were intended to increase public awareness about the project and to encourage constructive feedback about relevant issues.

The main components were:

- Erection of Public Displays;
- Public Meetings and Information Sessions;
- Contacting all interested groups;
- Media releases; and
- Survey of Public.

C2.0 DISPLAYS

Displays were erected at locations throughout the study area. These locations were selected by the relevant local Shires as the most appropriate locations for display. Most of the locations are known to local communities as points where information affecting the community is often displayed. All display locations receive high visitation by local and/or visiting and school/public holidays.

These locations are shown in Table C1. Locations 4, 5, 6 and 7 were erected in March, 1991 and updated to show the Picton options in July, 1991. Displays at locations 1, 2 and 3 were erected on the 10 July 1991 and showed all options.

TABLE C1

DISPLAY LOCATIONS

1.	SECWA South West Regional Office South West Highway Picton	5.	Manjimup Community Centre Cnr Rose and Mount Streets Manjimup
2.	Capel Library Forest Road Capel	6.	Nannup Library Adam Street Nannup
3.	Busselton Library Stanley Street Busselton	7.	SECWA 365 Wellington Street Perth
4.	Margaret River Library Willmont Avenue Margaret River	8.	Augusta Library Allnut Terrace Augusta

C3.0 PUBLIC MEETINGS

A series of meetings with relevant authorities, public information sessions and public meetings were arranged throughout the planning period. These have been summarised in Tables C2 and C3.

TABLE C2

SUMMARY OF PUBLIC CONSULTATION
MANJIMUP OPTION

Event / Persons Contacted	*Date*
Manjimup Shire Council	08 Nov 1990
Nannup Shire	09 Nov 1990
Nannup Shire Council	13 Dec 1990
Augusta-Margaret River Shire	14 Dec 1990
- Nannup Shire Council	28 Feb 1991
- Manjimup Shire Council	28 Feb 1991
- Augusta - Margaret River Shire Council	01 Mar 1991
Public Display erected	25 Mar 1991
Presentation to CALM	09 Apr 1991
Presentation to EPA	18 Apr 1991
Information Sessions (12 Noon to 8pm)	
Scott River	Tuesday 26 March 1991 Dunnets Shearing Shed Milyeannup Coast Road Scott River
Manjimup	Wesnesday 27 March 1991 Community Centre Cnr Rose and Mount Streets Manjimup
Scott River	Thursday 2 May 1991 Dunnets Shearing Shed Milyeannup Coast Road Scott River
Public Meetings	
Manjimup	Tuesday 14 May 199 Community Centre Cnr Rose and Mount Streets Manjimup
Augusta	Wednesday 15 May 1991 Lesser Hall Allnut Terrace Augusta
Scott River	Thursday 16 May 1991 Dunnet's Shearing Shed Milyeannup Coast Road Scott River

TABLE C3

PUBLIC CONSULTATION
PICTON OPTION

Event / Persons Contacted	*Date*
Capel Shire	10 Jul 1991
Busselton Shire Council	10 Jul 1991
Augusta-Margaret River Shire Council	11 Jul 1991
NOTE: The Shire of Dardanup and the City of Bunbury declined SECWA's offer to meet with them	
Information Sessions (12 Noon to 8pm)	
Capel	Friday 19 July 1991 Shire Hall Forest Road Capel
Busselton	Wednesday 24 July 1991 Civic Centre, Main Hall Southern Drive Busselton
Margaret River	Thursday 25 July 1991 Cultural Centre Gloucester Park Margaret River
Public Meetings (Starts at 7.30pm)	
Busselton	Tuesday 13 August 1991 Civic Centre, Main Hall Southern Drive Busselton
Capel	Wednesday 14 August 1991 Shire Hall Forest Road Capel
Margaret River	Thursday 15 August 1991 Cultural Centre Gloucester Park Margaret River

C4.0 MEDIA RELEASES

The following media outlets were issued with periodic press releases regarding the project.

- Print Media
  - South West Times[1]
  - Bunbury Mail
  - Leschenault Reporter
  - Busselton Margaret River Times[1]
  - Augusta Margaret River Mail[1].
- Radio
  - CBS (ABC)
  - GWN
  - Radio West - Bunbury.
- TV
  - GWN.

C5.0 INTEREST GROUPS CONTACTED

The following groups were contacted by SECWA about the proposal and invited to attend all information session and public meetings.

- Mineral Sands Study Group;
- Scott River Region Study Group;
- Blackwood Protection Group;
- Institute of Foresters of Australia
  Head Office, Southern Branch - Central Branch;
- Australian Conservation Foundation;
- Leewin Conservation Group;
- Conservation Council of WA Inc.;
- WA Farmers Federation;

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[1] Denotes papers where advertisements were taken out, giving the dates of the Picton option Public Meetings.

- Augusta Ratepayers Association;
- South West Development Authority;
- Augusta Business Association;
- WA Fishermans Associations;
- Department of Agriculture
  (Busselton and Manjimup and Bunbury);
- D'entrecasteaux Coallition;
- Forest Protection Society
  State Office and Warren Branch;
- Beenup Consultative Group;
- Busselton Peace and Environment Group;
- Busselton Mineral Sands Action Group;
- Friends of the Tuarts;
- Busselton Fauna Society;
- Karri D'entrecasteaux Regional Advisory Committee; and
- East Witchcliffe Action Group.

C6.0 SURVEY RESULTS

Surveys to gauge the general publics perceptions of the relative importance of the issues associated with transmission line projects were conducted at 8 (eight) meetings. These meetings were arranged during the preliminary rounds of public consultation instigated by SECWA as part of its investigations into the option to supply the Beenup Mineral Sands Mine with power at 132kV from its Manjimup and Picton substations. Table C4 provides details of these meetings.

All interested parties attending these meetings were encouraged to take part in the survey by completing Form 1. Participants were asked to give each of the issues listed a ranking in order of importance from 1 to 13; 1 (one) being the most important. If they considered that some issues were of equal importance they were instructed to assign the same ranking to these issues.

The collated results of the surveys taken at each meeting are shown in Table C5. As can be seen from the tabulated results, opinions varied from meeting to meeting.

TABLE C4

DETAILS OF MEETINGS

Meeting A - Beenup Consultative Group
Date: 8 May 1991
Venue: Augusta/Margaret River Shire Offices
Number present: 15
No. participating in the survey: 15

Meeting B - Public Meeting, Shire of Manjimup
Date: 14 May 1991
Venue: Manjimup Community Centre
Number present: 24
No. participating in the survey: 21

Meeting C - Public Meeting, Shire of Augusta/Margaret River
Date: 15 May 1991 (2.00pm)
Venue: Augusta Lesser Hall
Number present: 12
No. participating in the survey 8

Meeting D - Public Meeting, Shire of Nannup
Date: 15 May 1991 (7.30pm)
Venue: Scott River
Number present 23
No. participating in the survey 23

Meeting E - Busselton Mineral Sands Action Group
Date: 19 June 1991
Venue:
Number present: 18
No. participating in the survey: 18

Meeting F - Public Meeting, Shire of Busselton
Date: 13 August 1991
Venue: Busselton Civic Centre
Number present: 33
No. participating in the survey: 33

Meeting G - Public Meeting, Shire of Capel
Date: 14 August 1991
Venue: Capel Shire Hall
Number present: 22
No. participating in the survey: 22

Meeting H - Public Meeting, Shire of Augusta/Margaret River
Date: 15 August 1991
Venue: Margaret River Cultural Centre
Number present: 36
No. participating in the survey 34

TABLE C5

SUMMARY OF ISSUES AND RATINGS

Issues	*A*	*B*	*C*	*D*	*E*	*F*	*G*	*H*
Location in Recreation Areas, National Parks and Conservation Areas	1	7	1	12	7	11	11	7
Interference with Agricultural Land Use	4	2	6	1	3	1	4	1
Removal of Vegetation	8	6	7	9	9	9	5	9
Potential for Soil Erosion and Water Turbidity	2	1	2	6	8	8	9	8
Visual Amenity	6	3	12	11	11	7	8	5
Health Risks	10	10	5	5	1	4	1	4
Interference with Aviation	13	7	13	10	12	9	12	13
Devaluation of Private Land	9	13	11	2	5	3	3	3
Choice of Location - Private V Public Land	11	9	8	3	4	5	5	6
Fire Risk	3	11	10	7	6	6	10	10
Conflict with the Objectives of CALM	12	12	9	13	13	13	13	12
Conflict with Resident Lifestyles	5	4	4	4	2	2	2	2
Potential Damage to Wetland and Marshland	7	5	3	8	10	12	7	11

However, if the results of all the meetings are collated, the four most important issues were:

- o interference with agricultural land use;
- o conflict with residents lifestyles;
- o health risks; and
- o devaluation of private land.

These views are consistent with the results expected from communities predominantly comprising people who derive their living from agriculture.

Conclusions

The General impression gained from the aforementioned meetings was that the majority of people in attendance were of the opinion that the proposed line should have minimal impact on privately owned property.

SECWA's position on the Manjimup option being the preferred corridor is consistent with this community view.

ISSUES AFFECTING TRANSMISSION LINES

- ☐ Location in Recreation Areas, National Parks and Conservation Areas
- ☐ Interference with Agricultural Land Use
- ☐ Removal of Vegetation
- ☐ Potential for Soil Erosion and Water Turbidity
- ☐ Visual Amenity
- ☐ Health Risks
- ☐ Interference with Aviation
- ☐ Devaluation of Private Land
- ☐ Choice of Location - Private V Public Land
- ☐ Fire Risk
- ☐ Conflict with the Objectives of CALM
- ☐ Conflict with Resident Lifestyles
- ☐ Potential Damage to Wetland and Marshland

Appendix D

APPENDIX D

GLOSSARY

APPENDIX D

GLOSSARY

Access (road)	Road used for passage to and along transmission line for purposes of construction and maintenance.
Alignment	The specific, surveyed route of a transmission line.
Alternative (route)	An optional path or direction for a transmission line.
Archaeology	The science that investigates the history of peoples by the remains belonging to the earlier periods of their existence.
Assessment (environment)	An evaluation of existing resources and potential impacts to them from a proposed act or change to the environment.
Capacity	The maximum load that can be generated or transmitted by generating or transmission facilities for a given period of time without exceeding approved limits of temperature or stress.
Capability	The ability to generate or transmit power.
Centreline	A line identified within each broad corridor representing the preferred location for the transmission line.
Circuit	A complete closed conducting path over which electric current may flow.
Committed mitigation	Obligation to a measure that would diminish the severity of an impact.
Conductor	A material, usually in the form of a wire or cable, suitable for carrying an electric current.
Corridor	A continuous trace of land of defined width through which a utility route passes.
Cultural resources	Any site or artefact associated with cultural activities.
Electromagnetic field	A space or region within which magnetic forces are present around an electrical current.
Electrostatic field	Pertaining to a space or region within which atmospheric electricity at rest interferes with radar, radio or television reception.
Emergent (vegetation)	Vegetation coming into existence.
Environment	The surrounding conditions, influences or forces that affect or modify an organism or an ecological community and ultimately determine its form and survival.
Erosion	The group of processes whereby earth or rock material is loosened or dissolved and removed from any part of the earth's surface.

Ethnography	That aspect of cultural and social anthropology devoted to the first-hand description of particular cultures.
Fault	A fracture or fracture zone along which there has been displacement of the sides relative to one another parallel to the fracture.
Floodplain	That portion of a river valley, adjacent to the river channel, which is built of sediments and is inundated with water at least once every 100 years.
Generic mitigation	Mitigation measures or techniques to which the applicants made commitment on a non-specific basis.
Geology	The science that relates to the earth, the rocks of which it is composed, and the changes that the earth has undergone or is undergoing.
Habitat	A specific set of physical conditions that surround a single species, a group of species, or a large community. In wildlife management, the major components of habitat are considered to be food, water, cover and living space.
Hydrology	The science that relates to the water of the earth.
Impact	A modification in the status of the environment brought about by the proposed action.
Insulator	A device that is resistant to the conduction of electricity used for isolating and supporting conductors.
Kilovolt	1,000 volts (a volt is a measure of electrical potential difference which will cause a current of 1 ampere to flow through a conductor whose resistance is 1ohm).
Kilowatt	A unit of power equivalent to 1,000 watts.
Landform	A term used to describe the many types of land surfaces that exist as the result of geologic activity and weathering, e.g. plateaus, mountains, plains and valleys.
Microwave	A very short electromagnetic wave.
Mitigation	To alleviate or render less intense or severe.
Particulates	Minute, separate particles, such as dust or other air pollutants.
Rare	A plant or animal restricted in distribution. May be locally abundant in a limited area or few in number over a wide area.
Residual impact	The adverse impact on an action occurring after application of all mitigating measures.

Route	A transmission route is the general path of a transmission line and associated facilities. in this environmental document, a route is comprised of contiguous segments or links.
Seen area	That portion of the landscape which can be viewed from one or more observer positions. The extent or area that can be viewed is normally limited by landform, vegetation, structures or distance.
Sensitivity	The state of being really affected by the actions of external influence.
Significant (impact)	"Significant" has been used in this document to describe any impact that would cause a substantial adverse change or stress to one or more environmental resources. In general, all potential high impacts were considered to be "significant"; but in some cases potential moderate impacts were considered significant.
Species	A group of individuals of common ancestry that closely resemble each other structurally and physiologically and in nature interbreed producing fertile offspring.
Study area	A given geographical area delineated for specific research.
Substation	A facility in an electrical transmission system with the capability to route and control electrical power, and to transform power to a high or lower voltage.
Wetlands	Those areas that are inundated by surface or groundwater with a frequency sufficient to support vegetative or aquatic life that requires saturated or seasonally saturated soil conditions for growth and reproduction.

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