PROPOSED SILICON PROJECT

W.A. SILICON TRUST

Report and Recommendations by the Environmental Protection Authority

Environmental Protection Authority
Western Australia
Bulletin 279 May 1987

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CONTENTS

APPENDICES

SUMMARY

The WA Silicon Trust has prepared an Environmental Review and Management Programme (ERMP) for the WA Silicon Project. The EPA released the ERMP for a 10 week public review period and received 41 submissions from the public and Government agencies on this document. The project has four major components. These are:

- mining of quartzite ore from a site near Moora;
- the logging of firewood quality jarrah by the Department of Conservation and Land Management from the northern jarrah forest;
- the conversion of the wood to charcoal in charcoal retorts at Coolup: and
- the smelting of the quartzite with high purity charcoal in an electric arc furnace at Wundowie.

While there are environmental impacts associated with each component of this project the EPA considers that most of these are manageable. However, the EPA is concerned about the following issues:

- the use of the jarrah forest resource;
- the transport of quartzite through Toodyay;
- the siting of the charcoal retorts; and
- the projected ground level silica fume concentrations at Wundowie.

Following consideration of the ERMP, the submissions and additional information from the proponent and the Department of Conservation and Land Management the EPA considers that subject to the proponent's commitments given in the ERMP and Appendix 1 of this Report and the recommendations made in this Assessment Report the EPA has concluded that the proposal is environmentally acceptable.

RECOMMENDATION 1

The EPA recommends that the proposal as described in the Environmental Review and Management Programme (ERMP) is environmentally acceptable subject to:

- *The proponents' commitments given in the ERMP and in Appendix 1 of this Assessment Report; and*
- *the Authority's recommendations in this Assessment Report.*

1. INTRODUCTION

The WA Silicon Trust are proposing to establish a silicon production process in Western Australia to supply 23 000 tonnes per year of silicon metal for local and export markets. The most of the metal will be exported. The ERMP identified the project as having four major components.

1. The logging of firewood quality jarrah by the Department of Conservation and Land Management from the northern and central jarrah forest.

2. Mining of quartzite ore from a site near Moora.

3. The conversion of the wood to charcoal in charcoal retorts at Coolup; and

4. The smelting of the quartzite with high purity charcoal in an electric are furnace at Wundowie.

A schematic diagram representing the above is shown in Figure 1. The locations of the components of the project are shown in Figure 2.

A further component of the project is the transport of the raw materials and product between the various parts of the process.

2. SITE EVALUATION

The proponent evaluated alternative sites at Dwellingup, Wundowie, Middle Swan, Worsley, Bullsbrook and Coolup for the smelting and charcoal processes (and combinations of both at the various locations).

The Wundowie and Coolup sites were selected for the smelting and charcoal respectively. Factors which effected these decisions are as follows:

. one of the members of the WA Silicon Trust, Agnew Clough Pty Ltd, owned land at Wundowie. This, coupled with the cost and timing of the construction of the energy supply, and the industrial nature of the area, prompted the selection of Wundowie as the location of the smelter. Because of this location there are environmental disbenefits to the State which result from the tranportation of the raw materials to the smelter and the need to provide a further powerline up the Scarp.

  An alternative location nearer to central energy generating facilities and located on a major transport route, in this case rail may have been feasible, would have potentially produced a more environmentally optimal location for the smelter.

. the environmental impact of the charcoal site.

  Sites on the Darling Scarp and in other locations were considered for the charcoal plant. At the time of writing the ERMP only a relatively few sites were available on the Scarp and these were unacceptable because of the need to avoid crossing the Lane Poole reserve and the Nanga Bridge. As a consequence of this the site at Coolup was selected. This issue is discussed further in Section 4 of this Report.

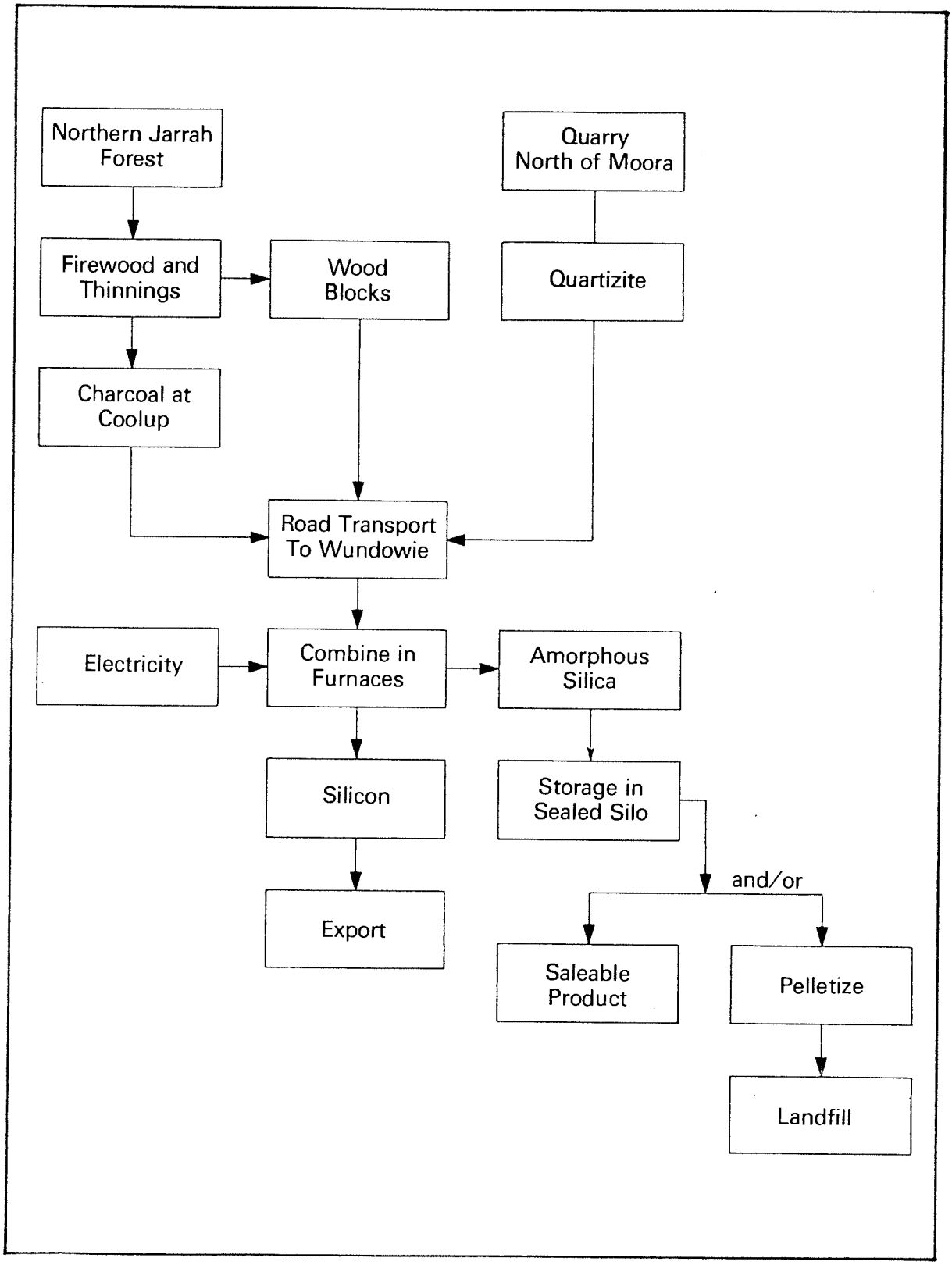

Figure 1. PRINCIPAL ELEMENTS OF THE SILICON PRODUCTION PROCESS

Source: Silicon Project ERMP

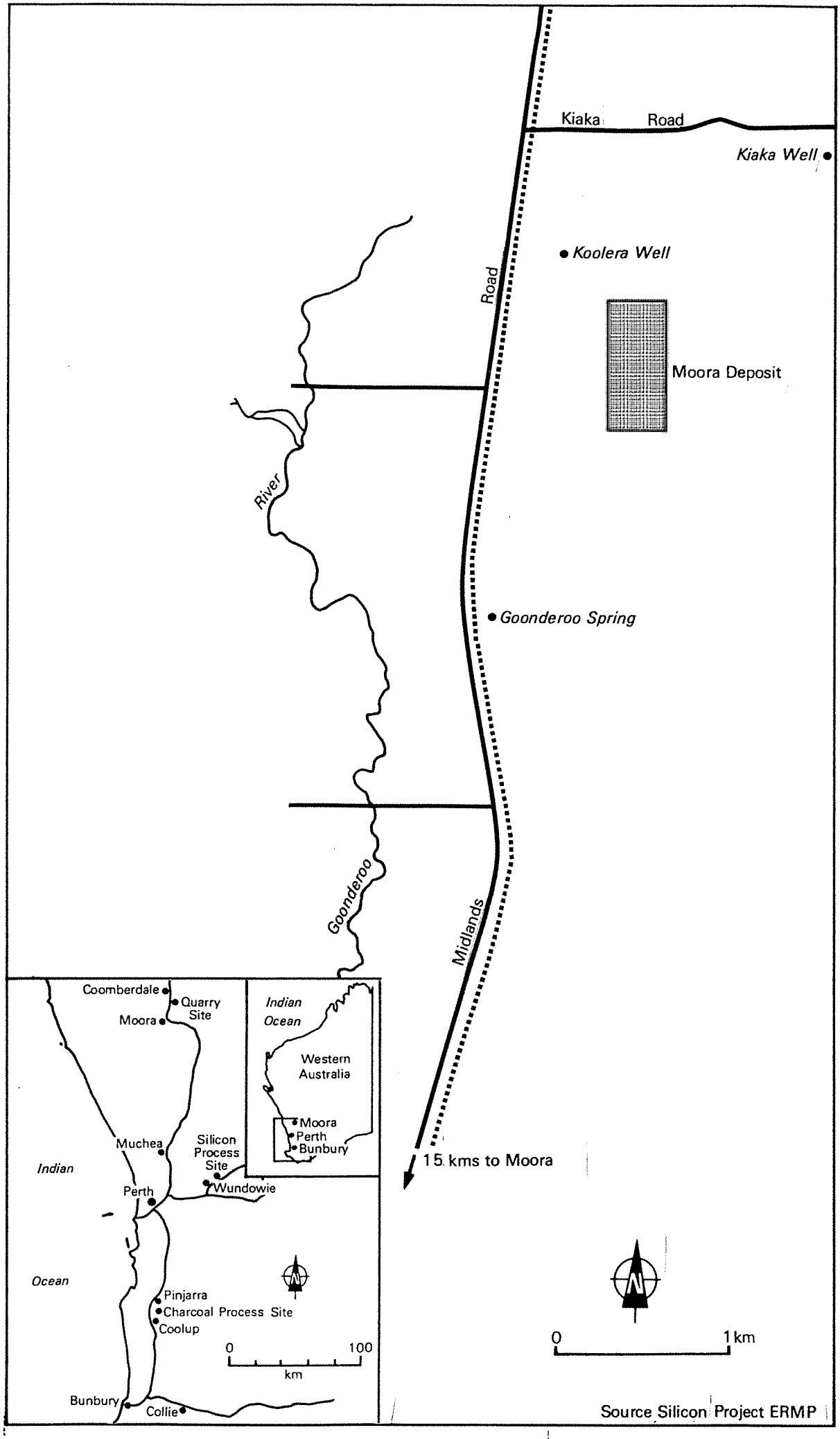

Figure 2.1 Quartzite Deposit Location

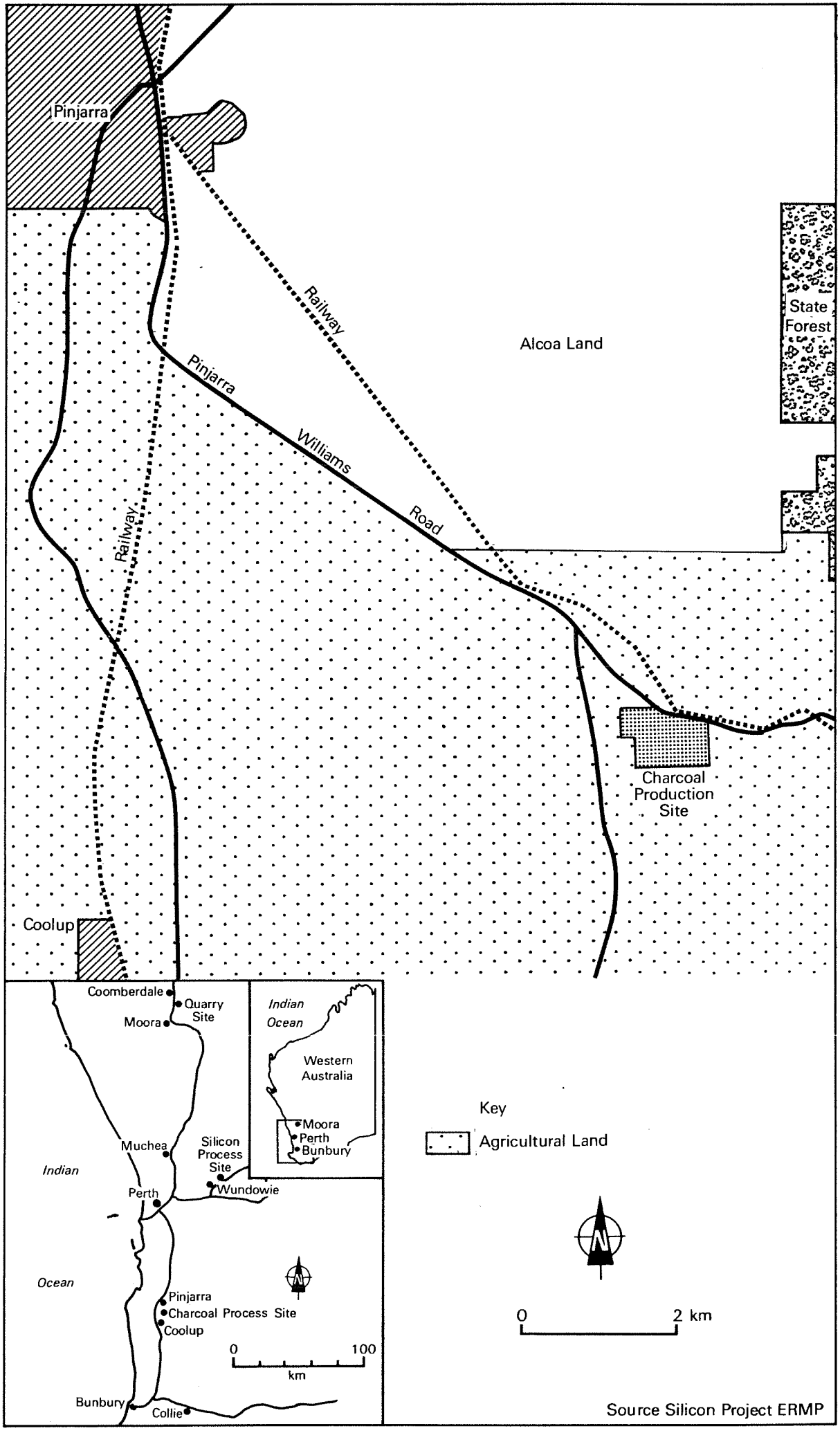

Figure 2.2 Charcoal Production Site

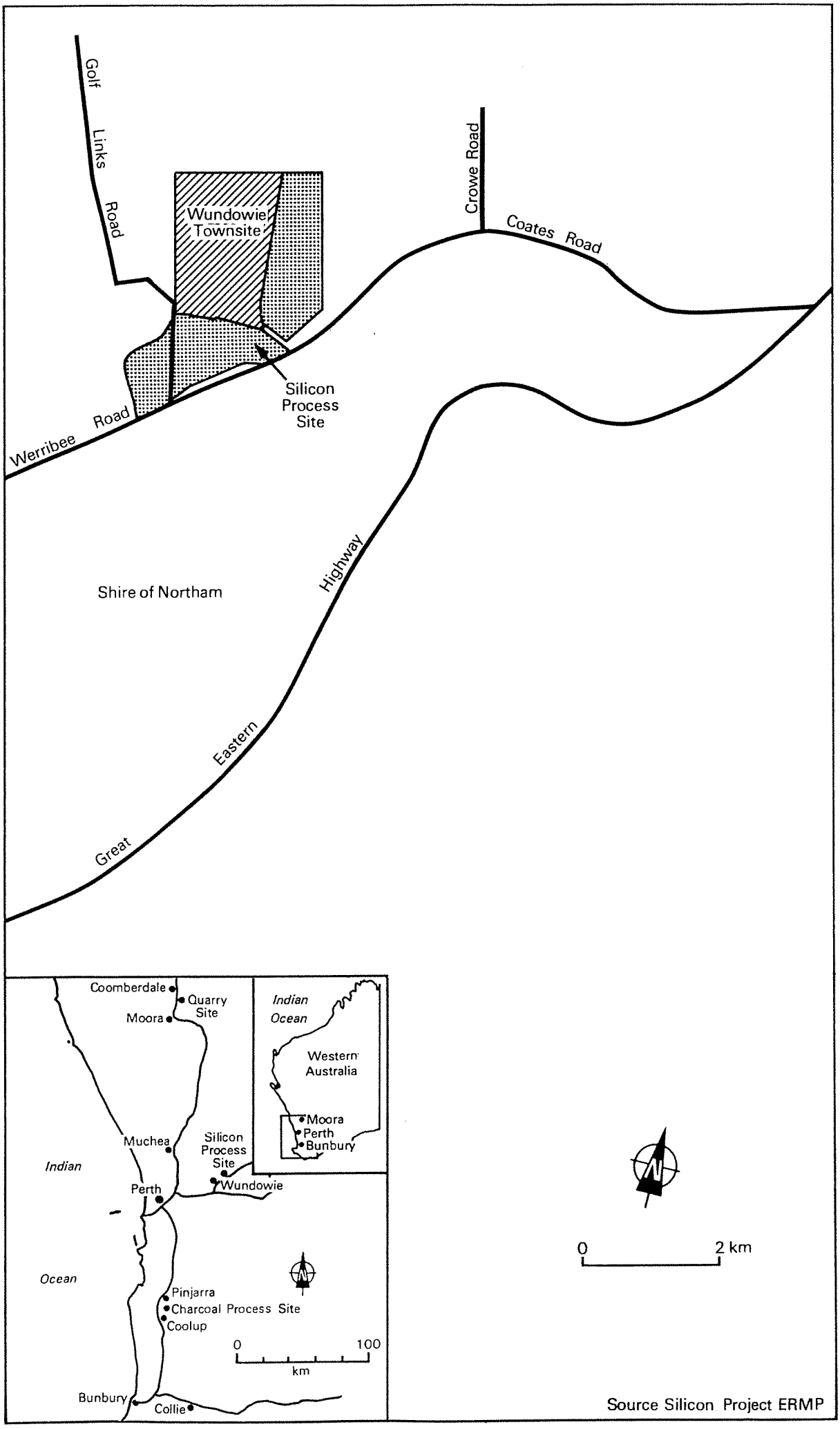

Figure 2.3 Silicon Process Site

3. SUMMARY OF PUBLIC AND GOVERNMENT AGENCY SUBMISSIONS

3.1 INTRODUCTION

A total of 41 submissions were receivied. Ten of these were from Government Departments, three from Local Authorities, six from conservation orientated groups and the balance from private individuals. One of the submissions was a petition signed by 14 persons.

3.2 CRITICISM OF THE ERMP

Of the 41 submissions, 21 commented that the document was:

- inadequate;
- lacked information; and
- contained numerical and textual inconsistencies.

Some submissions requested that the EPA reject the document and the proponent redraft it and make it available for public review. Of all the sections in the ERMP the forestry section was most often commented on as being deficient.

3.3 COMMENTS ON SPECIFIC ISSUES

There were numerous issues arising from the public submissions. Lists of issues were supplied to the proponent; the response to which can be found in Appendix 1. Listed below, for each section of the project, are the major issues.

The WA Silicon Trust is the proponent for the whole project. However, because the Department of Conservation and Land Management (CALM) is the producer, supplier and manager of the wood supply for the project it has agreed to respond to the issues which were raised concerning the forestry section of the project. This response can be found in Appendix II.

(a) FORESTRY

Summary of general comments:

- there were basic philosophical questions about the use of the jarrah forest. Some submissions considered that the forest should be used for the preservation of jarrah ecosystems and not for wood production; and
- because CALM is the manager of the forest and supplier of wood it was considered that it was not accountable to any one for its policies and practices in the forest and consequently, it was in a position to provide wood to the proponent and not be accountable for the impact of its actions on the ecosystem.

Submissions questioned the availability of the resource and the impact on other human uses of the wood resource; for example:

- while CALM had provided a letter saying that wood was available there was no indication as to where the wood would come from;

- there are discrepancies in the wood supply figures given in Introduction and the Wood Supply section of the ERMP;

- the parameters set for acceptable firewood logs in the ERMP are within the parameters of those which are acceptable as saw logs;

- what will happen to the existing domestic firewood cut and fence post supplies?;

- is there a potential impact on the apiary industry if trees are logged on apiary sites? and

- the ERMP does not look at any other source of wood (eg private land and mine sites) other than the CALM managed forest.

Many submissions highlighted concerns about the impact of this proposal on the jarrah forest ecosystem. These were the spread of disease and pest infestation, the loss of flora and fauna habitats, changing the salinity regime of the region, net export and consequent depletion of nutrients, the damage to the soil structure with resulting erosion. The issues associated with each of these are listed below.

- the spread of disease - most commonly mentioned was the spread of Phytophthora cinnamomi a fungus which induces jarrah dieback. Also mentioned was the jarrah leaf miner insect;

- the loss of flora and fauna habitats - the proposed logging could create a near monoculture with the ensuing loss of species diversity and niches available for vertebrate and non-vertebrate fauna;

- changing the salinity regieme - the extra logging could produce conditions under which the salt levels in the runoff could increase. WA Water Authority seek a commitment that green firewood will only be taken from >1 100 mm rainfall areas during the first 6 years of operation;

- net export and consequent depletion of nutrients - currently nutrients are exported from the forest through logging, firewood extraction, fence post collection. It was suggested that the further export of nutrients in the form of firewood for charcoal could lead to the long term nutrient depletion of the forest; and

- damage to soil structure - further logging will increase the number of vehicles operating in the forest. This will lead to extra erosion, damage to the soil structure and mechanical damage to the remaining standing trees.

The submissions also highlighted the absence of any details of monitoring of the above impacts except to examine the loss of fauna habitats. These are listed below:

- what will happen to the project if the study of fauna habitats shows that a significant damage to fauna is occurring?;

- if any monitoring of the impacts of logging produces evidence of a significant negative impact in the areas mentioned above, what will happen to the project?

- there is no information on the monitoring of the cutting and which trees will be removed; and

- it is difficult to get an overview of the impact of this project on the forest (eg does this amount to clear felling of the jarrah forest?) The ERMP does not supply sufficient information on which to make a judgement of the impact of the project.

(b) QUARTZITE SUPPLY

The issues raised in submissions on the mining of quartzite covered three main areas. These are discussed below:

- the operation of the mine - concern was expressed about the potential impact of water use, noise nuisance, dust and blasting;

- the rehabilitation of the mine site and protection of the species Regelia megacephala. Submissions questioned the decision to rehabilitate the mine back to pasture and supported the concept of improving the survival of R megacephala by rehabilitating the mine site back to indegenous species and reserving remaining areas of R megacephala as conservation reserves; and

- it is proposed to transport 60 000 tonnes per year of quartzite from the mine site to Wundowie. The most economical method of transporting the material is by truck down the Great Northern Highway, though Toodyay to Wundowie. This would create an 20-40% increase in heavy vehicles passing thorugh Toodyay.

Other issues raised in the submissions were the back loading of fume, the effects of blasting, and noise on houses in the area.

- The Aboriginal Sites Department of the WA Museum has noted a discrepancy in the ERMP concerning aboriginal sites and has advised that two archaeological sites have been recorded in the quarry area.

(c) **CHARCOAL PRODUCTION**

The Charcoal plant is proposed to be sited at Coolup. The plant will require an average of 130 000 tonnes/year of timber.

The site at Coolup is opposed by nearby residents for the following reasons:

- the disruption to the nearby residents quality of life through noise, odour, visual impact of the plant; and

- a proliferation of industry in a rural area along the base of the scarp.

The impact that log transport will have on the town of Dwellingup and the other road users in the vicinity of the plant and on the access roads from the forest.

(d) SILICON PRODUCTION

Submissions to the EPA raised the following issues concerning the silicon smelting plant at Wundowie. These include:

. the effect of an earthquake on the plants operation;

. the control of dust from stockpiles and operations;

. the fate of waste water from washdown, runoff etc;

. the transport routes to and from the smelter;

. the decommissioning of the plant; and

. the use of the rail system to transport the product to Fremantle.

4. ENVIRONMENTAL IMPACTS AND MANAGEMENT

4.1 FORESTRY AND UTILISATION OF THE FOREST RESOURCE

In keeping with the concepts of multiple forest use, and given the areas of the northern jarrah forest which have been set aside for purposes other than wood extraction, the EPA considers that the use of the forest for the extraction of firewood for the silicon project is an acceptable use of the forest resource.

Furthermore after consideration of the amounts of wood to be extracted and the available resource, (based on the information supplied by CALM (Appendix 2), and the information contained in the Draft Timber Production in Western Australia Strategy and the Draft Forest Management Plan for the northern forest) the EPA is satisfied that there is sufficient timber resource available for all the existing users of the forest and the proposed cut for the silicon smelter without causing an unacceptable environmental impact.

4.2 IMPACTS ON THE JARRAH ECOSYSTEM

The issues raised in the submissions concerning nutrient depletion, loss of flora and fauna habitats, disease spread, soil structure damage and salinity increase in water runoff are all issues which have been encountered in previous forest management operations.

After considering the information supplied by CALM (Appendix 2), the references in that document and the information contained in the Draft Management Plans the EPA is of the opinion that while there is a risk of a detrimental impact on the forest from the above factors this risk is outweighed by the positive benefits to the forest which will occur as a result of the silvacultural techniques to be employed as part of this project.

4.3 RESEARCH INTO THE JARRAH ECOSYSTEM

The above acceptance by the EPA of CALM's advice on the impacts of this project on the jarrah forest depends on research into the long term interactions between the varying uses of the forest resource in the northern jarrah forest. As the demands on the forest increase there will be less flexibility within the forest ecosystem to accommodate potentially conflicting uses. Current research is providing an understanding of the basic interactions, both ecological and human, that occur in the forest but continued research of this kind would facilitate planning for conflicting uses.

4.4 QUARTZITE MINING - DUST, NOISE, WATER USE

The EPA considers that these are adequately addressed in the additional information from the Silicon Trust in Appendix 1. The EPA also notes that the excessively high water use described in the ERMP has now been reduced to less than 10% of the ERMP figure and that the provisions of the Rights in Water and Irrigation Act as administered by the WA Water Authority will adequately protect the resource and protect other users. The EPA also considers that operational dust will be controlled in accordance with the Mines Regulations Act.

4.5 QUARTZITE MINING - REHABILITATION

The ERMP indicated that there would be a significant impact on the known populations of the rare plant species Regelia megacephala. The EPA accepts the advice given in the additional information from the Silicon Trust that due to an inaccuracy in interpretation of the basic information on the locations of stands of R megacephala the ERMP portrayed the potential impact on these plant populations as greater than should actually occur.

RECOMMENDATION 2

The EPA recommends that:

1. *The proponent should resurvey the site to determine the type, extent and condition of the vegetation communities on the mine site;*

2. *Prepare a management and rehabilitation plan for the minesite which includes the results of trials into rehabilitation of the site back to native vegetation; and*

3. *Submit these plans to the Mines Department for approval.*

The Aboriginal sites Department of the WA Museum have commented that two archaeological sites have been recorded in the quarry area.

The EPA indicates that the landowner should comply with Section 18 of the Aboriginal Heritage Act.

4.6 TRANSPORT OF QUARTZITE

It is proposed to transport the quartzite by truck down the Great Northern Highway through Toodyay to Wundowie. Because of the configuration of the roads entering and leaving the town and the number of heavy truck movements (approximately 15/day) the EPA considers that this additional traffic through Toodyay could be disruptive to the town's lifestyle and may present a safety hazard to the inhabitants of the town.

The proponent has investigated other options for transporting the quartzite to Wundowie which avoids Toodyay. These are:

- various combinations of road and rail; and
- taking the quartzite by road south to Midland along the Great Northern Highway then east to Wundowie along the Great Eastern Highway.

All of these options are considered to be marginally more expensive in comparison with the road route through Toodyay. The EPA considers that it would be desirable if an alternative to road transport through Toodyay was available. If a road-rail option was used it would avoid potential road traffic problems which may arise along the currently favoured route.

RECOMMENDATION 3

The EPA recommends that the proponent, in conjunction with the nominee of the Minister for Transport and the Toodyay Shire Council, determine an alternative for transporting the quartzite to Wundowie which minimises the disruption to the town of Toodyay.

4.7 SITING OF THE CHARCOAL PLANT

The EPA does not consider that the Coolup site is the most desirable location for the charcoal plant because of its disruption to the rural character of the surrounding land and the impact that the log and charcoal trucks will have on the surrounding towns and transport routes. The EPA notes the Shire of Murray's objections to the site for similar reasons.

Following extensive discussions with the proponent and the Department of Conservation and Land Management and the Department of Resources Development (DRD) the EPA believes the reasons for the siting of the plan in the Coolup area are as listed below. Correspondence to this affect from CALM is included in Appendix IV:

- There is a 4:1 reduction in weight which occurs in the conversion of wood to charcoal. Consequently for economic reasons the charcoal plant has to be located as close as possible to the wood supply;

- The cost of log haulage is a major factor in the economic viability of the project and is very sensitive to variations in the required haulage distances from the forest to the charcoal plant. The proposed site is roughly central to the forest from which the wood will be collected.

- In its initial stages, the project requires large quantities of dead, dry wood. CALM is proposing to supply this from the western Scarp dieback areas which are in close proximity to the Coolup site;

- Over the life of the project CALM is proposing to supply timber to the charcoal plant from both north and south of the Lane-Poole Reserve;

- CALM his indicated strong opposition to the operation of log trucks through the Lane-Poole Reserve because of the potential disruption to the publics' use of the Reserve, the road traffic safety aspects of the road through the Reserve, the structural safety Nanga Bridge and the extensive road upgrading which would be required to avoid damage to the existing forest road network if trucks were to cross the Reserve;

- While a scarp site may have less potential for disruption to the surrounding land users, if criteria of not crossing the Lane-Poole reserve is adhered to, then it is more economical to select a site in the foothills for the charcoal plant which can be fed by trucks travelling down the Scarp either near Waroona from Dwellingup or from other Scarp access roads to the north. This avoids the added expense of having to travel back up the Scarp to an alternative Scarp site;

- A further option considered was to locate the charcoal plant in the east of the scarp. This was not feasible because of the poor access to Wundowie and the unavailability of electrical power; and

- Attempts have been made by the proponent to acquire land adjacent to, or as part of, the existing Pinjarra heavy industrial complex. For various reasons no land was available.

Having considered the above the EPA recognises that the location of the charcoal plant in the general area between Coolup and the Scarp fits in the above scenario. However, the EPA considers that the presence of the plant in this location will be disruptive to the surrounding rural area and a daily additional 30-40 log truck (and 7-10 charcoal truck) movements to and from the plant and utilising the road network around the site will effect surrounding towns and road users. Most of the impact of this will have to be bourne by the residents of the area.

To a certain extent this impact could be ameliorated by:

- improving the standard of road access down the scarp particularly from Dwellingup to the Coolup site;

- by close monitoring and control of the air and noise emissions from the charcoal plant's operations; and

- further investigation of partial rail transport of charcoal from Coolup to Wundowie.

RECOMMENDATION 4

The EPA recommends that:

1. *The nominees of the Minister for Conservation and Land Management and the Minister for Transport, the proponent, the Main Roads Department and the relevant local Authorities should liaise to closely examine the routes and means which will be used to transport logs and charcoal to and from the Coolup site with a view to improving safety and minimise the disruption to other users. This should be done before construction commences: and*

2. *The proponent should submit, to the Local Authority for approval, plans of landscaping proposals to minimise the visual impact of the plant.*

4.8 SMELTER OPERATION WUNDOWIE

The proponent proposes to control air emissions from the smelter at Wundowie. Of particular concern to the EPA is the fallout of silica dust on the town. In a discussion of appropriate standards for amorphus silica the ERMP states that "the maximum ground level concentration of amorphous silica should not exceed 0.3 mg m^{-3} (300 $\mu g\ m^{-3}$) as a one hour average".

The atmospheric dispersion modelling results included in the ERMP were invalid due to invalid assumptions. Following requests for more information the proponent provided modelling results showing near-source ground level concentrations of amorphous silica dust as high as 1 625 and 700 $\mu g\ m^{-3}$ for the maximum 10 minute and 24 hour averages respectively.

It has been estimated that a 10 minute value of 1 625 $\mu g\ m^{-3}$ corresponds to a 1 hour average of 1 000 $\mu g\ m^{-3}$. These results have not been analysed in relation to the boundary of the plant. However, on the basis of these modelling results and the standard suggested in the ERMP, the pollution impact of the plant appears excessive. The proponent has requested the opportunity to re-examine the emission parameters employed in the model and to re-run the model.

The EPA is confident that measures are available to the proponent (possibly including the construction of a stack for venting bag house emissions) which will ensure that acceptable concentrations are achieved both inside and outside the plant boundary, protecting occupational health and the ambient environment.

RECOMMENDATION 5

The EPA recommends standards for ground level concentrations of amorphous silica fallout outside the plant boundary and how these standards should be met should be determined as a condition of the required Works Approval and licence. Furthermore the proponent should liaise with the nominee of the Minister for Works to ensure compliance with occupational health and safety regulations.

The EPA's request for further information on the effects of noise from this plant on the Town of Wundowie has not been met by the proponent at this stage.

RECOMMENDATION 6

The EPA recommends that the effects of noise emissions on the Town of Wundowie from the plant will be acceptable before the required Works Approval is issued.

5. CONCLUSION

The EPA has considered the ERMP, the submissions from the public and the additional information supplied by CALM and the proponent. The EPA has also sought additional information on the transport components of the project.

The Authority has examined the impacts that this proposal will have on the Jarrah forest and considers them to be acceptable.

Following investigations of the quartzite mining and site rehabilitation proposals the Authority considers that the proposed water use is acceptable and the mining operation will not have a major impact on the populations of Regelia megacephala. The transport of quartzite to Wundowie should be further investigated so as to ameliorate the potential impact on the Town of Toodyay.

The Authority accepts the reasons for the selection of the Coolup area as a location for the charcoal plant. However, it recognises that there will be an impact on road users and nearby residents as a result of its location.

The selection of Wundowie as the location of the smelter creates some impacts resulting from the transportation of raw materials and the provision of electricity.

The EPA considers that the proponent should do further work to avoid unacceptable air and noise emissions from the plant.

The EPA does not consider that the locations chosen by the proponent for the various parts of the project have provided the optimal solution for minimising environmental impacts. Neither does the ERMP document canvas options or provide a demonstration that the proponent has sought to do much else than justify, in environmental terms, sites which were selected for other reasons. Nevertheless, the Authority considers that the project is environmentally acceptable subject to the proponent's commitments given in the ERMP and Appendix 1 of this report and the recommendations made in this Assessment Report.

APPENDIX I

ADDITIONAL INFORMATION IN RESPONSE TO QUESTIONS FROM THE EPA SUPPLIED BY THE PROPONENT.

A portion of this information consists of a detailed technical report on the projected air dispersion of silica fume from the Wundowie smelter prepared by Steedman Ltd and can be viewed at the EPA Information Centre, Ground Floor, BP House, 1 Mount Street, Perth.

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15 April, 1987

The Director - Evaluation
Environmental Protection Authority
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ATTENTION: MR. D. GALLOWAY.

Dear Sir,

SILICON PROJECT ERMP.

We enclose additional information in response to questions relating to silicon production, quartzite supply and charcoal production. Information bearing forestry matters is mostly in the province of C.A.L.M. and will be supplied separately.

Yours faithfully,
for AGNEW CLOUGH LIMITED

L.W. WALSH
MANAGER - RESEARCH AND EXPLORATION.

WEST AUSTRALIAN SILICON PROJECT

ADDITIONAL INFORMATION IN RESPONSE TO E.P.A. QUESTIONNAIRE

I N D E X

WEST AUSTRALIAN SILICON PROJECT

ADDITIONAL INFORMATION IN RESPONSE TO E.P.A. QUESTIONNAIRE

SILICON PRODUCTION

1 What effect would a major earthquake (eg Meckering) have on the plant if an earthquake occurs during operation?

Reference is to page 79, Section 5.1.2 of the ERMP, paragraphs 3, 4 and 5, and in particular it is noted that no structural damage attributable to the Meckering earthquake is evident to the existing 30 metre high Lambiotte Retorts which were in place at the time of that major earthquake. Similarly, according to reports, the blast furnaces were undamaged.

Further it is noted that all major components (particularly civil and structural) will be designed to confirm with earthquake resistance requirements laid down in AS 2121-1979 "The Design of Earthquake - Resistant Buildings".

The silicon furnaces will be continuously tapped, so there is no significant accumulation of molten metal as there is in a blast furnace.

2 What effect, if any, will dust from stockpiles, loading or transport of quartzite and charcoal have on the surrounding area?

Reference is to pages 106 and 114 in the ERMP. The quartzite delivered from the quarry into stockpile at Wundowie will be coarse and wet screened. Dust levels at the point of discharge from truck into stockpile will be kept within occupational health limits and will therefore have no effect on the area outside the immediate stockpile vicinity. The open quartz stockpile will be regularly damped down with water sprays or the like to further minimise dust generation during quartz recovery operations. Further damping down of quartz at conveyor transfer points into the furnace day bins will be conducted on an as required basis. The use of controlled dust suppression measures combined with the coarse particle size of the lump quartz involved will ensure that no dust nuisance or hazard is caused either to plant operators or to the surrounding area.

Charcoal will be transported in purpose-built, totally-enclosed trucks and will be discharged into a partly enclosed dump hopper for conveying via a conveyor and tripper into a covered stockpile. Light damping down of the charcoal stockpile will also be practised as necessary to suppress dust. In addition dust collection will be practised at conveyor transfer points and discharge points into day bins.
Total control of charcoal dust is expected to be superior in every respect to charcoal handling operations previously practised on site at Wundowie.

...2/

3 Where will the waste water eg washdown, runoff etc be disposed of? See also submission 20.

Dust suppression when practised around stockpiles and adjacent areas will be directed at damping down surfaces of stockpiles materials. No water cannon or similar are intended to be used. Normal practice will not entail washdown of paved areas; the process is essentially hot and dry.

Where surface run-off is induced from stockpile bases and in-plant roads during periods of heavy rain the drainage systems will as far as possible direct all such run-off to a central collection sump where settling of any particulates can occur prior to decanting of remaining clear water. Any sludge collecting in this central sump will be removed periodically and carted to an approved landfill. Appropriate licenses for these procedures will be sought once plant design is finalised and anticipated quantities are known.

4 What route will the trucks take to and from the smelter? Will these have a negative impact on the towns along the route?

Truck haulage routes to and from the Smelter are presently being resolved in conjunction with Main Roads Department, Local Shires, haulage contractors and the proponent.

These discussions will consider the effects on towns along the routes and wherever possible these will be avoided.

However, the frequency of operation of vehicles for the relatively low tonnages involved is not anticipated to have any significant detrimental impact on towns along the route.

5 The proponent and their consultant have agreed to extensive discussions with the Pollution Control Division concerning a considerable modification on the section on noise and air emissions. This has not as yet taken place. See also submission No 2.

A report prepared by Steedman Limited Appendix I. Notes on Air Quality Estimates for a Proposed Silicon Plant, Wundowie, Western Australia, Addendum 1 February 1987, and its accompanying covering letter are submitted herewith in response to Comment No. 5 regarding air emissions.

The relevant points raised in Submission No. 2 are noted. The ERMP recognises (page 107) that more stringent dust limit criteria for silica fume have been recommended by some authorities.

...3/

The observation that the stated amount of silica fume is not reconcilable with the 60 000 T quartzite feed and the 23 000T of silicon product is correct. Recovery of 23 000T Si from 60 000T SiO_2 is based on a conversion efficiency between 82% and 83%.

Test production using these raw materials in commercial scale furnaces has shown that those conversion efficiencies will be easily achieved. The ERMP figure for silica fume probably includes an allowance for considerable pelletising moisture but it is an over-estimate. It is now estimated that dry basis fume production will be 9 000 to 10 500T.

The probable necessity of measures to avoid charcoal dust nuisance in the stockpile area is acknowledged. Coarse charcoal will be transported to Wundowie after removal of -5mm. fines. Screening operations were carried out at Wundowie when a comparable quantity of charcoal was formerly produced there. A minor dust nuisance experienced at that time was mainly attributable to operation of batch type kilns for a proportion of the production.

In connection with the concern felt about the evaporation pond at the charcoal production site, Submission 2 concedes that "there may not be an exact parallel with the ponds at Wundowie" but goes on to suggest that experience there should direct attention to the Coolup works. The new plant will be quite unlike the old in that an incinerator will render pyroligneous vapours in the off-gas innocuous and there will not be quantities of tarry liquid effluent to be dealt with.

With reference to noise, it is reiterated that all practicable steps will be taken to ensure that Noise Abatement Regulations are complied with and to avoid noise levels which will be unacceptable to local residents.

6 There is an old railway bridle path walkaway on the southern edge of the site. A submission recommended inclusion this into any landscaping proposals.

Reference is made to a bridle path on the southern boundary. According to Wundowie residents there is no such bridle path. Perhaps the submission was alluding to a section on the southern side of Coates Road, east of Hawke Avenue which is used by a local riding school. That is Railway land which is not under our control.

7 Will there be any runoff into the Werribee Creek as has occurred in the past with the old iron works.

There is absolutely no parallel between the proposed silicon plant operation and the previous State-run and subsequently ACL-acquired iron works.

...4/

Any run-off which occurs will be essentially clear water overflow from a sump or pond collecting essentially inert solids picked up from areas around the roads and stockpiles during periods of heavy rain.

8 What plans have been made for decommissioning of the site?

It is expected that land use of the industrial reserve will continue unchanged on a long term basis and no specific decommissioning plans have been formulated. Whenever a change is justified, the furnaces would be dismantled and disposed of as scrap, as the blast furnaces were.

9 Has the proponent considered using the rail system to transport the silicon metal to Fremantle?

It was not regarded as a practical alternative initially but enquiries are under way with Westrail.

...5/

QUARTZITE SUPPLY

1 Agnew have informed EPA that water usage is greatly reduced. What is the current proposal and what affect will that have on other users e.g. stock, vegetation and domestic? What monitoring will be undertaken to determine if the operation is affecting the water table?

At a meeting in Moora between concerned neighbours and representatives of the proponent, advice previously conveyed by letter was further amplified. The proponents representative stated that water usage would be less than 10 percent of the quantity proposed in the ERMP.

In addition the parties are now aware that the Water Authority intend to bring the area into the ambit of licensing requirements of the Rights in Water and Irrigation Act prior to commencement of mining.

Preliminary tenders for the mining/crushing contract close in mid April and more definition of water requirements will be provided then.

2 Will an area of veg. containing the R. megacephala + Kunzea sp be reserved as a nature reserve - cf pg 74 para. 4 how will it be set aside.

It appears that the consultant confused the proposed minesite with the "quarry site" on the adjoining location M574 which is vested in the Minister for Transport, being Midland Railways land. The principal population (no.1) of Regelia megacephala will not be affected by the present proposal. The portion of it which lies within location M573 is clear of the proposed minesite, as is the remainder which is in M574.

While the area containing population 1 is covered by Agnew Clough Limited prospecting licences there is at present no intention to mine there.

The "quarry site" referred to pre-dates the proponent's activities in the area. The correct interpretation of the distribution of R. megacephala vis-a-vis proposed mining operations is contained in the accompanying letter and comments from Dr. A. Tingay. Appendix II

3 What advice has CALM give (Pg. 72 para. 7) on protection of populations from weed infestation and fire? Will the proponent be following this advice.

...6/

Specific advice has not been sought as yet. As previously disclosed the main population is separated from the minesite by land which is alternately cropped and grazed. Advice will be sought from C.A.L.M. in due course.

4 What will happen if the rehabilitated minesite suffers erosion?

Rehabilitation measures will be aimed specifically at avoiding risk of erosion. Advice from appropriate authorities and consultants will be sought accordingly. The area will be monitored.

5 Will dust from the transport, mining or silica fume back filling operations affect the residents along the route.

Mining

Appropriate dust control measures will be taken in the mining operation to limit respirable silica dust in accordance with the Mines Regulations Act Regulations 1976 (see page 76 of ERMP)

General nuisance and airborne dust from mobile equipment and truck operations in the pit and on haul roads will be suppressed by road watering (see also page 76 of the ERMP).

Dust levels will be sufficiently low to cause no hazard or inconvenience to workers employed in the mining operation and as a consequence should have nil adverse effect on the nearest residents to the mine which are 0.6 km and 1.6 km respectively from the quarry limits.

Transport of Quartz

Transport of quartz from Moora to Wundowie will be by the shortest, most practical and economic route after discussions with the Main Roads Department and the various local Government Authorities concerned.

The quartz will be wet screened and will have a bottom size of 25mm or possibly higher. There will be no dust hazard or nuisance emanating from the quartz itself. Transport will be by truck trailer combinations on mostly sealed roads and the incidental dust nuisance will be minimal and not significantly more than currently occurs as a result of the passage of heavy trucks over this route.

The population density along the proposed route, other than in the townships of Moora and Toodyay is low and the effect of dust from truck transport proposed is expected to be negligible.

...7/

Transport of Silica Fume

Recent studies have indicated that it should be possible to sell most if not all of the silica fume generated by the silicon smelter at Wundowie. This dust will be transported in totally enclosed tankers between Wundowie and the consumers depots in Metropolitan Perth. An average of 7 to 8 trucks per week will travel between Wundowie and Perth along the Great Eastern Highway and no dust nuisance to residents will be caused by the minimal addition to truck traffic along the route.

Unsold silica fume will be pelletized and transported to an approved landfill in the Wundowie area. There is no intention to back load silica fume to the quartzite quarry at Moora either in pelletized or unpelletized form.

6 - 9
incl What are the current background noise levels?

How will the expected high (above regulations) noise levels from operations affect the nearby residents?

How will the operation affect the neighbours quality of life.

What compensentation is proposed to be supplied to surrounding landowners if they are negatively affected by the project.

While background noise levels have not yet been ascertained it has been assumed that ambient levels are low. Departures from normal rural patterns would be restricted to periodic increases due to rail traffic. The distance from neighbouring residences is such that changes are expected to be minor.

The closest residence, "Goonderoo", is on the farm which contains the minesite. Its owners, L & S Doust, are strong supporters of the project and have already relocated in Moora. The project will acquire the farmhouse as a base for operations.

Noise and other issues were discussed at a recent meeting in Moora attended by all interested neighbours. Representatives of the proponent explained what was planned and undertook to maintain contact with individual property owners to ensure that operations would have minimal unfavourable impact on their quality of life.

No specific or general offer of compensation was made. The only existing compensation agreement is the "Private Property Agreement" with L. & S. Doust in accordance with provisions of the Mining Act.

...8/

The proponent's position, put to the Moora meeting is:-

..... There should be no significant effect on the quality of life of other neighbours.

..... The proponent will continuously monitor the situation and will take appropriate steps to redress the problem should any presently unforeseen effects emerge.

The explanations were well received by the meeting which then expressed support for the project. There is no perception of disruption or inconvenience which will entail compensation but it was made clear that the project will maintain close communication with neighbours when operations start.

10 Have noise contours been generated for the mining operation?

Noise contours have not been generated for the mining operation. It was considered unwarranted in view of the distance to the nearest residence, other than Goonderoo which will be acquired by the project, and the relatively low noise levels associated with this small quarrying operation.

11 What form of road transport will be used to take the quartzite to Wundowie and backload the silica fume? Will this damage the road or unduly affect other users e.g. in the towns along the route?

As referenced in the answer to Question 5 the proponents do not intend to back load silica fume from Wundowie to the quartzite quarry at Moora.

The quartzite will be transported to Wundowie using truck trailer combinations with an average payload of 35 tonnes of crushed and wet screened quartzite.

Preliminary bids have been called from various transport operators. Until these bids have been received and analysed and full discussions held with the Main Roads Department and various Local Government Authorities, no decision can be made on the final route for transport for quartz. The possible alternatives have been well canvassed in a report from the Director Planning and Traffic for the Main Roads Department dated 25 March 1987.

Inevitably, increased wear on the roads will result from the passage of an additional 111,000 gross tonnes of truck transport over the roads in question but with normal maintenance measures by the authorities concerned, no undue inconvenience or distress should be caused to other users.

...9/

12 Will the blasting structurally affect houses in the area.

Reference is made to page 78 paragraphs 3,4,5 and 6 of the ERMP in particular "The use of millisecond delays in explosive detonation will reduce the ground vibration to the level of ambient micro-seismic activity due to natural sources at distances of 1km. Therefore ground vibration from blasting will not be a problem at this site."

As a consequence houses in the area which are already structurally sound will not be affected by blasting activities at the proponents quarry.

13 & 14 What is the long term management plan for monitoring the rehabilitation of the area

Refer to submission no. 31 from Ag. Dept. re rehabilitation.

No detailed long term management plan for monitoring rehabilitation has been formulated as yet.

The alternatives proposed in the ERMP (p.74) are subject to further testing. A prediction was made that the rehabilitation approach most likely to succeed is one based on agricultural pasture and crop species. However, in connection with indigenous vegetation, it was also stated that

> "...trial experimental plots seeded with *Regelia megacephala* will be established to see if this restricted species can be regrown. If the trials are successful this will become the rehabilitation priority."

It is not considered appropriate to discard any alternative until further advice is obtained and tested.

15 Has rail transport been considered as a method of transporting the quartzite to Wundowie.

In the evaluation of alternative sites to Wundowie for the location of the silicon smelter, rail transport of quartzite was considered eg. to Dwellingup, Worsley or Middle Swan. All of these sites were situated adjacent to existing rail lines.

However there is no longer a rail line into Wundowie and the nearest rail head to the location is Northam. The adverse economics of double handling quartzite off rail at Northam into trucks for transport to Wundowie some 37 kilometres may make it impractical to use rail as an alternative to road transport for haulage of quartz to Wundowie.

Enquires are under way with Westrail

CHARCOAL PRODUCTION

1 What is the drainage on the site?

Run-off from stormwater or plant spray systems will ultimately be discharged into the creek system to the northern boundary of the site as well as water seepage into the ground.

2 Is the site connected hydrologically with any other water user?

The system will be connected hydrologically to downstream farmers extracting water from the creek system as well as to borewater users, if any, extracting water from below ground.

3 If so, what affect will this proposal have on those users e.g. from wood stockpile run-off, process water evaporation dam etc?

All water discharged from the site will comply with Statutory Requirements on permissible contaminant levels. There will therefore be no detrimental effects to horticultural, agricultural or domestic users downstream as a result of site rainwater run-off or process water disposal. Under current plans there will be no disposal of process water through evaporation as referenced in your questionnaire.

Bunding of process areas will prevent any water pollution as a result of any accidental spillages. Leaching of wood storage areas may require settling pond installation subject to further engineering evaluation.

4 Is the site suppled with mains water, if not where will the water be supplied from? (see 2 & 3 above)

The site will not be supplied with mains water. Water will be supplied from groundwater bores.

5 What is the existing background noise levels at the site?

Existing background noise levels have not been measured yet. It has been assumed they are relatively low, in keeping with the rural nature of the area.

...11/

6 What effect will the noise from the plant have on the neighbours lifestyle?

Having regard to the distance from the plant to neighbouring residences, the noise attenuation measures proposed and the nature of the operation, it is believed that there will be no significant effect on neighbours' lifestyles. Neighbourhood noise levels will be considerably lower than those close to long established timber mills in the southwest.

7 What are the hours of operation of the sawmill?

Between the hours of 7.00am and 11.00pm on weekdays under normal operating conditions.

8 What happens if the incinerator breaks down?

The charcoal system will operate an an air tight circuit. In the event of incinerator failure, the system will be shut-down and purged with steam to prevent combustion of the wood/charcoal mix. This is expected to be a rare event as only electrical failure or fan failure would be expected to shut down the incinerator system.

9 Will there be any fallout of charcoal dust on the surrounding land users, if so how severe will it be?

All charcoal screening and handling operations will incorporate dust extraction systems. Given the distance from the plant location to the boundaries, is not expected to be any measureable dust fallout (see question 26).

10 What route will be taken to the plant by the power suppliers?

There is an existing 22kV distribution line which is fed from SECWA's Coolup sub-station and which runs across lot 192 (the proponents' intended charcoal site). Power will be supplied by SECWA from the existing distribution line at 440V through a 1MVA stepdown transformer.

11 Will the plant's lights be visible to the neighbours at night?

Adequate lighting will be provided on the site to permit staff to operate the plant at night. The plant will therefore be visible from a distance, however,

...12/

there should be no disturbance to any adjoining properties. All lighting will be directional, aimed at only lighting the appropriate work areas. It should also be noted that following development of tree screening, the plant will not be visible from outside the boundary from most aspects.

12 What will happen to the residue in the gas cooler bleed water evaporation dam?

There will be no gas cooler bleed water evaporation dam. All bleed water from the gas cooler will be evaporated in the incinerator and solid residues combusted.

13 Is there any proposals to compensate neighbours for loss of amenity or income from the plant's operation?

There is no proposal to compensate neighbours and it is not considered appropriate to formulate one. The proponent will maintain close communication with the small numbers of people concerned so steps can be taken promptly to rectify any unforeseen outcomes of its activities.

14 Will smoke be generated from the sawdust being burnt on site? What affect will this have?

An incinerator system, similar to those presently in use at modern timber industry facilities, will be installed for disposal of sawdust from the project.

The modern incinerators, colloquially referred to as "smokeless" incinerators, provide a near complete combustion of both the timber fibre and the off-gases.

Any significant emission of smoke is now regarded as unacceptable in the timber industry. The proposed incineration system will not create an unacceptable working or adjoining environment.

It should also be noted that efforts are underway to find an alternate commercial use, involving disposal of sawdust off site.

15 Is it expected that Mines or EPA will conduct the air monitoring (3.3.6)?

The question possibly arises from misinterpretation of section 3.3.6, p. 50 of the ERMP, which is phrased ambiguously. That paragraph was meant to convey that

...13/

monitoring of air quality will be conducted in accordance with requirements of either or both of the Department of Mines and Department of Conservation and Environment. In accordance with subsequent developments D.C.E should now be deleted and Environmental Protection Authority substituted.

16 What are the proposed monitoring programmes for the site?

Answers to questions 1,3 and 12 deal with run-off and liquid effluents; 8, 9 and 14 with air quality. It is believed that no significant difficulties will be entailed in keeping discharges well within statutory limitations. It is recognised that monitoring may be required in order to demonstrate that this belief is well founded. The answer to question 15 touches on air quality monitoring and the same general statement can be made in connection with water; that is that monitoring will be conducted in accordance with requirements of the relevant Authority. Beyond that it is not practical to specify detailed monitoring programmes at this stage of design.

17 Which alternative sites have been considered?

The extent of consideration of alternative sites is discussed in section 1.4.6 of the ERMP (p.14,15). Having chosen the Pinjarra/Coolup region, alternatives within that area have been considered, but so far nothing more suitable than the ERMP site has been located.

At a meeting on January 29th attended by neighbours of the proposed plantsite, representatives of the Shire of Murray and representatives of the proponent, the proponents position was defined as follows:

a) it believed that the site was environmentally suitable, and if further study confirmed this to be so, and if no acceptable alternative could be found then the plant would be built there.

b) it acknowledged that the neighbours concerns should be taken into account even if those concerns were not well founded, and undertook to look for an alternative site which would have no significant environmental or economic disadvantages compared to the site proposed by the ERMP.

...14/

It was suggested at that meeting and on other occasions that Alcoa owned land contiguous with their Alumina refinery site would be preferable, but Alcoa have declined to negotiate. They state that they do not wish to further fragment their land holdings. Other possible sites have been examined but failed to meet environmental and economic criteria. The deadline beyond which a change of site would present severe difficulties is fast approaching.

The proponent's representatives will attend a Shire of Murray Health/Building /Planning Committee meeting on April 14th in order to obtain and provide further definition of this issue.

18 What is the current zoning of the area?

The area is not zoned at present. It is subject to East Murray Interim Development Order No 8. It will be affected by a new District Planning Scheme which is currently before the State Planning Commission.

19 Which routes will be used by the transport to and from the site? What affect will this have on the roads, other users and surrounding inhabitants?

Truck haulage routes to and from the smelter are presently being resolved in conjunction with Main Roads Department, local shires, haulage contractors and the proponent.

These discussions will consider the effects on towns along the routes and wherever possible these will be avoided.

However, the frequency of operation of vehicles for the relatively low tonnages involved is not anticipated to have any significant detrimental impact on towns along the route.

20 Can the condensate from the retorts be recovered and used instead of burnt?

Experience in earlier operations at Wundowie showed that byproducts of wood carbonisation in batch retort charcoal operations were recoverable, but with negative commercial and environmental results.

The principal factors are:

..... Jarrah is very poor in yields of acetic and homologous acids; approximately 2.8% compared to 7% from typical European hardwoods, and also in methanol; 1.69% vs 2%.

..... Condensation and treatment of the pyroligneous liquor yields significant quantities of wood tar for which there is no useful market. The storage of this material can involve unfavourable environmental consequences.

The opinion of Dr. W. Hewertson, Head of CSIRO's Wood Technology Division was sought during planning the silicon project and he advised that no new development has given any encouragement for byproduct recovery at the scale envisaged for this project.

21 How visually obtrusive will the plant be from the nearest neighbour or road?

The height of the retorts means they may not be concealed from view from all aspects. However the substantial buffer area provided will be conducive to reasonable effectiveness of perimeter tree screens.

22 How will the evaporation dam be sealed?

See response to Question 12.

23 What landscaping will take place to improve the visual amenity of the area?

Detailed plans are not yet formulated. They will reflect the proponents intention to minimise any deterioration of the environment and where it is reasonably possible to do so, to effect improvements to its present state.

24 Is the Company aware of the local residents opinion of the project?

The local resident's attitudes were ascertained at a meeting with them on January 29th. There were a range of views expressed.

The principal one seemed to be that they realised the charcoal plant was part of an important export orientated project but they would prefer it sited elsewhere. That view is restricted to the closer neighbours. Other feedback from residents of surrounding areas has been uniformly supportive of the proposal.

25 Why is another site along the base of the scarp proposed for industry?

Choice of the site was dictated by factors other than its proximity to the base of the scarp, such as transportation advantages arising out of balancing log haulage and charcoal haulage distances; proximity to people and power sources and other environmental factors.

As indicated in the answer to question 17, the proponent has nevertheless sought to find an alternative which would be acceptable to everybody, or at least cause concern to fewer, but so far unsuccessfully.

26 What effect will the plant have on the fruit and nut orchards close to the plant?

The plant is not expected to have any detrimental effects whatever on adjoining fruit and nut orchards. Independent studies have shown that charcoal, when added to soil at the rate of around 400g/m^2 will significantly enhance both root and plant development. We therefore anticipate that local farmers may seek to acquire any surplus charcoal fines produced by the plant for addition to their orchards.

Carryover of airborne dust is not expected to be of a magnitude to cause any detrimental effects on plant or crop growth.

27 What plans have been made for decommissioning of the site?

None, but proponent is aware of the need to do so in due course, and will submit a proposal to the appropriate authority closer to the time when it can be predicted that industrial use will come to an end.

28 Has rail transport been considered as a means of transporting the charcoal to Wundowie?

Rail transport of charcoal was considered when looking at alternative sites for both charcoal and silicon production, where both the charcoal site and the silicon smelter site were adjacent to an existing railway line or siding.

With the smelter now located at Wundowie some 37 kilometres from the nearest railhead at Northam, transport of charcoal by rail/truck with the requirement for double handling was not considered economically feasible The unfavourable tonnage/volume factor of charcoal and the risk of creating fines by double handling are negative factors. However these matters are being discussed with Westrail in ascertaining the economics of rail haulage.

APPENDIX I

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March 17, 1987

Dr A. Tingay,
Maunsell & Partners Pty. Ltd.,
P.O. Box 7190,
Cloisters Square,
PERTH W.A. 6000

Dear Sir

AIR QUALITY ESTIMATES
WUNDOWIE SILICON PLANT

Further to our report (R333) on the revised air quality estimates for the proposed plant at Wundowie, below are comments on the 24 hour ground level concentrations.

The estimated peak 10 minute ground level concentrations correspond to low wind speeds. As can be seen from the wind speed and direction percentage occurrence matrices for Kalamunda and Northam given in appendix A of report R292, such wind speeds are prevalent during early winter mornings. Wind speeds less than 6 km hr^{-1} (1.7 m s^{-1}) occur for approximately 75% of the 0900 hr readings at Northam. Therefore, transient high ground level concentrations, particularly in winter, will occur due to mechanical downwash.

However, relating these high concentrations to a 24 hour standard is difficult. The quoted relation (Turner, 1970) is more appropriate to shorter sampling periods, say upto 1 hour, rather than 24 hours. Furthermore, such a relation assumes uniformity in wind speed and direction over the sampling period. This would not be the case for a typical winter's day at Wundowie and the quoted 24 hour peak concentration of 700 µg m^{-3} an be considered to be very conservative. However, with the limited meteorological data available for the area it is not possible to accurately predict how often the 24 hour standard will be exceeded.

Yours faithfully,
STEEDMAN LIMITED

Barbara Brown

BB:DJT:631

Notes on Air Quality Estimates

For a Proposed Silicon Plant

Wundowie, Western Australia

Addendum I

Prepared for

Maunsell & Partners Pty Ltd

Steedman Limited
February, 1987
Job No. AS631
Copy No. 2
Report No. R333

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February 19, 1987

Dr A. Tingay,
Maunsell & Partners Pty Ltd,
P.O. Box 7190,
Cloisters Square,
PERTH W.A. 6000

Dear Sir,

AIR QUALITY ESTIMATES
WUNDOWIE SILICON PLANT

Attached are our revised notes on the method of estimating the air quality from the proposed plant at Wundowie. This discussion supplements an earlier report R292, and should be read in conjunction with that report.

Following consultation with Ken Rayner of the Environment Protection Authority, the original emission scenario was altered to include downwash. The inclusion of downwash has resulted in higher ground level concentrations within the building wake, under low wind speed conditions the maximum 10 minute and 24 hour averaged ground level concentrations are 1625 and 700 $\mu gm\ m^{-3}$ respectively.

Should you require further information, please do not hesitate to contact us.

Yours faithfully,
STEEDMAN LIMITED

B. J. B—

Barbara Brown

BJB:KMS:AS631

TABLE OF CONTENTS

APPENDIX II

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23585
AT:JE

1st April, 1987.

Mr L. Walsh,
Agnew Clough Ltd.,
3rd Floor, 22 Mount Street,
PERTH WA 6000.

Dear Len,

WA SILICON PROJECT ERMP

Attached are my comments on the data provided in Burgman's paper on the distribution of *Regelia megacephala*. Having considered the paper carefully, I conclude that Burgman did not locate the population on the proposed quarry site, possibly because it had been burnt by a fire shortly before his visit. This means that the populations identified by him will not be affected by your proposal.

I have discussed this matter with Malcolm Trudgen who prepared the original botanical assessment for the ERMP and he accepts this interpretation also. Neither of us had the opportunity to visit the areas specified by Burgman, so our comments assume that his report and conclusions are accurate.

Yours sincerely,
MAUNSELL & PARTNERS PTY LTD

Alan Tingay

Dr A. Tingay

WESTERN AUSTRALIAN SILICON PROJECT ERMP

- Comments on the distribution and status of *Regelia megacephala* in the vicinity of the proposed quartzite quarry north of Moora.

Regelia megacephala is a geographically restricted plant which is apparently restricted to a relatively small area north of Moora. In this locality, it occurs on quartzite hills and part of the known population grows on the proposed quarry site.

It has been suggested that the species should be gazetted as rare or in need of special protection under provisions of the Wildlife Conservation Act because of its limited distribution and the fact that all known populations occur on private property.

The ERMP contains the statement that:

The total known population consists of approximately 24,250 plants of which about 8,000 occur on the quarry site. A further 6,700 occur on the same hill, but not within the impact area, and 5,750 on a similar hill to the south, but still on the Goonderoo property (Burgman 1983).

The report referred to (Burgman 1983) is unpublished and confidential. The proponents however, have now been supplied with a copy and this has enabled a review of the available information on the distribution of *R. megacephala*. It is now apparent that the quarry site referred to is not the small costeans in the area affected by the present proposal. Rather it is an old quarry established and operated by Westrail to the south on Location M574.

This interpretation is supported by the distribution map presented by Burgman and his supporting information relating to Locations M573 and M574. The relevant pages are attached to these comments. These data demonstrate that the plants on the proposed quarry probably represent an extension of Burgman's population No. 4 as they are on the same quartzite range. This population is separated by farmland from the main population (Burgman No. 1).

Burgman notes that Population 4 had been burnt and grazed and was only in fair condition at the time of his survey. It is possible that there was little evidence of the plants on the site of the proposed quarry due to the recent fire. Recent evidence of a subsequent fire and continued grazing pressure was also apparent in late 1985.

As a result of this re-assessment, it can be confidently concluded that the proposal will have less impact on the total *R. megacephala* population than was stated in the ERMP. It is apparent that:

- the total population is probably larger than Burgman's estimated 24,250 plants
- the populations identified by Burgman, including the highest quality stands, will not be affected by the proposal

This analysis does not alter the conclusions and commitments made in the ERMP with respect to management which are as follows:

The quarry plan has been designed to ensure minimum area disturbance to the chert hills to which *R. megacephala* is restricted. Advice from the Department of Conservation & Land Management will be sought on the best methods to protect and manage plants not directly on the quarry site. The proponents will erect fences to protect the adjacent populations.

The proposal therefore offers the potential of ensuring some protection for this restricted species and the vegetation of which it is a component. With present land use the long term status of this species is likely to deteriorate.

TAXON: Regelia megacephala

POPULATION NO: 1

SURVEY DATE: 23/11/82

LOCALITY:

Description: 12.2 km N of Moora on Geraldton Hwy, 0.5 km E of Hwy on track through quartz quarry.

Lat. and Long.: 30°32'S 116°03'E

Shire: Moora

Land Status: Private blocks M573, M574

HABITAT:

Soil: Quartz rock and gravel

Landform: W side of steep hills in quartz hill range

Vegetation: Open Low Woodland of Eucalyptus sp., Casuarina sp. Thicket and Dense Heath A and B of Regelia megacephala, Dryandra sessilis, Calothamnus quadrifidus, Melaleuca scabra, Casuarina campestris, Isopogon scabriusculus (?), Daviesia sp., Acacia sp., Daviesia quadrilatera, Baeckea sp., Hibbertia racemosa (?), Xanthorrhoea sp.

POPULATION DATA:

Area occupied: 200 m x 3.2 km (2.4 km N of quarry, 0.8 km S of quarry)

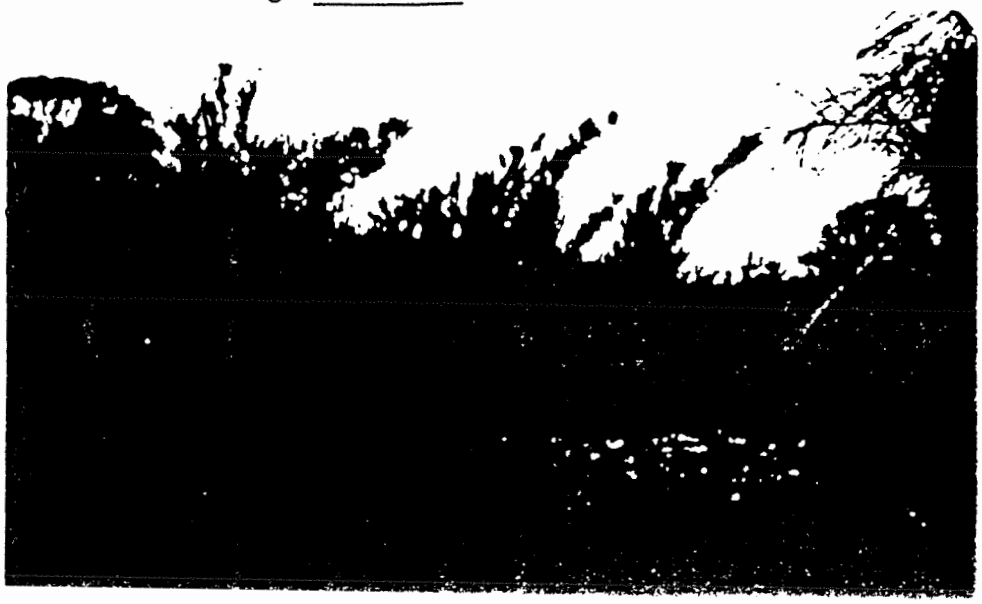
No. of plants: 14 700 (approx.)

Age structure: 50% <50cm, 20% <1 m, 25% <2.5 m, 5% with d.b.h. 1-3 cm.

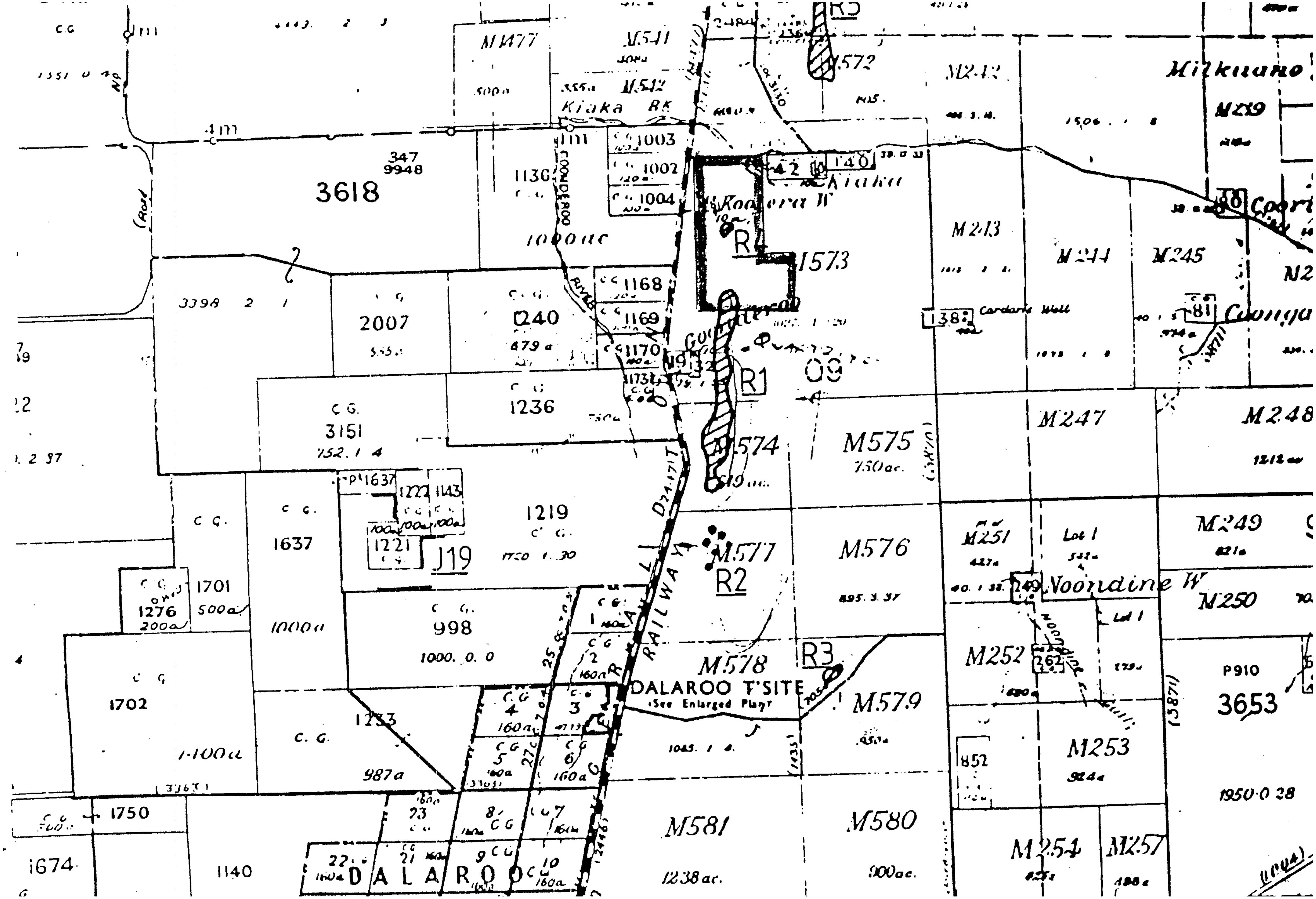
Condition: V. good

Reproductive Stage: In flower

Comments: Distribution of the population is ± continuous but patchy. Most dense stands are centred around the quarry. Stands occur on the W side of the range of hills and are restricted in places to stony outcrops. The largest stand (approx. 8 000 plants) occurs immediately S of the quarry, 300 m E of the Geraldton Hwy. Hills south of the quarry are crossed by survey lines and drill holes. Plants do not occur in Dense Heath or Thicket of Casuarina sp., in Eucalypt woodland or Low Forest in the immediate vicinity, or on the E side of the range. Seedlings are numerous on survey tracks cleared through Casuarina stands.



TAXON:	Regelia megacephala
POPULATION NO:	4
SURVEY DATE:	25/11/82
LOCALITY:	
Description:	14.3 km N of Moora, 1.3 km S of 'Kiaka' Rd., 0.6 km E of Geraldton Hwy.
Lat. and Long.:	30°31'S 116°03'E
Shire:	Moora
Land Status:	Private block M573
HABITAT:	
Soil:	Quartz rock and gravel
Landform:	Crown of hill at northern end of range
Vegetation:	Heath A and Thicket of Regelia megacephala, Dryandra sessilis, Leucopogon sp., Xanthorrhoea sp., Hibbertia racemosa, Casuarina sp.
POPULATION DATA:	
Area occupied:	11 000 m^2 (220 m x 50 m)
No. of plants:	2 050
Age structure:	10% <50 cm, 15% <1m, 65% <2.5 m, 10% with d.b.h. 1-3 cm.
Condition:	Fair (40% dead - evidence of fire and clearing)
Reproductive Stage:	Flower
Comments:	Recent fire and clearing has damaged 40% of the stand. 5% of these are regenerating. Population 4 occurs 500 m N of the N extent of Population 1, separated by a wheat field. Grazing of Regelia is evident in short, many stemmed seedlings. Grazing appears to suppress development of seedlings.



3618
347
9948
1130
1003
1002
1004
Kiaka Rk
M1477
M541
M542
M572
R5
M2.12
M239
M213
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1573
R1
R2
R3
R4
09
3398
2007
1240
1168
1169
1170
1236
3151
1219
1637
1221
1222
1143
J19
1701
1276
998
1702
1233
1750
1674
1140
DALAROO
DALAROO T'SITE
(See Enlarged Plan)
RAILWAY
P910
3653
1950·0·28
852
Noondine W
Cardarie Well
138
81
80
140
42
Goomalling
Coondero
12.38 ac.
900 ac.
750 ac.

APPENDIX II

RESPONSE FROM THE DEPARTMENT OF CONSERVATION AND LAND MANAGEMENT ON QUESTIONS ARISING FROM THE ERMP.

This Appendix contains information supplied by CALM on the issues raised in association with the forestry component of the project.

SUMMARY

The Department of Conservation and Land Management has reviewed all aspects of the Silicon Project in so far as they relate to the provision of jarrah timber for the production of charcoal.

The resource available to the proponent has been checked and the Department is satisfied there is no difficulty with the level of resource required, nor will the Project have any adverse implications for the sustained yield of the forest.

This review outlines the Department's plans for providing the firewood resource from logging which is largely integrated with the current logging programme for the sawmill industry. CALM has adequate field control procedures to ensure compliance with all environmental protection requirements.

The environmental impacts of the provision of the firewood resource have been evaluated and no serious adverse impacts have been identified.

The Project has the potential to bring important benefits for management of the northern jarrah forest, improving the efficiency of timber utilisation and thus extending the old growth resource, improving the efficiency of forest regeneration and improving forest productivity.

INTRODUCTION

This review has been produced in response to points of concern raised by the EPA about aspects of forest management as they relate to the Silicon Project.

The proponent has estimated the timber resources available for the project and has made an assessment of the environmental impacts of supplying the timber. This assessment was necessarily incomplete, since the administration of the procurement of the firewood resource and of the forest from which it comes, are the responsibility of the Department of Conservation and Land Management (CALM). The comments made in this review are intended to elaborate on certain aspects of the Project to assist the Environmental Protection Authority in making its recommendations to Government.

FOREST MANAGEMENT IN RELATION TO THE SILICON PROJECT

Department of Conservation and Land Management,
Western Australia

May 1987

OVERALL FOREST MANAGEMENT CONSIDERATIONS

The CALM Act sets out the overall objectives of forest management in Western Australia and requires the production of land management plans for all categories of land under the control of the Department. These plans set out the issues in each area and describe how CALM proposes to address them, together with management guidelines and policies currently in use. Accountability for field performance is the responsibility of the Operations Directorate of the Department.

The area of forest from which timber supplies will be drawn for the proposed charcoal production facility for the Silicon Project is covered by two CALM regional management plans - for the Northern Forest Region (1) and the Central Forest Region (2) - and by an overall State timber supply strategy (3). Draft copies of these documents are now available for public comment.

A feature of the jarrah forest is the large resource of timber which is below sawlog specification (see (3) Table 7) and which presents serious problems in forest management. Availability of a market for this poor quality material would have the effect of greatly facilitating efficient regeneration of cutover forest, of increasing the efficiency of utilisation of timber harvested and of increasing the growth rate of the forest as a whole. These points are elaborated upon later in this review.

The CALM Act also sets out a clear objective for the forest as a whole to be managed on a sustained yield basis. This is reflected in the forest management guidelines (4, P. 44), which state that the aim of management is to:

> "adjust the cut from the native forest progressively to a level consistent with the growth of the forest ....".

The sustainability of the timber yield from the forest is further considered under Resources, below, but sustainability can also be considered from the viewpoint of the maintenance of the jarrah forest ecosystem itself. This has been approached in two ways; reservation from felling of about 34% of the jarrah forest in secure reserves (3), and intensive, long-term research on forest management techniques to ensure the maintenance of the productivity of the forest.

The reserve system is one of the best and most comprehensive to be found anywhere in the world. As such it provides a complete range of reference sites against which any suspected changes can be evaluated.

With regard to research backing for forest management, the CALM publication Timber Production in Western Australia (3) lists no less than 177 references in the literature on the jarrah forest, and this list is by no means exhaustive. This research background is combined with an ongoing commitment to research by CALM.

There are, of course, some changes to the jarrah forest ecosystem clearly in progress where dieback disease has had a severe effect on the forests, and the bauxite mining industry is the cause of the conversion of about 350 ha a year to other eucalypt species. Apart from these changes, there is no evidence to suggest any past management actions have had a long-term adverse effect on the ecosystem as a whole.

FIREWOOD RESOURCES

The ERMP for the Western Australian Silicon Project (5) sets out (Tables 2.1 and 2.2) the estimated level of resources available to the industry.

The data quoted in the ERMP were taken from CALM records using appropriate conversion factors from cubic metres to tonnes. CALM carries out periodic broadscale Resource Level Inventories (RLI) over the jarrah forest, recording the volume of sawlogs, firewood and regrowth material by species. Although the inventory is based on a small sample of the forest, about 0.6% by area, the sample is statistically valid over the forest as a whole.

In addition to the RLI, Management Level Inventory (MLI) is carried out on individual logging coupes to provide more precise data for the rolling five-year logging plans. These rolling plans are updated annually. Actual volumes harvested are checked against predicted MLI yield to monitor accuracy of predictions, to control the overall level of the cut and to provide continual adjustment to utilisation factors.

The firewood resource data in the ERMP combine both MLI and RLI data to develop the summary given in Table 2.1. It has been of some concern to CALM that the RLI data are over 10 years old and did not assess the firewood resource according to a precise specification which related to the requirements given for the Silicon Project.

The firewood specification given in the ERMP is completely unrealistic. It has been made quite clear to representatives of the proponent that CALM will only sell for firewood that quality of material which cannot be used for a higher value end use. Under no circumstances could material which could be used for sawlogs be used for firewood. The pressure on the sawlog resource is so great none could be wasted in this way, nor can the Government forego the extra financial return from sawlogs.

On this basis the resource data given in the ERMP have been re-evaluated in the light of recent discussions and field inspections with the proponent. The results of this re-evaluation are presented in the attached Table 1, which shows that, even on the worst case scenario, there is adequate resource of firewood available for the life of the project in the Dwellingup and Harvey districts.

Table 1 Silicon Project Resource Statement

Total firewood resource estimated by proponent using CALM base data (a)	5,777,000 t
Less 10% likely to be usable as second grade sawlog (b)	577,700 t
Less 20% likely to be unusable by charcoal plant (c)	1,155,400 t
Net Available Firewood Resource	4,044,000 t
Total firewood requirement for life of project (ERMP, Page 24)	2,480,000 t

Notes:

(a) This is the quantity assessed as being below the current sawlog marketability standard in areas available for timber production in the Dwellingup and Harvey forest districts only. This amount does not include "trade waste", which is material in the crowns of felled trees normally not used, but which can be used for firewood.

Additional resources are - trade waste 827,000 t
- ex bauxite mining 375,000 t

(Source: ERMP P. 24 and P. 27)

(b) This estimate is based on experience with the woodchip industry in the karri forest. About 10% of the trees classed as not marketable for sawlogs, when felled and inspected, can be used for second grade sawlogs.

(c) This is a "guesstimate" based on inspections of trial lots of firewood logs by staff of the proponent. In a worst case scenario, if 40% of the total resource estimated by CALM were not acceptable to the charcoal plant, the resource would be reduced to 2,889,000 t.

CALM concern about the precision of the overall estimate of firewood resources has been allayed by current field checks which are showing (eg in Scott, Cameron and Kennedy blocks) that the original RLI figures are within 1 to 3% of the current MLI figures. The critical factor, as shown in Table 1, is what will be the lower limit of acceptability as a charcoal quality log.

In terms of the effect of the Silicon Project on sustained yield of the jarrah forest in the Dwellingup and Harvey districts, the situation is as follows:

Area available for timber production in the Dwellingup and Harvey forest districts (from (5), Table 2.1, plus forest in the 25 year mining envelope and all forest cut over 1970-86, which is excluded from that total)	232,000 ha (approx)
Estimated current annual increment (from estimates in Table 7 in (3))	255,000 m^3
Total allowable cut of sawlogs, poles etc	103,000 m^3/yr

Of the 100,000 t of firewood to be provided from these two districts (see harvesting plans below) about half will be from live (green) trees and half from dead trees (from (5), Table 2.1). On this basis, about 50,000 t or about 50,000 m^3 will come from green trees. In practice, the figure will be less than this due to the use of timber being cleared from bauxite mine pits and no more than 40,000 m^3 of additional green timber will be harvested for the project.

On these data, overall increment in the forest greatly exceeds the level of harvest, even with this project included. Further, most green trees to be harvested for the project will be old, overmature trees which are contributing very little indeed to the forest increment. Their removal is essential if the increment of the forest is to increase to the potential outlined in Table 7 of the Timber Production Strategy. Even a temporary localised overcut would be justified to achieve the increase in increment which is possible.

It is the presence of these unmarketable trees which has prevented efficient regeneration and achievement of maximum potential increment in all selection cut jarrah forest. Their removal would be a major advance in silviculture of the jarrah forest (8). For the first time in this area complete, rather than partial, regeneration of cutover forest will be possible.

These older, previously unmarketable, trees are the inevitable result of a selection cutting system where there was a market for only one main product - sawlogs. It is CALM's experience that the availability of a residue market enables a logging contractor to fell and evaluate virtually all trees nominated for removal. A percentage (averaging about 10%) of those trees will prove to be acceptable sawlogs, so, in this way, the Silicon Project would have a beneficial effect on the utilisation of the forest resource. It would actually increase the resource available to the sawmills operating in these two districts. This does not mean an increased rate of cutting, merely a larger resource.

It is important to note that the availability of a firewood market does not imply that all dead or defective trees will be felled. A significant proportion of dead trees and trees with hollow butts cannot be felled for safety reasons. There is also a continuing loss of trees in the jarrah forest due to dieback disease and to "natural causes".

In the Dwellingup and Harvey forest districts there are about 38,000 ha of high quality regrowth forest arising from intensive logging operations in the early part of this century. At present these forests are achieving little more than 1.1 m^3/ha/year increment due to severe overstocking. A programme of thinning these forests in the last three years has been constrained by the costs of the operation, which produces very small quantities of small sawlogs, posts and rails. Eventually, the charcoal plant will be partly supplied from this regrowth. The operation will then be self-financing and there will be a major expansion of the thinning programme. As a result of this thinning the annual increment will rise from 1.1 m^3/ha to 1.7 m^3/ha in these stands.

The potential to thin high quality regrowth forest would be major benefit to the forest from the Silicon Project, but this potential will not be realised for several years, due to the requirement to maximise the proportion of dry timber input for the first 6 years.

Page 28 of the ERMP states that there is a requirement for dry wood only to be supplied for the first 5 years, green firewood being supplied from year 6 onward. This is operationally quite impossible to achieve. CALM's proposals to meet the requirements of the charcoal production facility and of the silicon furnace at Wundowie are outlined below.

It has always been CALM's intention that supply of timber for the charcoal production facility would be integrated with other logging operations in order to achieve operational efficiency and economy, as well as maximum silvicultural benefit.

In practice, this means that existing logging operations in these districts, instead of supplying only sawlogs, poles and piles with some minor products, will now harvest dead trees and live, previously non-marketable, trees from the same logging coupes. Normally, the one contractor will be commissioned by CALM to remove all harvestable produce from a particular coupe. Allocation of logs to particular categories will be done according to specifications enforced by CALM field staff supervising the operation (see (6), Section 6). This document would, of course, be amended to include a firewood log specification if this Project proceeds.

As the resource obtainable from this operation will be only about 50% dry wood, the Project will require supplementation by a separate harvesting operation confined to areas of forest severely affected by dieback disease, where the majority of the yield would be dead trees.

The other requirement for 24,000 t per year of green firewood (ERMP, Page 28) for direct feed to the silicon furnaces at Wundowie could be obtained most economically from the thinning of high quality regrowth jarrah forest in the Mundaring area.

There would be thus four logging operations supplying timber to the proponent in the first instance, viz:

1. an integrated operation with logging for Yarloop mill,

2. an integrated operation with logging for Dwellingup mill,

3. a "pure" firewood operation in disease-affected forest (however this operation would throw up a few second grade sawlogs),

4. a regrowth thinning operation near Mundaring.

As soon as practicable, a regrowth thinning operation would be mounted in the Dwellingup or Harvey area.

IMPACT OF THE SILICON PROJECT ON THE FOREST

The proposed Silicon Project has a number of potential impacts on the forest in such areas as spread of dieback disease, export of nutrient capital, salinity of streams, increased soil erosion and adverse effects on flora, fauna and the ecology of the forest in general. These will be considered in turn.

(a) Dieback Disease

The planning and performance of all forest operations in the northern jarrah forest are dominated by the requirements for the prevention of further infections of the dieback disease due to the soil fungus Phytophthora cinnamomi. The requirements for protection of forest from the disease and for handling areas already infected are

spelt out in great detail in field operational manuals (6 and 7). All CALM staff involved in control of hardwood logging are required to have a sound knowledge of the biology and management of the disease, and there is also training of industry personnel as required. The latter is increasing in importance as staff constraints within CALM mean that responsibility for certain aspects of forest operations is being devolved onto industry.

The specifications for logging hygiene include strict requirements for mapping disease occurrence, evaluation of potential disease impact before logging and (in areas subject to the disease risk regulations) the use of a decision model to guide how or if an operation may take place.

In areas free of dieback disease logging is effectively excluded for the wet period of the year (4-6 months depending on seasonal conditions), so that all logging activity is concentrated in the summer months and stock-piles are accumulated to operate sawmills through the winter. However, in areas already affected by the disease, all year round logging is possible, provided strict rules for hygiene are adhered to, in order to prevent transport of infected soil out of the infected area.

The harvesting of firewood for the Silicon Project would be subject to the same stringent controls as are applied to all other timber harvesting activities. It has been made quite clear to the proponent in discussions with CALM staff, that the proposed industry will receive no concessions at all in this respect. On this basis the Project will not result in an increased potential for spread of the disease.

CALM also has a strong commitment to ongoing research on dieback disease. Most of the resources of the Dwellingup Research Station have been devoted to this problem for many years. The close ties between research and operational staff within CALM ensure that any significant new research results are promptly incorporated into field practice.

Current research covers biology of the fungus, evaluation of severity of disease expression on the wide range of sites encountered in the forest, means of mapping those sites, and monitoring of experimental logging trials. The results of the latter, reported in (9) provide a convincing vindication of the effectiveness of the procedures presently used.

(b) Export of Nutrients from the Forest

A possible long-term loss in forest productivity due to the export from the forest of the nutrients contained in the wood is often raised as an argument against intensive forest management. The argument has stimulated a great deal of research in Australia in the last 10 to 15 years, some of it in the jarrah forest.

Research published by Hingston et al from CSIRO (10) gives estimates of the available nutrient pool on typical jarrah forest sites and confirms what was already well known, that jarrah grows on extremely infertile sites. It is able to do this because it has low requirements for the essential nutrient elements and because it efficiently recycles what is available. These facts are confirmed by the low nutrient element content of the timber and is the very reason why jarrah charcoal is attractive for the production of high grade silicon metal - it contains very low levels of chemical "impurities". The proposed Silicon Project will therefore not have a significant effect on the nutrient capital of the forests.

The data obtained by Hingston et al are consistent with similar research by the same group in the karri forest and other workers studying nutrient recycling in Eastern States eucalypt forests. As a generalisation it can be said that there is a risk of progressive site depauperation with continual cropping on a short rotation of, say, 50 years. With a rotation of 100 years there is generally believed to be little risk of a significant reduction in soil fertility. In jarrah forest the physical rotation is 200 years or more, so there is adequate margin for error in this regard.

In any case, the question is a hypothetical one. Should at any time a decline in productivity due to nutrient removal be detected, it would be readily and economically corrected by the administration of the required nutrients in fertiliser.

(c) Stream Salinity

The environment of the northern jarrah forest, as a whole, is an area of widespread concern with respect to stream salinity. The area contains all the surface catchment areas feeding dams supplying the Metropolitan Area and is well known to be underlain, in part, by subsoil strata containing a large store of salt (11, 12). Concern over the possible adverse effects of bauxite mining in this area led to the initiation in the mid 1970's of a large amount of research on land use and stream salinity in this area (13, 14, 15).

There is now a very complete body of knowledge on regional trends in soil and stream salinity and a great deal is known about hydrological processes in the region (16). Using this knowledge we are now able to predict with reasonable precision the consequences of any significant change in land use.

The removal of dead standing trees or logs on the forest floor can have no possible influence on stream salinity. The removal of live trees could have an adverse effect only if all trees were removed, without regeneration, over large areas of the forest in the eastern zone (less than 1100 mm rainfall). This could not happen, since the prime silvicultural objective of the potential new market for residue logs is to improve the quality of the regeneration of the forest and to improve forest health and vigour. There are also forest management guidelines for the eastern zone of the forest, agreed upon with the Western Australian Water Authority, which ensure that the amount of forest left after a logging operation does not fall to a level which would disturb the hydrological balance.

A further safeguard is provided by the fact that the over-riding priority for forest management for all jarrah forest north of Collie is protection of catchment values. No operation can be permitted if it would compromise that objective. CALM maintains close consultation with the Western Australian Water Authority in catchment management matters and field operational prescriptions are under continual review.

Logging coupes are also widely dispersed over the forest. Normally only a small proportion of any catchment area is affected each year.

(d) Soil Erosion

Soil erosion control is covered in forest harvesting operations by prescriptions in operational manuals (6), where the logging contractor is obliged to install appropriate structures to contain erosion. Of more concern to CALM are the possibilities of soil damage through continuation of logging operations in excessively wet conditions. This is approached in two ways: ceasing harvesting operations, particularly log skidding into the bush landings, when soil damage exceeds certain levels (see (6) Section 5), and by requiring the contractor to carry out rehabilitation on soil damaged by logging and on log landings. The manuals also specify procedures to prevent entry of sediment into streams.

The proposed Silicon Project will be required to conform to all these specifications, consequently no additional erosion nor stream sedimentation will result.

(e) Impact on Flora and Fauna

The proposed increase in the harvest from the forest for the Silicon Project is unlikely to have any observable effect on the flora of the region. The increased intensity of logging due to a higher level of cut per hectare to remove trees previously left behind does offer the potential for more soil compaction, which could possibly adversely effect some species of flora. However, the gravelly and generally coarse-textured soils which predominate in the jarrah forest are less susceptible to compaction than most soil types.

The removal of more jarrah trees is also not expected to have a serious adverse effect on the quantity of jarrah nectar produced and hence an effect on the beekeeping industry. The trees to be removed will be dead, in poor health due to over maturity or come from dense regrowth stands. In the latter two cases the trees to be removed will be making little contribution to nectar production due to poor health or competition respectively. The more vigorous forest which will result from improved silvicultural treatment made possible by residue removal is likely to produce more nectar.

The effect of the proposed Project on fauna is more complex. As the provision of firewood for the charcoal production facility will largely utilise dead or defective standing trees and logs already on the ground, there will undoubtedly be a decline in the availability of nest sites for hole nesting fauna and of cover for fauna requiring logs on the ground. However, as noted previously, not all standing dead trees nor all trees with hollow butts can be felled. Further, a proportion of the logs on the ground, mainly the older ones, will be too rotten or too heavily attacked by termites to be worth using for firewood.

The jarrah forest - because of the incidence of wildfire and jarrah dieback - has large numbers of dead and defective trees. It also has a large quantity of material on the ground - logs, crowns and stumps remaining from past logging operations. This means that the number of nest holes and log habitats is greatly in excess of that which would have been present in the "natural forest". This together with the fact that not all nest hole and log habitats will be removed would ensure that the project would not have a significant impact on fauna.

The larger fauna will not be affected by the project as they have coped very well with a much larger timber industry in the past than exists today, although there are only observational data to support this contention.

More quantitative data are available from recent research on bird habits in the jarrah forest. Abbott and van Heurck (17) studied the bird population in jarrah and yarri (E. patens) forest in unlogged forest and in forest where half the trees had been removed. They found the number of bird species and total bird populations were similar in both areas, suggesting that most bird species will tolerate a high level of disturbance in the forest. Other work by the same authors (18) suggests that some foraging bird species may be disadvantaged by thinning in regrowth stands. However, this must be kept in perspective. Only a small proportion of the jarrah forest in the region will be affected by logging in any period of, say, 3 years. Further, by dispersing the logging coupes, in a manner similar to that used in the karri forest, any detrimental effect can be minimised.

It should also be remembered the silicon project will not utilise marri trees, which are a significant component of the northern jarrah forest. Old marri provide, in fact, better hole nest sites than jarrah. For example, they tend to be the preferred nest trees for possums.

The intention of the proponent to fund a research project to examine these aspects is welcome. If the project is undertaken within the CALM research organisation, any worthwhile results can be rapidly incorporated into field practice. No problems are foreseen if it becomes necessary to exclude from logging particular trees which have obvious high value as nest sites, so long as no more than two or three trees per hectare are involved.

MONITORING IMPACTS OF THE PROJECT

A high degree of monitoring of the impacts of the Project would take place as a matter of course during existing procedures. As mentioned above, the resource estimates for each logging coupe are checked against actual yield for each product and the progressive yield of each (first grade sawlog, second grade log, pole, pile etc) is checked against the buyer of the product to ensure accurate rendering of accounts for royalty payment and progressive monitoring of the yield against the allowable cut and supply contracts.

In the field, there is daily supervision of logging procedures by CALM field staff, who take prompt corrective action should any environmental problems arise - whether in respect of disease hygiene, soil erosion, soil damage, sediment discharge into streams etc. In this context it is very important that the logging contractor be employed by CALM and not by the proponent of this project. In this way the forest manager has complete control over all operations in the forest.

No special monitoring of stream salinity is planned following logging which includes firewood procurement for the Silicon Project. Research trials which have been under way for several years using the same silvicultural regime which would be followed if the Project is approved, will provide an early warning of any problems in this regard. However, the accumulated weight of evidence from much recent research on the hydrology of the jarrah forest indicates any adverse effect on stream salinity is a remote possibility indeed. This is particularly so where it is considered in the light of the wide dispersion of logging coupes which is the normal practice.

Monitoring fauna impacts is more difficult. The postgraduate study to be funded by the proponent will be of assistance in this regard and any useful results will be immediately incorporated into field practice.

CONCLUSIONS

The Department of Conservation and Land Management has thoroughly reviewed all aspects of the proposal to harvest jarrah for the production of charcoal for the Silicon Project. It is satisfied that there will be no difficulty in availability of timber resource for the Project, although there are currently unresolved questions relating to the precise specification for timber to be supplied to the charcoal production facility and to the arrangements for logging contracts. However, these are in the process of being resolved.

No significant adverse environmental impacts of the Project are foreseen in respect of its impacts on the forest. CALM is also confident that its 10 years of experience with a residue-using industry in southern forests will enable it to control the new industry successfully.

The Project will also have important beneficial effects on forest management in the northern jarrah forest, improving the efficiency of timber utilisation, improving the efficiency of forest regeneration and improving forest productivity.

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APPENDIX III

List of persons or agencies which have submitted comments on the ERMP to the EPA:

Shire of Moora (including 2 letters and 1 submission)
Government Chemical Laboratories
R Frayne
D Zlatnik
L Doust
P Gardiner
Department of Agriculture - Animal Production Branch Apiculture Section
Dwellingup Greenbelt Committee
L & N Rosenthal
Shire of Mundaring
Department of Industrial Development
Shire of Murray (including 3 letters)
L Newton
WA Water Authority
Institute of Foresters
Mallesons Stephen Jaques for Owston and Comserve
Shire of Moora (follow up letter)
W Gliddon
P Miller
Minister for Health and Lands
D McCorkill
J Lavis
H Tonkin
Australian Conservation Foundation - R Humphries
R & L Salter
S Jones
M Burkett
S Pedler
EPA Pollution Control Division
G Olsen and L Vickery
Department of Agriculture - Director of Agriculture
W Kaeding
Campaign to Save Native Forests (WA)
The Tree Society
Conservation Council of WA Inc
South-West Forests Defence Foundation Inc
Department of Mines - Geological Survey
M Dawson
WA Museum
Dwellingup Branch of the Australian Labor Party
Main Roads Department
Department of Occupational Health, Safety and Welfare

APPENDIX IV

LETTER FROM CALM CONCERNING THE CHARCOAL PRODUCTION SITE

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ENVIRONMENTAL PROTECTION AUTHORITY

LOCATION OF THE PROPOSED CHARCOAL PRODUCTION FACILITY

During discussions between representatives of the proponent of the Silicon Project and the Department of Conservation and Land Management the matter of the location of the charcoal production facility received much attention.

Once the resource area had been decided as the Dwellingup and Harvey forest districts the charcoal facility was to have been located as close as possible to the resource area to minimise log hauling costs.

Consideration was given to locations in the east or the west of the resource area. The eastern location, on private property east of the forest zone was seriously considered. However it was eventually discarded due to excessive charcoal haulage costs on the existing road system. There were also some difficulties with provision of electricity, infrastructure and labour.

On the western side of the forest, a location in the vicinity of Del Park was considered. Electricity supply was easy and Pinjarra provided the necessary infra-structure. It was very close to the northern half of the resource area, but there were long firewood haulage distances caused by the existing road pattern and by the South Dandalup Dam. Also, the southern half of the resource - all that south of the Murray River, would have to cross the river at Nanga Bridge. The extra road haulage from the Harvey area down to the coastal plain and back up the Scarp again to Del Park was an unacceptable economic burden. Also, the entire logging traffic would have to pass through the centre of Dwellingup.

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After much consideration the option of bringing the timber through the Lane Poole reserve at the Nanga Bridge was discarded. The reserve as a whole and especially the zone around the Nanga Bridge receive very heavy usage by recreating public, mainly on weekends and in school holidays, and during the week by school parties. The school camp facilities around this area are fully booked years ahead. At any one time there are normally over 100 students and staff moving around the vicinity of the Bridge. There is only one road which can be used to cross the River at this point and the combination of 20-odd truck movements a day and several school bus movements was judged to be too dangerous a mixture, considering the tortuous nature of the road. There is an even more hazardous situation on weekends and school holidays, when up to 10,000 people have visited the area on one day. Since logging contractors haul logs seven days a week from November to April while accumulating winter stockpiles, the road hazards would be extreme.

A coastal plain location part way between Dwellingup and Harvey seemed to offer great improvements in road safety and easy access to labour and infrastructure. Log supplies from the south would be forced to come straight down the Scarp near Waroona or Yarloop and then proceed along the coastal plain. It had the disadvantage that about half the log trucks would still have to pass through Dwellingup township. However, this would have happened anyway with the Del Park location.

Although this was recognized as undesirable, the extra 15-20 truck movements a day through Dwellingup was recognized as the lesser of the two evils. The local population are used to log truck traffic, unlike the city drivers who constitute about 90% of the visitors to the Lane Poole reserve (source: Visitor survey by Department of Youth, Sport and Recreation 1984). These visitors will still encounter the log trucks on the Dwellingup-Pinjarra road, but at least the road is bitumenised and is of adequate width.

From these considerations, a number of sites in the Coolup area were examined. At the time of writing there is still some doubt as to the precise location of the facility as land purchase negotiations were not finalised.

It should be noted that no trucks will pass through the main Pinjarra townsite. Trucks carrying charcoal only will come down the Dwellingup-Pinjarra road along the northern edge of the town and go north along the South West Highway.

Syd Shea
EXECUTIVE DIRECTOR

8 May 1987