Mineral sands mine, Dardanup

ISK Minerals Pty Ltd

Report and recommendations
of the Environmental Protection Authority

Environmental Protection Authority
Perth, Western Australia
Bulletin 605
December 1991

The purpose of the report

This report contains the Environmental Protection Authority's environmental assessment and recommendations to the Minister for the Environment on the environmental acceptability of the proposal.

Immediately following the release of the report there is a 14-day period when anyone may appeal to the Minister against the Environmental Protection Authority's recommendations.

After the appeal period, and determination of any appeals, the Minister consults with the other relevant ministers and agencies and then decides whether the proposal may or may not proceed. The Minister also states the legally binding environmental conditions which might apply to any approval.

Appeals

If you disagree with any of the assessment report recommendations you may appeal in writing to the Minister for the Environment outlining the environmental reasons for your concern and enclosing the appeal fee of $10.

It is important that you clearly indicate the part of the report you disagree with and the reasons for your concern so that the grounds of your appeal can be properly considered by the Minister for the Environment.

Address

Hon Minister for the Environment
18th Floor, Allendale Square
77 St George's Terrace
PERTH WA 6000

Closing date

Your appeal (with the $10 fee) must reach the Minister's office no later than 5.00pm on 24 December, 1991.

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Contents

Figure

Appendices

The Environmental Protection Authority, on advice from the Department of Agriculture and the Water Authority, considers that the proponent could adequately manage the impact of its proposal on surface water. The Environmental Protection Authority has recommended that a surface water management programme be established to ensure that the levels and the quality of surface water in the area are not adversely affected by the proposal (Recommendation 2).

- **Groundwater**

Groundwater management is a main concern due to the proposal's possible impact on water tables and salinity problems in the Waterloo area about 6 kilometres west of the proposed site. Maintenance of groundwater levels is especially important during the dry summer season when neighbouring properties rely heavily upon their bores for water supply.

The results of previous hydrogeological and technical studies conducted for the Water Authority of Western Australia have been incorporated into the modelling for this mining proposal. Results of the model indicate the effect on groundwater is expected to influence areas within about 500 metres of the mine. Therefore, it is predicted that the proposed mine would not affect groundwater levels or salinity problems in areas remote from the minesite. The proponent has detailed procedures to manage impacts on groundwater including commitments to:

- consult with landowners and relevant government departments to ensure that operations at Dardanup do not unreasonably affect agricultural enterprises in neighbouring properties, especially in relation to surface and groundwater;
- continue hydrogeological and technical studies, including regional monitoring of water bores, to facilitate pre-emptive prediction of impacts of mine dewatering on local and regional hydrology; and
- licence all bores and other water supply and water management facilities in accordance with the requirements of the relevant legislation.

Upon advice from the Water Authority of Western Australia, the Environmental Protection Authority considers that the proposal would not significantly affect groundwater levels. The Environmental Protection Authority has recommended that a groundwater management programme be established for the purpose of mitigating any impacts on the area's groundwater regime. (Recommendation 2).

- **Rehabilitation**

Rehabilitation is a central issue of the proposal and is tied to the end use of the minesite. The proponent intends on rehabilitating the mined land to maintain the existing agricultural productivity. This would include ensuring the rehabilitated land has the capacity to transmit water at rates to manage potential flooding.

Progressive rehabilitation would occur as each mining stage was completed. The rehabilitation plans include the proponent's commitments to:

- ensure that backfilled mine areas have the capacity to transmit water from east to west in a fashion similar to that which currently occurs;
- rehabilitate land disturbed by mining activities to restore agricultural productivity to levels at least equal to those which currently exist;
- consult with the Department of Agriculture, the Water Authority of Western Australia and landowners to include native vegetation in rehabilitation strategies; and
- minimise clearing and land disturbance, consistent with safe and efficient operations.

The Environmental Protection Authority, on advice from the Department of Agriculture considers that the proponent has adequately addressed rehabilitation requirements. The Environmental Protection Authority has recommended that a rehabilitation programme be established to ensure that the mined land was progressively restored to an environmentally stable condition (Recommendation 3). The actual final land use is the prerogative of the land owner.

- **Transport and noise impacts**

  Transport and noise impacts on nearby residents are an issue as the proposed mine site is in a rural area and in close proximity to a number of residences.

  The proposed transport route for heavy mineral concentrate is regarded as the least disruptive option as there are no residences along the route. The increased traffic on the South West Highway due to transport of heavy mineral concentrate and the increased traffic on the local roads due to work force and operating supplies transport would be insignificant.

  The noise from the operations would be managed by:

  - strategically locating and designing facilities; and
  - liaising with landowners.

  The Environmental Protection Authority considers that the proponent's noise and transport mitigation measures would ensure these impacts on nearby residents are acceptable. The Environmental Protection Authority has recommended noise limits to protect residents from the impacts of the proposed mining operation (Recommendation 4) and will set details of the measurement of noise levels in the works approval and licence for the proposed mine under Part V of the Environmental Protection Act.

- **Dust levels**

  Dust emissions from materials handling operations, stockpiles, open areas and transport activities are a key issue, particularly during summer when strong easterly winds occur.

  The Environmental Protection Authority notes that the proponent would implement management procedures which would minimise dust emissions including commitments to:

  - restrict clearing to the minimum area required for safe and efficient operations;
  - vegetate stockpiles and other exposed non-traffic areas;
  - ensure the solar-dried clay tailings ponds are kept sufficiently wet; and
  - use watering and other methods of control of fugitive dust from traffic areas, for example speed restrictions and the use of binding agents are techniques commonly used in the mining industry as adjuncts to watering.

  The Environmental Protection Authority considers that the proponent's dust mitigation measures should ensure the impacts on nearby residents are acceptable. The Environmental Protection Authority will also set air quality levels in the works approval and licence under Part V of the Environmental Protection Act to protect residents from the impacts of the proposed mining operation.

Other environmental issues considered during the assessment of the proposal were related to:

- **Aesthetics**

  The visual impact of the mine site needs to be considered due to its location on the lower foothills of the Darling Scarp and the rural nature of the area.

  The Environmental Protection Authority notes that the proponent would implement management procedures that would minimise visual impacts of the operations including commitments to:

  - restricting the size of operational areas to the minimum required the safe and efficient operation;
  - maintaining vegetation where it shields mining operations from view from both public and private areas;
  - establishing vegetation on areas, including stockpiles, to shield operations from view; and
  - selective location of stockpiles.

The Environmental Protection Authority considers that the proponent would satisfactorily manage the visual impacts for the purpose of minimising the mine's visual disturbance to nearby residents and tourists.

- **Flora and fauna**

  Clearing for agricultural use has removed most of the native vegetation in the area. Remnant native vegetation exists along roads and in small pockets for shelter for stock. Thus the area offers only restricted habitats for native fauna.

  The proponent has made commitments to:

  - preserve remnant vegetation where practicable; and
  - enrich and establish native vegetation alongside existing permanent public roads and roads developed or disturbed as a result of project activities.

  The Environmental Protection Authority concludes that the proponent would adequately manage this issue to ensure the impacts on the flora and fauna are mitigated.

- **Community issues**

  The proposal would mean a change to the local community, which has been a farming area for generations. The proponent has recognised the need to become active in community development and would continue its programme of community consultation.

  The proponent has made appropriate commitments.

  The Environmental Protection Authority believes community issues can be best managed through interaction and cooperation between the community and the proponent.

Upon consideration of the Consultative Environmental Review document, the issues raised in submissions and the proponent's response to those issues the Environmental Protection Authority has concluded that the proposal would be environmentally acceptable, subject to the following recommendations:

Recommendation 1

The Environmental Protection Authority concludes that the proposal by ISK Minerals Pty Ltd to mine the Dardanup site as described in the Consultative Environmental Review is environmentally acceptable.

In reaching this conclusion the Environmental Protection Authority identified the main environmental factors requiring detailed consideration as:

- **surface and groundwater management;**
- **rehabilitation of the mine site; and**
- **impacts associated with dust and noise.**

Accordingly, the Environmental Protection Authority recommends that the proposal could proceed subject to:

- **the Environmental Protection Authority's recommendations in this report; and**
- **the proponent's commitments which appear in Appendix 1.**

Recommendation 2

The Environmental Protection Authority recommends that prior to mining the proponent should prepare an Environmental Management Programme to monitor and manage surface water and groundwater quality in the mining area to the satisfaction of the Environmental Protection Authority, on the advice from the Water Authority of Western Australia. The Environmental

Management Programme should include but not necessarily be limited to the proponent's commitments for monitoring and reporting and strategies to be implemented in the event of a deterioration of water quality in the monitored areas.

Recommendation 3

The Environmental Protection Authority, noting that the final land use after mining would be determined between the land owners and the proponent, recommends that the mine site should be rehabilitated to an environmentally stable condition. Accordingly, prior to commencing mining, the proponent should develop a rehabilitation plan in consultation with the land owners and the Department of Agriculture, in order to progressively rehabilitate the land to the satisfaction of the Environmental Protection Authority.

Recommendation 4

The Environmental Protection Authority recommends that the proponent be required to ensure that the introduced noise from the project does not cause the noise in the surrounding residential areas to exceed:

- 50dB(A) from 7am to 7pm Monday to Saturday;
- 45dB(A) on Sunday and from 7pm to 10pm Monday to Saturday; and
- 40dB(A) from 10pm to 7am every day.

These levels should not be viewed as normal operating levels for the project. They are the upper limits above which action will be taken by the Environmental Protection Authority. The Environmental Protection Authority considers that noise below these levels is not unreasonable provided it does not include tonal components, impulses or other intrusive characteristics.

1. Introduction

The Environmental Protection Authority has assessed a proposal by ISK Minerals Pty Ltd to mine a deposit of mineral sands at Dardanup, approximately 15 kilometres east of Bunbury. (Figure 1).

The proposal was referred to the Environmental Protection Authority in July 1991 and assessed at the Consultative Environmental Review level, recognising the environmentally significant issues of the proposal and public interest in mineral sands mining.

The Consultative Environmental Review was submitted for the proposal and has undergone a four week public review period, which finished on 28 October 1991.

2. The proposal

The proponent currently operates a mineral sands mine and concentrating facility at Waroona and a dry separation plant at Picton, near Bunbury. The proposed mining operation at Dardanup would progressively replace the Waroona mine.

Minerals from the proposed mine would increase the supply to the Picton dry separation plant and would enable the proponent to expand its activities. In the medium to long term the proponent plans to establish production facilities for synthetic rutile and, ultimately, titanium dioxide pigment. These further developments would require referral to the Environmental Protection Authority if and when they are proposed.

The orebody proposed for mining as part of this project is located between Burekup and Dardanup, on the lower foothills of the Darling Scarp east of Bunbury.

The Dardanup heavy mineral sand resource is a low grade deposit and covers an area approximately 5 kilometres in length and 0.5-1.5 kilometres in width. Mineralisation is confined to a medium to light grey, fine to medium grained clayey sand layer which averages approximately 5.5 metres in thickness. The mineralised zone is at the surface in the northern part of the resource but may be covered by as much as 9 metres of overburden in some areas to the south.

The expected life of the Dardanup operation is at least 10 years. The proponent seeks to mine approximately 40 hectares per year yielding 200 000 tonnes per annum of heavy mineral concentrate. Rehabilitation would occur progressively as the mining proceeds.

Mining methods at Dardanup would be carried out by either sluice mining or dry mining. Whichever option is chosen, a combination of thickened clay tailings, solar-dried clay tailings, sand tailings and overburden would be returned to the mined out areas to ensure the condition of the soil is optimised.

Primary separation of the ore would occur on-site. Oversize material would be removed and the ore then separated from the tailings in a semi-mobile concentrator prior to transport.

The heavy minerals concentrate would be transported by road to the existing Picton plant. The transport route would be along the road called Dowdell's Line, which would be extended from its existing alignment along a gazetted easement, to South West Highway and thence to Picton. The Picton plant's facilities would be expanded to accommodate the increased throughput of heavy minerals concentrate.

Water for mining operations would be provided from water progressively removed from the mining area prior to mining and supplemented as necessary by pumping from deep bores. Streams crossing the mine area would at times be diverted as part of mine dewatering operations. Local groundwater levels up to 500 metres away could be affected by the mine dewatering process.

Water storage dams would occupy an area of 2-5 hectares to the east of the orebody. Ponds used to solar-dry the clay tailings would occupy an estimated 80 hectares, again to the east of

the orebody. The clay tailings would be kept at a level of dampness to mitigate potential dust problems.

Water management studies show water supply and demand is close to balance, on an annual basis. On a seasonal basis there is an excess in winter and a small deficiency in summer. This excess water would be diverted to the existing irrigation channel which runs through the mine area and ultimately joins the Collie River.

The infrastructure requirements of power supply, construction workers, labour force and operating supplies are readily available. An existing 22kV agricultural electricity supply line is within 1 kilometre of the proposed mine site but would need upgrading in order to supply the mine site. The estimated peak on-site construction work force and the operations labour force is expected to be supplied from and accommodated in Bunbury and the local environs. The work force and operating supplies are expected to normally access the mine site via the South West Highway and Harris Road.

Areas disturbed by mining and its supporting infrastructure would be progressively rehabilitated with the aim of returning agricultural productivity to levels at least equal to those which currently exist.

3. Existing environment

The project area is located on the Pinjarra Plain which is part of the Swan Coastal Plain. The Pinjarra Plain is an alluvial feature, (made of soil or sands left by rivers or floods) soils are sandy and clayey. Mineral sands have been deposited by changing sea levels over the last 200 million years.

The area has been highly modified to support the present land use of agricultural production. Drainage ditches have been constructed as part of the agricultural development of the area, to enhance surface water removal during wet winters. Drainage is into the Leschenault Inlet, with some small ephemeral streams also connected into the artificial drainage system.

Groundwater flow is generally westward. Groundwater in the project area has a lower salinity than those areas further to the west such as the Waterloo area.

Clearing for agricultural use has removed most of the native vegetation in the area. Remnant native vegetation exists along roads and in small pockets for shelter for stock. Thus the area offers only restricted habitats for native fauna

No Aboriginal or European heritage sites have been identified on the proposed mine site. A survey was conducted for unrecorded Aboriginal sites. However none were found.

4. Environmental impacts and their management

Following a review of the environmental aspects of the proposal and taking into account submissions from the public and government agencies, the Environmental Protection Authority concludes that the proposal would be environmentally acceptable, subject to a number of conditions as discussed in the following sections of this report.

Recommendation 1

The Environmental Protection Authority concludes that the proposal by ISK Minerals Pty Ltd to mine the Dardanup site as described in the Consultative Environmental Review is environmentally acceptable.

In reaching this conclusion the Environmental Protection Authority identified the main environmental factors requiring detailed consideration as:

- **surface and groundwater management;**
- **rehabilitation of the mine site; and**

- **impacts associated with dust and noise.**

Accordingly, the Environmental Protection Authority recommends that the proposal could proceed subject to:

- **the Environmental Protection Authority's recommendations in this report; and**
- **the proponent's commitments which appear in Appendix 1.**

4.1 Surface water

Surface water level is a key issue as the agricultural enterprises in neighbouring properties depend on the water supply. Drains, irrigation channels, streams and bores manage winter floods and low summer water levels. Disruption to this system could significantly affect existing land uses.

On a regional scale, impacts of the proposal on surface waters are expected to be negligible. Only a small amount of water is likely to be directed from the proposed mine during the winter to existing water courses and thence to the Leschenault Inlet; this water would have low salinity, no chemical additions and very low turbidity. The existing drainage system could manage the additional volume of water from the proposed mining operations.

The volume of water leaving the proposed Dardanup mine is an extremely small flow. In the worst case, this amount of water would be increased to approximately 475 ML per annum. Based upon the scenario of disposal of excess water as described in the Consultative Environmental Review this amount of water would constitute approximately 1.7% of the capacity of the drain, which transmits at least 186 ML per day (data provided by the Water Authority).

Turbidity could be managed in waters leaving the proposed mine. Management of turbidity has been identified as being manageable by use of erosion control strategies and settling ponds developed and operated in consultation with the Water Authority and other government instrumentalities. The Water Authority has agreed that consultations will take place to determine and establish appropriate standards for water turbidity.

The issue of surface water levels and quality as discussed in the proposal's description (section 4.3.1; CER), the proponent's commitments (1, 2, 3, 4 & 9; Appendix 1) and the proponent's response to submissions (sections 4.1, 4.5, 4.7, 5.1; Appendix 2), specifically address the issue of surface water levels and quality.

The Environmental Protection Authority, on advice from the Department of Agriculture and the Water Authority, considers that the proponent could adequately manage the impact of its proposal on surface water. The Environmental Protection Authority has recommended that a surface water management programme be established to ensure that the levels and the quality of surface water in the area are not adversely affected by the proposal (Recommendation 2).

4.2 Groundwater

Groundwater management is a main concern due to the proposal's possible impact on water tables and salinity problems in the Waterloo area about 6 kilometres west of the proposed site. Maintenance of groundwater levels is especially important during the dry summer season when neighbouring properties rely heavily upon their bores for water supply.

The results of previous hydrogeological and technical studies conducted for the Water Authority have been incorporated into the modelling for this mining proposal. Results of the model indicate the effect on groundwater is expected to influence areas within about 500 metres of the mine. Therefore, it is predicted that the proposed mine would not affect groundwater levels or salinity problems in areas remote from the minesite.

Notwithstanding the low probability of effects several kilometres from the mine, ISK Minerals is currently consulting with the Water Authority, the Department of Mines and the Department

of Agriculture to ensure that the groundwater monitoring regime to be developed would include areas remote from the mine.

The issue of groundwater level, as discussed in the proposal's description (section 4.3.2; CER), the proponent's commitments (1, 2 & 9; Appendix 1) and the proponent's response to submissions (sections 4.3, Appendix 2), specifically address the issue of groundwater level.

Upon advice from the Water Authority of Western Australia, the Environmental Protection Authority considers that the proposal would not significantly affect groundwater. The Environmental Protection Authority has recommended that a groundwater management programme be established for the purpose of mitigating impacts on the area's groundwater regime.

Recommendation 2

The Environmental Protection Authority recommends that prior to mining the proponent should prepare an Environmental Management Programme to monitor and manage surface and ground water in the mining area to the satisfaction of the Environmental Protection Authority, on the advice from the Water Authority of Western Australia. The Environmental Management Programme should include but not necessarily be limited to the proponent's commitments for monitoring and reporting and strategies to be implemented in the event of a deterioration of water quality in the monitored areas.

4.3 Rehabilitation

The Dardanup deposit is located on private, agricultural land used primarily for grazing purposes. Rehabilitation of the proposed mine site is an important issue as it is an area of highly productive dairy farms.

The objective of rehabilitation at this site is to return the mined area to agricultural production with a productivity at least the equal of that existing prior to mining. In this regard an important consideration is the ability of the soil to allow horizontal water movement. The proponent is committed to ensure that post-mining water movement will avoid potential flooding. Rehabilitation would be progressive following each stage of mining.

The proposal's description (section 2.1.5; CER), the proponent's commitments (5, 6, 8 and 11, Appendix 1) and the proponent's response to the submissions (sections 5.4, 5.6 and 6.8; Appendix 2) describe the proponent's rehabilitation plans. These plans include the proponent's commitments to:

- ensure that backfilled mine areas have the capacity to transmit water from east to west in a fashion similar to that which currently occurs;
- rehabilitate land disturbed by mining activities to restore agricultural productivity to levels at least equal to those which currently exist;
- consult with the Department of Agriculture, the Water Authority of Western Australia and landowners to include native vegetation in rehabilitation strategies; and
- minimise clearing and land disturbance, consistent with safe and efficient operations.

The Environmental Protection Authority, on advice from the Department of Agriculture considers that the proponent has adequately addressed rehabilitation requirements. The Environmental Protection Authority has recommended that a rehabilitation programme be established to ensure that the mined land was progressively restored to an environmentally stable condition.

Recommendation 3

The Environmental Protection Authority, noting that the final land use after mining would be determined between the land owners and the proponent, recommends that the mine site should be rehabilitated to an environmentally stable condition. Accordingly, prior to commencing mining, the proponent should develop a rehabilitation plan in consultation with the land owners and the Department of Agriculture, in order to progressively rehabilitate the land to the satisfaction of the Environmental Protection Authority.

4.4 Transport and noise impacts

Transport and noise impacts on nearby residents are an issue as the proposed mine site is in a rural area and in close proximity to a number of residences.

Employees would use private vehicles to travel to work, the routes used would depend on residential location. With three shifts operating, and with car-pooling likely to occur, light vehicle movements are likely to be no more than six or seven at each shift change.

With regard to the use of roads by dairy herds, it is considered that existing arrangements should be able to be continued. The permanent increase in traffic as a result of the mine will be small so that dairying operations should be substantially unaffected.

Should traffic problems develop, ISK Minerals will consult with the Shire of Dardanup and other relevant parties to develop appropriate management programmes.

Some heavy traffic may use other routes during construction, but the effects will be small and temporary - a small construction operation and a short construction period are anticipated.

The transport of heavy mineral concentrate from the mine to the processing plant involves the construction of a new section of road along Dowdell's Line. The selection of this route was heavily influenced by the views of the local community. Although other routes were seen to offer advantages (eg. upgrading Harris Road which is in need of improvement) each route increased trucking past houses which was likely to cause disturbance.

In response to community concerns the proponent will construct the new section of road without making it continuous with the existing road (to avoid traffic problems further down the road).

The noise from the operations would be managed by:

- strategically locating and designing facilities; and
- liaising with landowners.

In developing these strategies for noise level control, ISK Minerals proposes to use successful strategies developed from the Waroona minesite.

Mitigation of transport and noise impacts on nearby residents is discussed in the proposal's description (sections 4.2 &4.5; CER) and the proponent's response to submissions (sections 6.5.1 & 6.7; Appendix 2).

The Environmental Protection Authority considers that the proponent's transport and noise mitigation measures would ensure these impacts on nearby residents are acceptable. The Environmental Protection Authority has recommended noise limits to protect residents from the impacts of the proposed mining operation (Recommendation 4) and will set details of the measurement of noise levels in the works approval and licence issued under Part V of the Environmental Protection Act.

Recommendation 4

The Environmental Protection Authority recommends that the proponent be required to ensure that the introduced noise from the project does not cause the noise in the surrounding residential areas to exceed:

- **50dB(A) from 7am to 7pm Monday to Saturday;**
- **45dB(A) on Sunday and from 7pm to 10pm Monday to Saturday; and**
- **40dB(A) from 10pm to 7am every day.**

These levels should not be viewed as normal operating levels for the project. They are the upper limits above which action will be taken by the Environmental Protection Authority. The Environmental Protection Authority considers that noise below these levels is not unreasonable provided it does not include tonal components, impulses or other intrusive characteristics.

4.5 Dust levels

Dust emissions from materials handling operations, stockpiles, open areas and transport activities are a key issue, particularly during summer when strong easterly winds occur.

In developing the dust management strategies, ISK Minerals is drawing heavily on both industry experience and, especially, its successful management at its existing Waroona mine. The Waroona mine is located in a geographical and topographical situation similar to that of the proposed Dardanup mine.

The key elements of the dust management strategy are:

- restriction of clearing to the minimum area required for safe and efficient operations;
- vegetation of stockpiles and other exposed non-traffic areas;
- ensuring the solar-dried clay tailings ponds are kept sufficiently wet; and
- watering and other methods of control of fugitive dust from traffic areas, for example speed restrictions and the use of binding agents are techniques commonly used in the mining industry as adjuncts to watering.

Dust monitoring in and around the mining operation would be carried out by ISK Minerals to determine both on-site and off-site impacts. The detailed programme would be developed in consultation with the Department of Mines and the Environmental Protection Authority.

The Environmental Protection Authority notes that the proposal as described in the Consultative Environmental Review (section 4.4; CER) and the proponent's response to the submissions (sections 2.5 & 6.4; Appendix 2) discuss control of dust levels.

The Environmental Protection Authority considers that the proponent's dust mitigation measures would ensure the impacts on nearby residents are acceptable. The Environmental Protection Authority will also set air quality levels in the works approval and licence issued under Part V of the Environmental Protection Act to protect residents from the impacts of the proposed mining operation.

4.6 Aesthetics

The visual impact of the mine site needs to be considered due to its location on the lower foothills of the Darling Scarp and the rural nature of the area.

The Environmental Protection Authority notes that the proponent would implement management procedures that would minimise visual impacts of the operations including commitments to:

- restricting the size of operational areas to the minimum required safe and efficient operation;
- maintaining vegetation where it shields mining operations from view from both public and private areas;

- establishing vegetation on areas, including stockpiles, to shield operations from view; and
- selective location of stockpiles.

The Environmental Protection Authority considers that the proponent would satisfactorily manage the visual impacts for the purpose of minimising the mine's visual disturbance to nearby residents and tourists.

4.7 Flora and fauna

Clearing for agricultural use has removed most of the native vegetation in the area. Remnant native vegetation exists along roads and in small pockets for shelter for stock. Thus the area offers only restricted habitats for native fauna. No rare or endangered species were recorded in the project area.

The proponent has made the following commitments to minimise further impacts on flora and fauna:

- preserve remnant vegetation where practicable; and
- enrich and establish native vegetation alongside existing permanent public roads and roads developed or disturbed as a result of project activities.

The Environmental Protection Authority concludes that the proponent would adequately manage this issue to ensure the impacts on the flora and fauna are mitigated.

The proposed mine site is almost wholly cleared, privately-owned agricultural land. Therefore, the proposed mine's impacts on flora and fauna would be minimal.

The Environmental Protection Authority feels that the proposal as described (sections 6.8 & 6.11; CER) and the proponent's response to submissions (section 6.6; Appendix 2) are satisfactory.

4.8 Work force and employment

There would be 35-40 jobs associated with the proposal. The wind-down of the proponent's Waroona operation may mean some employees could transfer to the Dardanup mine. The proximity to the City of Bunbury means that the catchment area for the project work force is wider than the local community. These factors would influence employment opportunities for local residents. Notwithstanding this the proponent has stated that it sees local people as potential employees.

Potential secondary impacts associated with the workforce, such as housing and education, would be negligible given the small number of workers involved and the proximity of Bunbury that has more than adequate infrastructure to cope with this project.

4.9 Community issues

The introduction of mining to the long established farming area of Dardanup will mean change in the community. There is a strong attachment to the area, which has in most cases been farmed by successive generations of families.

The presence of the mining company and its personnel as part of the community, will also affect community dynamics.

Successful operation of similar mining proposals in agricultural areas shows that these changes can be adequately managed. Managing community impacts depends on the level of interaction between the proponent and the community and the time it takes for the proponent to become an accepted member of the community.

The proponent has recognised that some change is inevitable for the Dardanup and Burekup communities. It proposes to actively participate in community development. If local residents

welcome the proponent's attempts to participate in the development of the community they could identify areas where the proponent could best contribute its resources.

5 Public consultation and submissions

The proponent began an early consultation programme before the referral of the proposal to the Authority. It included individual consultation with landowners in the area and an open day at the Dardanup Hall. Approximately 90 people attended the open day, where ISK Minerals staff and representatives from government agencies discussed the project with members of the community.

After referral of the project the proponent attended a meeting of the Burekup Progress Association to outline the project and answer questions (26 people attended). A community meeting was held to address the issue of transport (50 people attended). The meeting provided an important opportunity for the community and the proponent to exchange ideas on the impacts of various transport routes. The company continued to liaise with landowners during the development of the Consultative Environmental Review.

Upon release of the Consultative Environmental Review the proponent ensured that all interested people had access to the document and provided a further opportunity for discussion by holding another open day in Dardanup. The open day was attended by 40 people.

ISK Minerals indicated that individual consultation would continue with landowners in areas potentially effected by changes in water conditions. The proponent has stated in the Consultative Environmental Review that it will continue to consult with the Dardanup, Burekup and Waterloo communities during the development of the project. The proponent recognised the Shire of Dardanup and the Land Conservation District Committee as important vehicles for this consultation.

The Authority recognises that some concerns still exist and that the consultation process has raised the profile of community development issues. The community can now use the opportunities initiated by the assessment process to work through concerns relating to both the mining proposal and general community issues. The community should ensure that the proponent has adequate opportunity to participate in community development given its planned presence in the community for the next decade.

The Authority recognises that the proponent's public consultation was genuine and ambitious and believes that the long term relationship with the community will benefit from the consultation.

6. Conclusion

Upon assessment of the ISK Minerals Pty Ltd proposal, the Environmental Protection Authority has concluded that the proposed Dardanup mineral sands mine would be environmentally acceptable subject to the operation being carried out in accordance with the proposal detailed in the Consultative Environmental Review and the Environmental Protection Authority's recommendations in this Assessment Report.

Appendix 1

Proponent's response to submissions

ISK MINERALS PTY LTD
DARDANUP MINERAL SANDS PROJECT
RESPONSE TO PUBLIC SUBMISSIONS

1. INTRODUCTION

The following responses have been prepared after review of submissions made at the end of the four-week period of public comment on the Consultative Environmental Review (CER) prepared for the Dardanup Mineral Sands Project. The public comment period ended on 28 October 1991.

For submissions from government instrumentalities, responses are made in a sequential manner, by instrumentality and by subject. For other submissions (from individuals and non-government organisations), responses are made to the list of questions and issues received from the EPA on 8/11/91. Where writers of submissions gave the relevant authority, copies of the submissions were also used to facilitate the preparation of responses.

2. DEPARTMENT OF THE ARTS, SPORT, THE ENVIRONMENT, TOURISM AND TERRITORIES (DASETT)

2.1 REQUIREMENT FOR COMMONWEALTH APPROVALS

ISK Minerals Pty Ltd (ISK Minerals) is aware of the requirement for export and foreign investment approvals from the Commonwealth Government, and is currently seeking Foreign Investment Review Board approval of the project. Approval has been granted for the purchase of several properties in the area of proposed mining, but overall project approval is pending environmental approval.

With regard to the application of the Environment Protection (Impact of Proposals) Act 1974, ISK Minerals understood that the Commonwealth and State Governments were managing this aspect of the approvals process through the agreed arrangements which exist between the State and Commonwealth governments. ISK Minerals is happy to take the opportunity identified in DASETT's submission to expedite joint Commonwealth/State assessment of the project.

2.2 MINING TECHNIQUES

The use of a dredge in the mining operation at Dardanup is not feasible because of the presence of significant amounts of rock and clay in the orebody.

2.3 MONAZITE QUESTIONS

Work carried out to date indicates the amount of monazite in ore at Dardanup is similar to that contained in ore currently being mined at ISK Minerals' Waroona mine. Dry separation operations at Picton do not recover a monazite product (concentrations are so low that such separation is not warranted) and the small amount of monazite which does exist will continue to remain in the sand tailings and be returned to the mine and mixed with other pit backfill.

It is on this basis that the CER notes ISK Minerals' expectation that the Picton plant will continue to have no radiation-related "controlled" work areas, as defined by the relevant occupational health legislation.

In relation to dust management at the Picton plant, the modern facilities incorporate integrated dust extraction, collection and disposal, and are regularly inspected by Mines Department officials, who have commended the effectiveness of the dust control system.

2.4 ABORIGINAL HERITAGE

ISK Minerals' ethnography consultant, McDonald Hales & Associates, advised on 4 November that the knowledgeable informant referred to in the CER had returned to Western Australia and has been consulted in relation to the Dardanup Project. A copy of their report, which advises

that there should be no ethnographic impediment to development of the project in its currently-proposed form, has been transmitted to the EPA and the Commonwealth (DASETT).

2.5 STOCKPILE DUST MANAGEMENT

In addition to the dust control measures described in Section 4.4 of the CER, vegetation will be established on topsoil and overburden stockpiles. Where such vegetation does not establish from seed and other plant propagules contained in the earth constituting the stockpiles, grass and other quick-growing vegetation (e.g. cereal rye) will be established by hydroseeding or other techniques for applying seed and fertiliser.

ISK Minerals proposes to adopt the strategies of direct use of overburden as backfill (combined with filtered sand tails and thickened clay tailings), and of direct replacement (where possible) of topsoil. Consequently stockpiles will be restricted in both number and size. Stockpiled overburden is thus likely to be restricted to that produced from the establishment of the initial pit. It is also planned that freshly-won topsoil be replaced directly on backfilled pits, although logistical considerations will likely mean stockpiling at least the first year's topsoil prior to its use in rehabilitation.

2.6 PICTON PLANT - NATURE OF EXPANSION AND NOISE CONSIDERATIONS

In accordance with the conditions of approval for the establishment of existing operations at the Picton site, a noise survey was conducted in the area of the plant in 1989. A report dated March 1989 was forwarded to the EPA.

The report noted that noise levels were typical of those associated with industrial areas. It further noted that the noise limits proposed in the Works Approval issued by the EPA for the operation were being regularly exceeded prior to construction of the Picton plant. This reflected the classification of the area as a commercial area with medium density transportation.

It has since been recommended to the EPA that an "Industrial" classification would be more appropriate. While ISK Minerals has successfully dealt with two informal noise complaints since the Picton plant was commissioned, the EPA's Bunbury office advises that it has received no formal noise complaints from the Picton area in general, and in relation to ISK Minerals' Dry Processing Plant in particular. With the nearest residence located 300 metres to the south of the plant, it is confidently expected that this situation will persist. Noise emissions do not necessarily increase linearly with increasing numbers of sources, so that it is possible that increased noise from the expanded Picton plant may not even be perceived at residences in the area: other background noise is likely to affect such perception.

2.7 CONSERVATION OF CASUARINA OBESA

As noted in Sections 2.1.5, 4.2.1 and 4.9 of the CER, ISK Minerals intends to include native vegetation in the post-mining landscape. The strategies and prescriptions required to meet this commitment will be developed in consultation with the relevant government instrumentalities and other interested groups.

With respect to Casuarina obesa, which is not well represented in the conservation estate, ISK Minerals will consult with the Department of Conservation and Land Management to understand the ecological requirements of the species. To the extent that it is reasonably achievable, establishment of this species will be included in revegetation plans.

2.8 HERITAGE MATTERS

ISK Minerals will facilitate the provision of relevant information to the Australian Heritage Commission, building on the consultation and liaison already established with the Western Australian Museum. ISK Minerals' consultant in these matters, McDonald Hales & Associates, has apprised ISK Minerals of its obligations under the Aboriginal Heritage Act 1972. It is understood that the meeting of these obligations, in consultation with the Western Australian Museum, is likely to satisfy the requirements of the Heritage Commission.

2.9 SUMMARY OF ENVIRONMENTAL COMMITMENTS

Most of the CER commitments are evolutionary, depending on knowledge to be gained in operations and thus not lending themselves to milestone approvals. Importantly, ISK Minerals considers that it has appropriately identified the parties and organisations involved in the consultations required to meet these commitments.

With regard to determining the technical acceptability of the work performed in meeting the commitments, it is assumed that the EPA, advised by other government instrumentalities as appropriate, will assume responsibility.

3. DEPARTMENT OF CONSERVATION AND LAND MANAGEMENT

3.1 FLORA

As noted in the CALM submission, the botanical work performed by E M Mattiske & Associates in the area of the proposed Dardanup minesite revealed no rare or restricted species. However, the relatively poor representation of Casuarina obesa in the conservation estate was noted; plans to address this situation are discussed above in Section 2.7 of this document.

3.2 VISUAL IMPACT

The five measures listed on Page 38 of the CER as means of minimising the visual impact of the Dardanup operation were based on the experience of ISK Minerals and its consultants. Professional landscape advice has not been considered necessary to supplement in-house skills and experience.

As noted in Section 4.6.1 of the CER, it is expected that the post-mining landscape will be similar to that which currently exists. Visual impacts during mining will demand consideration at a level reflecting their temporary nature, and it is considered that their impact is not likely to be such that extensive professional landscaping planning would be required.

ISK Minerals is aware of the negative visual impacts which can be generated by mining operations, and considers that the approaches and techniques listed in the CER will appropriately and pragmatically mitigate these impacts. It must be recognised however, that while visual impacts can to a considerable extent be avoided or mitigated, some impact is unavoidable.

ISK Minerals would be happy to discuss with CALM any suggestion which that organisation might have in relation to mitigation of visual impacts, thereby taking advantage of experience CALM may have gained in dealing with other similar activities.

3.3 WATER MANAGEMENT

3.3.1 Water Quality

Water likely to be discharged from the mining and concentrating operations at Dardanup is of low salinity (less than 1000 mg/l TDS; see Section 4.3.1 of the CER). It is considered that such a quality does not warrant a classification as "saline", since it meets the salinity standard for drinking water. Moreover, water will be discharged into existing drainage features containing water of similar quality.

As is also noted in Section 4.3.1 of the CER, water discharged from the operation would contain no unacceptable levels of chemical additions, and would meet turbidity standards determined in consultation with the Water Authority and other instrumentalities.

It is recognised that water discharged from the Dardanup operation will ultimately report to the Leschenault Inlet, and that appropriate monitoring will be required.

3.3.2 Impacts of Discharged Water on Vegetation

As noted in the CALM submission, the use of irrigation channels (or drains) for discharged water should preclude damage to vegetation from elevated water tables.

ISK Minerals is also aware of concerns that water tables might be raised as a result of storage of water in dams. It is intended that water storage dams for the Dardanup Project be excavated rather than constructed wholly above natural surface. It is believed that this approach, which will avoid the establishment of water heads significantly greater than those which currently exist, will minimise risks of flooding of downslope areas.

3.4 IMPACTS OF DEWATERING

ISK Minerals is aware of the potential impact of dewatering on nearby vegetation, especially in summer. At its existing Waroona mine, ISK Minerals has successfully mined to within a few metres of stands of Red Gum (Eucalyptus calophylla) without significant loss of trees - supplementary water was provided during the period between mining and backfill/rehabilitation.

As noted in Section 4.10.1 of the CER, the desire of local residents to preserve Red Gums has been related to ISK Minerals. To the extent that it is possible in terms of both technical feasibility and the commercial viability of the mining operation as a whole, it is planned that some stands of trees and other vegetation will be avoided in mining operations.

4. WATER AUTHORITY OF WESTERN AUSTRALIA

4.1 WATER BALANCE CALCULATION

As discussed in detail in Section 5.1.2 below, the rainfall input to the water balance model for the Dardanup operation was based on records for Dardanup. A figure for evapotranspiration was taken from the Mackie Martin report on groundwater investigations in the South-West of Western Australia; that study addressed the area proposed for mining, and is thus directly applicable.

The sensitivity of the water balance to rainfall and evaporation is significantly less than it is to ore throughput (and hence area of clay tailings dam). This is discussed in detail below in relation to the submission from the Department of Agriculture.

4.2 POST-MINING HYDROGEOLOGICAL REGIME

As identified in Section 4.3.2 of the CER, unplanned backfilling of mine-pits could result in reduced permeabilities and restrict the natural flow of water from east to west in the superficial aquifers. Modelling of this system predicts increased water tables by as much as 4 metres to the east of the pit, and reduced water tables by as much as 3 metres to the west.

This undesirable result can be avoided by providing, during backfilling operations, pathways for transmission of water from east to west in much the same way as occurs at present. The precise method by which this will be achieved will be developed in consultation with the Water Authority and the Department of Agriculture, and much of the detailed design will follow from data obtained during mining operations. Understanding the geological and geotechnical nature of the existing pathways for water movement will be important in designing the post-mining system. Post-mining groundwater regimes are also discussed in Section 5.2 below.

Two possible techniques for re-establishing water flow pathways are identified in Section 2.1.5 of the CER: selective placement of permeable soil materials and the installation of engineered underground drains. Other approaches are expected to be discussed in progressive consultation with the above-mentioned instrumentalities.

Should these strategies be unsuccessful and cause unacceptable elevated water tables to the east of the mine and lowered water tables to the west, ISK Minerals accepts that it would be responsible for remedial work. To alleviate problems caused by high water tables to the east, engineered drains could be installed along the eastern edge of the backfilled pit: drainage water could be directed under gravity to existing drainage systems.

4.3 DOWNSLOPE SALINITY

The Water Authority have advised that their concern about salinity relates to areas several kilometres to the west of the mine. This matter was discussed at a meeting on 24 October 1991

attended by officers of the EPA, the Water Authority, the Department of Agriculture and the Geological Survey (as well as ISK Minerals personnel). The Geological Survey (which has conducted extensive hydrogeological work in the Picton-Dardanup area) advised that it was extremely unlikely that activities in the mine area would affect water tables (and thus salinities) in areas several kilometres to the west. This view supports that contained in the June 1991 report to the Water Authority by Mackie Martin & Associates Pty Ltd ("Groundwater Investigations for the Irrigation Strategy Study, South-West Western Australia").

Notwithstanding the low probability of effects several kilometres from the mine, ISK Minerals is currently consulting with the Water Authority, the Geological Survey and the Department of Agriculture to ensure that the groundwater monitoring regime to be developed over the next few months includes areas remote from the mine.

4.4 SOUTH SUPPLY CHANNEL INTEGRITY

No decision has yet been made in relation to mining under the Channel. The question is almost entirely an economic one - a balance between revenue from mining and all costs of mining the area involved (including costs of repair to the Channel and of provision of alternative routes for water flow).

ISK Minerals supports the proposal by the Water Authority for a joint inspection to determine an "agreed condition" prior to the start of work. ISK Minerals also accepts responsibility for repairs necessitated by actions or activities of it or its agents.

4.5 SUPPLY OF IRRIGATION WATER

In confirmation of commitments made in the CER, ISK Minerals affirms that mining and ancillary operations should be conducted without unreasonable interference to the supply of irrigation water to farmers. Similarly, the use of drains by ISK Minerals to manage excess water will be designed to avoid unreasonable interference to the use of those drains by farmers.

4.6 PRIOR NOTICE FOR WORK ON WATER AUTHORITY FACILITIES

ISK Minerals agrees to give the Water Authority at least six months notice of any work proposed on or adjustments to Water Authority controlled drains, channels and other facilities.

4.7 DISCHARGE WATER CONTROLS AND STANDARDS

As noted in Section 4.8 below, the Water Authority has signalled a preference for discharge water to be directed to the Valiant Drain, rather than the South Supply Channel. The following comments therefore concern the terms and conditions of such discharge, whatever route is taken.

Since receiving a copy of the Water Authority's submission on the CER, ISK Minerals has discussed with Authority officers the volume and quality standards for waters discharged from mining operations into the South Supply Channel and other channels. It has been agreed that the standards proposed in the Authority's submission (discharge not to exceed 10% of channel design capacity, ceasing when channel flow reaches 75% of that capacity; water turbidity no greater than 30 NTUS) represent starting points for discussion.

It has been suggested that the 75% upper limit may already be so regularly exceeded that it represents an unrealistic constraint on mining operations. Similarly, the 30 NTUS turbidity limit may be significantly lower than the turbidity of much of the existing flow during periods when ISK Minerals would be likely to want to discharge water - i.e. winter and early spring. During these periods of high runoff, turbidities are likely to be high in any event.

4.8 PREFERRED WATER DISCHARGE ROUTE

ISK Minerals accepts the Water Authority's advice that the Collie River is the preferred receiving water body for discharge of water from the mine. ISK Minerals has discussed with the Authority the possibility of discharging water into the Valiant Drain which runs alongside the easement of Dowdell's Line and reports to the Collie River. Use of this drainage route appears to be achievable, and final details of its use will be determined in consultation with the Authority. The significance of the capacity of this drain is noted in Section 5.1.1 below.

4.9 SOUTH SUPPLY CHANNEL ALTERNATIVES

ISK Minerals agrees that any alternative drainage system provided during interruption of the South Supply Channel would be constructed to designs advised by and/or approved by the Water Authority.

4.10 RUNOFF FROM REHABILITATED AREAS

Uncontrolled runoff from areas undergoing rehabilitation could transport silt into drainage systems. It is therefore planned that runoff from such areas will be directed to settling ponds to reduce silt loads prior to discharge. As noted in Section 4.7 above, ISK Minerals has discussed discharge water standards with the Water Authority, who have agreed that turbidity limits need to be assessed in relation to other contributions to runoff and turbidity - the 30 NTU limit is considered a good starting point for discussion.

4.11 OBSERVATION BORES

The bores known as Picton Line No. 4, in the northern section of the mine area, will not be disturbed by mining operations. The main bore is some 800 metres deep, and is part of a regional monitoring network operated by government instrumentalities. ISK Minerals will consult with the Water Authority to determine an appropriate stand-off distance around Picton Line No. 4.

4.12 WATER LICENSING

As noted in Section 6.0 of the CER, ISK Minerals will comply with all relevant licensing provisions of the Rights in Water and Irrigation Act 1914. Such licensing is likely to be required only for deep bores used to meet requirements not met by the recycling of process water and mine dewatering.

5. DEPARTMENT OF AGRICULTURE

5.1 APPLICABILITY OF THE MODFLOW MODEL RESULTS

5.1.1 Introduction

The Department of Agriculture submits that, because of the nature of some inputs and assumptions, the MODFLOW model might not accurately assess both the amount of water produced in mine dewatering and the lateral extent of "draw-down" effects from that dewatering. Underestimation of the amount of water extracted during dewatering would significantly affect the overall mine water balance, especially the amount of excess water which would need to be discharged. Underestimating the "draw-down" influence would lead to inadequate prediction (and thus poor pre-emptive management) of impacts on bores, wells, dams, springs, seeps and other water supply and management facilities on neighbouring land.

The MODFLOW model has been used by ISK Minerals to estimate that:

(i) 240-465 ML/a is produced from mine dewatering; and

(ii) drawdown effects are likely to be experienced only within 500 metres of the orebody.

Using MODFLOW results and process data, a discharge figure of 22 ML/a was calculated from the water balance contained in Fig. 18 of Gutteridge Haskins and Davey's (GHD's) September 1991 Water Management Study Report. If this were to be discharged continuously over four winter months into the Valiant Drain (see Section 4.8 above), it would constitute only 0.08% of the flow capacity of the drain at the intersection of Edwards Road and Dowdell's Line. This calculation is based on the Water Authority's advice that the capacity of the Valiant Drain at the Dowdell's Line/Edwards Road intersection is 2.54 cubic metres per second.

The discharge figure of 300 ML p.a. mentioned in the CER was based on preliminary water balance assessments, and was superceded by the 22 ML p.a. figure in more detailed work. The impact of increased clay tailings pond area on the water balance (and thus on the estimated amount of discharge water) is discussed in Section 5.1.5 below.

The following sections address the technical matters raised by the Department of Agriculture in its assessment of the validity of the data produced from water modelling studies.

5.1.2 Meteorological Data Inputs to Model

While both the CER and the GHD report on water management quote Bunbury figures for rainfall and evaporation, rainfall data for Dardanup were used in running the MODFLOW model, and a figure for evapotranspiration was taken from the Mackie Martin report (Groundwater Investigations for the Irrigation Strategy Study, South-West Western Australia; June 1991). ISK Minerals accepts that this is not made clear in either the CER or the GHD report, and regrets confusion which has been caused.

Moreover, there appears to be some confusion about the application of meteorological station data to field situations. Pan evaporation from meteorological records are increased by 7% to correct for the effects of bird guards, and turbidity in shallow ponds of the type proposed for Dardanup increase, not decrease, evaporation. This latter effect results from increased absorption of solar radiation. It is also noted that, for the small pond areas like those involved in the Dardanup Project, it is standard practice to use Pan Evaporation, rather than Lake Evaporation (which is generally calculated at 70% of Pan Evaporation) in estimating water balances.

On these bases, ISK Minerals is confident that the climate data inputs to the model used for estimating quantities of water produced from mine dewatering are appropriate. In view of the relative contribution of mine discharges to the capacities of existing drainage systems (see Section 5.1.1 above), greater precision in the estimation of water flows and balances does not appear to be necessary.

5.1.3 Mine Size

The mine pit sizes of 300 m x 300 m and 400 m x 800 m represent two of a number of pit geometry options which have been included in water management studies over a period of several months.

As discussed with Agriculture Department personnel at the 24 October 1991 meeting, the water inflows to the mine pit in the 400 m x 800 m case were manually extrapolated from the 300 m x 300 m case. It is acknowledged that this extrapolation may not completely account for radial flows at the corners of pits, but errors are considered by GHD, professional geotechnical engineers and hydrogeologists, to be less than 10%. In light of comments in Section 5.1.1 above about the relative volume of discharge water, this level of precision is considered to be acceptable.

5.1.4 Relevance of Pump Tests

As noted in the Agriculture Department submission, the MODFLOW model was not run taking direct account of pump testing carried out in mid-1991 in the area of the proposed mine. The Transmissivity (T) and the Storage Coefficient (SC) used in the model runs were derived from literature such as the Mackie Martin report, which has direct relevance.

The 1991 pump test data showed both Transmissivities and Storage Coefficients which were half those used in the initial modelling. Because the relationship between T, SC and the amount of water pumped is linear, the previous model results (using the higher values of T and SC) were factored down. In this way, the modelling is considered to adequately estimate the volume of water derived from mine dewatering; it was not considered necessary, in view of the small increase in precision which would have been obtained, to undertake expensive re-runs of the model using the new data.

5.1.5 Ore Throughput and Clay Tailings Dam Area

The Dardanup ore body contains 27% clay and ore throughput affects the area required for clay drying ponds. Based on a bulk density of 1.5 tonnes per cubic metre, clay tailings deposited one metre deep (when dry) would require approximately 18 hectares of drying ponds for each million tonnes of ore processed per annum.

Whilst it is believed that clay tailings can be deposited in depths of one metre and more, experience indicates that clay tailings are currently generally deposited to a depth of approximately 0.5 metre (when dry).

Test work carried out to date indicates that at least one-third of clay tailings can be mixed with the tails for direct return to the pit as fill. ISK Minerals is confident that half or more of this material will ultimately be able to be returned directly.

On this basis, 80 hectares of pond drying surface is required for a mining rate of 3.36 million tonnes per year. The GHD report figure of 30 ha was derived by the theoretical calculation of the area required for depositing half of the clay tails one metre thick; the 125 ha figure used in the CER was determined by empirical extrapolation from existing practices at ISK Minerals' Waroona operation.

Additional areas will be required for dam walls, access ways etc; actual requirements will depend on pond sizes and shapes.

Investigations are being carried out to reduce the required drying time, which will allow the deposition of greater thicknesses of clay tailings and so reduce the required area. Testwork is also being carried out to increase the amount of clay that can be mixed with the tails for diect return to the pit; this will also decrease the area of drying ponds required.

In terms of water balance, the increase in pond are requirement from the GHD report figure of 30 ha to 80 ha will increase the amount of water which might need to be discharged. In the worst case, this amount of water would be increased to approximately 475 ML per annum. Based on the scenario discussed in Section 5.1.1 above for disposal of excess water into the Valiant Drain at the junction of Edwards Road and Dowdell's Line, this amount of water would constitute approximately 1.7% of the capacity of the drain, which transmit at least 186 ML per day (data provided by the Water Authority).

5.1.6 Effect of Ore Moisture Content on Water Balance

Water Balance studies reported in the CER and in the GHD report are based on an ore moisture content of 15%. Higher moisture contents would reduce the amount of process water recycled and thus increase the amount of water requiring discharge.

At the annual ore throughput of 3.36 million tonnes proposed in the CER, an increase in moisture content to 20% would decrease the recycle water demand by 168 ML. However, it must be remembered that the ore will be dewatered prior to mining, so that sandy areas could have moisture contents significantly less than 10%. While freely-drained clays can be expected to have moisture contents greater than 15%, it is considered that the 15% figure is a conservative basis on which to assess water supply and management questions.

5.1.7 Influence of Hydraulic Conductivity Data

The Agriculture Department has advised that the figure of 1 metre per day used in the GHD work for hydraulic conductivity appears to be high. This is acknowledged and, as discussed at the 24 October 1991 meeting, this value was purposely used because it reflects a "worst case" situation. To use lower hydraulic conductivities would reduce the estimated amount of water obtained from mine dewatering.

5.1.8 Amount of Water Discharged

The amount of water discharged from the Dardanup operation, and its capacity to be managed with the existing drainage system, is discussed in Sections 5.1.1 and 5.1.5 above.

5.2 GROUNDWATER IMPACTS

5.2.1 Short Term Considerations

As is described in the CER, the GHD water modelling indicates that "draw-down" effects of mine dewatering may be expected within 500 metres of the mine. In Section 5.1.4 above, it was noted that pump tests at Dardanup showed that soil transmissivities were approximately

half those used in the modelling. This would in fact narrow the radius of influence of draw-down from mine dewatering.

ISK Minerals has undertaken to pre-emptively manage potential impacts of mine dewatering on neighbouring properties. Currently, information is being sought from approximately 20 landowners whose properties lie on or within 500 metres of the orebody. Data on water supply facilities and on existing surface and groundwater regimes within these properties is being collected, with a view to ensuring appropriate water management.

With this approach, it is believed that interruptions to existing water supplies can in most instances be addressed in advance, so that no disturbance to supplies occurs during mining operations. In the event of unforeseen or unforeseeable disturbances occurring, ISK Minerals can and will react promptly to re-establish water supplies.

5.2.2 Long Term Considerations

REGIONAL EFFECTS

A frequently-mentioned concern about the Dardanup mining operation is that it will affect water tables and exacerbate salinity problems on farmland several kilometres to the west. This issue is again raised in the Agriculture Department's submission.

At the 24 October 1991 meeting convened by the EPA, a Geological Survey officer with considerable experience of the hydrogeology of the Picton/Dardanup area stated that mining activities at Dardanup are most unlikely to affect water tables and salinities in areas to the west. This professional opinion supports one of the conclusions of the Mackie Martin report referred to in Section 5.1.2 above. It is considered that these opinions should allay fears about water table and salinity effects of mining on areas more than 500 metres from the mine.

LOCAL EFFECTS

In both the GHD report and the CER, it is recognised that unmanaged replacement of backfill into mined-out areas could reduce horizontal permeabilities and cause rises in water tables to the east and decreases to the west. Indeed, in informal discussions with a number of parties, it has been suggested that such an effect, if supplemented by a drain system on the eastern (upslope) side of the mine to remove excess water, would alleviate salinity problems to the immediate west of the mine.

However, it is ISK Minerals' plan, as described in the CER, to manage the backfilling operation so as to avoid creation of what could effectively be an underground dam. Two strategies are identified in the CER: selective placement of permeable materials to create water pathways across the backfilled mine, and the use of engineered drains to achieve the same result. It is noteworthy that the Mackie Martin report also addresses the use of engineered drains to achieve relief from elevated saline water tables in the region, especially to the west of the mine.

The materials are available to pursue the "selective permeability" approach mentioned above. In addition to overburden (some of which will comprise permeable sandy material), the sand tails from the concentrator (constituting 40% of the total mass of material to be used for backfill) have extremely high permeabilities.

A significant concern of landowners located upslope of the mine is reduced water supplies. This concern is based on previous experiences, such as the installation of the South Supply Channel in the 1930s, which effectively drained country upslope.

5.3 Surface Hydrology

5.3.1 Water Balance

The Agriculture Department's concerns about climatic data inputs used to determine components of the mine water balance have been addressed in Section 5.1.2 above.

5.3.2 LOCALISED STREAMFLOWS

Surface streams will generally be diverted around mining operations. As discussed at the 24 October 1991 meeting convened by the EPA, erosion control in the channels constructed to effect these diversions is largely a matter of design. Existing technology can be applied to control erosion and prevent unacceptably turbid waters being discharged downslope of the mine.

The GHD report suggests a 1 in 100 year design criterion for diversion facilities, but subsequent evaluations have identified a need to ensure that the facilities do not have flow capacities which exceed those of existing watercourses and drainage structures downstream. It is now proposed that diversion drains generally be designed for a 1 in 20 year rainfall event, to match the design of Water Authority drains and channels. The precise detail of the design would vary from catchment to catchment across the orebody.

The storage capacity of the mine-pit, dams and ponds during flood peaks, provide a means of reducing the impact of large rainfall events. It should also be recognised that when the mine is flooded to the point that uncontrolled flows would occur, the surrounding country would be experiencing similar, if not worse, problems.

5.4 AGRICULTURAL PRODUCTIVITY

As stated in the CER, it is ISK Minerals' commitment that rehabilitated mined-out land be returned to levels of agricultural productivity at least equal to those currently prevailing.

In terms of "engineering" the replaced soil profile, ISK Minerals will consult with the Agriculture Department and other relevant instrumentalities to achieve results which meet land use requirements. Care must be exercised in this regard to ensure that agricultural aims and regional hydrogeological aims are not brought into conflict. For example, a soil which increased runoff from the mine would be desirable because it would reduce recharge and thus lower saline water tables to the west. However, that increased runoff would likely cause concern to the Water Authority, whose drainage network is already under pressure in some areas. Moreover, the Mackie Martin report noted that even large changes in recharge in the area of the mine are unlikely to significantly influence regional problems of high saline water tables.

Similarly, the "prescription" aspects of rehabilitation (fertilisers, plant species, cultivation techniques etc) will be developed progressively with the Agriculture Department and other interested parties. Agroforestry may also have a role in the rehabilitation strategy.

5.5 MONITORING SYSTEMS

ISK Minerals is currently determining the extent and nature of current surface and groundwater monitoring in the area of the mine, with a view to supplementing existing efforts to provide a baseline against which the effectiveness of future management programmes can be assessed. The monitoring programmes would be determined in consultation with the Water Authority and the Agriculture Department, plus other instrumentalities (such as the Geological Survey) which may hold data and/or are currently monitoring in the area.

Monitoring will address groundwater levels and quality, and surface flows and quality.

For land owned by ISK Minerals, the commercial need to obtain maximum resale value for rehabilitated land will provide additional incentive to meet the rehabilitation aim of agricultural productivity at least equal to that currently enjoyed. For land on which mining takes place with consent of owners, standard commercial arrangements can be relied upon to address this question adequately. It is proposed that authorities such as the Agriculture Department will be specifically mentioned, as arbitrators of the success of rehabilitation, in documents which give ISK Minerals the right to mine private land.

5.6 REMNANT VEGETATION

The conservation of remnant vegetation and its protection from dewatering has been discussed in Section 3.4 above in response to the comments from CALM. It is not considered appropriate to assess the influence of existing remnant vegetation on regional hydrology: the Mackie Martin report comments that a major revegetation programme (in the area of the mine) would be

required to reduce recharge into the groundwater and reduce water levels in irrigation areas - even a 50% reduction in recharge would have a minimal effect, and such a reduction in recharge would demand a much greater deep-rooted vegetation than currently exists.

Nonetheless, and as noted in the CER, ISK Minerals plans to include native vegetation in rehabilitation plans to be developed progressively in the future. This, together with the conservation of native vegetation addressed elsewhere in the CER and in this document, address the amenity, agricultural ecology and landscape quality questions raised in the Agriculture Department's submission.

6. EPA - QUESTIONS FROM PUBLIC SUBMISSIONS (AND FROM THE SOCIAL IMPACT UNIT)

6.1 SURFACE WATER

6.1.1 Water Drainage

The significance of winter surface water flows has been discussed above in Sections 5.1.1 and 5.3 of this document. It is believed that the presence of the mine is unlikely to increase the amount of runoff reporting to the local and regional drainage system. Indeed, the surge capacity provided by the mine pit and storage ponds is likely to constitute a flood mitigation facility.

The relatively small amount of clearing that the mining operation involves is unlikely to increase runoff and drainage problems. Remnant vegetation covers but a small proportion of the mine area, and the Mackie Martin report states that a major revegetation programme would be required to reduce recharge (in the area of the mine) - runoff effects are largely the converse of recharge effects.

6.1.2 Summer Supply

As noted in Section 5.6.2 above, existing streams will be diverted around the mining operations and returned to their original watercourses downslope (to the west of the mine). Should such diversion significantly and undesirably reduce downstream flows, compensatory releases can be made from mine water supplies and storages (see Section 4.3.1 of the CER). It is ISK Minerals' commitment that water supplies to neighbouring landowners shall not be unreasonably affected by mining and ancillary operations. It is intended to return streams to original courses as part of rehabilitation.

6.1.3 Monitoring and Management Programmes.

ISK Minerals is, as noted in Section 5.2.1 above, currently consulting some 24 individual owners of land on and adjacent to the orebody to obtain information about the water regime and water use in the area. This information will be used to develop individual programmes for pre-emptively addressing and managing potential interference to farm water supplies (both surface and ground).

Should unforeseen problems develop, ISK Minerals has undertaken to act promptly to ensure maintenance of water supplies.

Monitoring of surface water flows is already carried out by the Water Authority as part of their management of drainage systems in the region. Individual farm monitoring programmes will be developed by ISK Minerals in consultation with landowners on a needs basis. However, the intra-year and inter-year variation in surface water regimes (in contrast to those of groundwater) are large, making difficult any attempt to interpret data on a progressive basis. It is considered more effective to maintain liaison with individual landowners and the Water Authority to avoid sudden and drastic alterations to surface water flows.

The question of monitoring water quality is discussed in Section 6.5.3 below. In short, consultation with the Water Authority is planned to develop appropriate standards for water leaving the mine.

6.2 GROUNDWATER

6.2.1 Local Effects

The possibility of mine dewatering affecting groundwater regimes within 500 metres of the orebody, and the management programmes proposed to deal with these effects, are discussed in Section 4.3.2 of the CER and in Sections 5.2.1 and 6.1.3 of this document. The landowner-specific programmes which will be developed from consultations with individual neighbours are considered likely to allow pre-emptive management of these "draw-down" effects of mine dewatering. Deepening of bores and wells, compensatory water releases and other strategies have been discussed with some landowners.

Local effects on salinity are likely to be beneficial, but temporary. The lowering of water tables resulting from mine dewatering will benefit downslope (western) areas by removing saline water from the root zone of agricultural plants, but the effect will be restricted to the 500 metre range of the "draw-down" effect and of at most a few years duration. Section 5.2.2 of this document describes how the backfilling operation will be managed to ensure that the post-mining hydrogeological regime is returned as close as is practicable to that which currently prevails.

It should also be noted that groundwater salinities in the area of the mine (the eastern part of the region considered by the State in its 1991 Irrigation Study by Mackie Martin & Associates) are relatively low. With groundwater effects restricted to within 500 metres of the mine, negative salinity effects are thus unlikely to be encountered.

6.2.2 Regional Effects

Section 5.2.2 above quotes the Geological Survey and the Mackie Martin report as evidence for the extremely low probability of mining operations causing hydrogeological and salinity effects outside of the mine (the 500-metre zone referred to in Section 6.2.1 above). Specifically, the Waterloo area to the west of the mine, where high saline water tables threaten future agricultural productivities, has been identified as being too distant from the mine to be affected.

6.3 VISUAL AMENITY

The management of visual impacts is discussed in Section 3.2 above in response to the submission from CALM.

While noting that some impact is unavoidable, ISK Minerals is committed to practically minimising impacts of facilities and operations. The location and size of facilities is an integral element of engineering planning, for both buildings and stockpiles, and the dust management programmes to be implemented (see Section 6.4 below) are considered important in minimising visual impacts.

At a local level, plantations of quick-growing trees will be used to screen facilities and operations from ground-level viewpoints. Impacts perceived from elevated positions (e.g. Henty Brook Road, to the east) will be addressed by the facility-location and dust management programmes discussed above.

As discussed in Section 6.10 below, elevated panoramic views of mining operations are sometimes regarded as being of value to tourism.

6.4 Dust Management

Dust management strategies are discussed in Section 4.4 of the CER and above in Section 2.5 of this document.

In developing these strategies, ISK Minerals is drawing heavily on both industry experience and, especially, its experience at its existing Waroona mine. The Waroona mine is located in a geographical and topographical situation similar to that of the Dardanup mine; dust problems associated with extremely strong easterly winds there have been successfully managed in the past.

The key elements of the dust management strategy are:

(i) restriction of clearing to the minimum area required for safe and efficient operations;

(ii) vegetation of stockpiles and other exposed non-traffic areas; and

(iii) watering and other methods of control of fugitive dust from traffic areas - speed restrictions and the use of binding agents are techniques commonly used in the mining industry as adjuncts to watering.

Dust monitoring in and around the mining operation will be carried out by ISK minerals to determine both on-site and off-site impacts. The detailed programme will be developed in consultation with the Mines Department and the EPA.

6.5 POLLUTION

6.5.1 Noise and Light

Drawing on experience gained from operation of its Waroona mine, where mining takes place in close proximity to farm houses, ISK Minerals will manage noise and light emissions to protect adjacent landowners at Dardanup from unreasonable interference. Location and design of facilities is a key aspect in this regard, with liaison with landowners being seen as important in developing operational practices which minimise noise disturbance and light spill. The strategic planting of quick-growing trees is also seen to be important in managing noise and light.

6.5.2 Air Pollution

Other than emissions from motor vehicles and mobile equipment, no chemical atmospheric emissions are involved in mining and concentrating operations. If sluice mining is adopted, the requirements for mobile equipment will be greatly reduced.

Physical emissions are addressed in Section 6.4 above, as they are confined to fugitive dust.

6.5.3 Water Pollution

Compared with the other, extremely large surface water and groundwater inflows from the Leschenault River (via the Collie and Preston/Ferguson Rivers, and via the deep Leederville and Yarragadee aquifers), the water eggressing the Dardanup mine is an extremely small flow. The contribution of mine water discharges to local drainage flows is discussed in Section 5.1.1 above.

In chemical terms, the Dardanup mining operation will not result in unacceptable quality of the surface and groundwater of the area. No significantly large volumes of chemicals are used in the mining and concentrating operations, and fuel and lubricant usages will be managed (by bunding etc) to ensure that contamination from these sources is most improbable.

Turbidity could, however, be contained in waters eggressing the mine. In Sections 4.7 and 4.10 above, the management of turbidity has been identified as being manageable by use of erosion control strategies and settling ponds developed and operated in consultation with the Water Authority and other government instrumentalities. The establishment of appropriate standards for water turbidity is also discussed in these sections - the Water Authority has agreed that consultations will take place to determine these standards.

6.6 FLORA AND FAUNA

The possibility of including Casuarina obesa (poorly represented in the conservation estate) in rehabilitation plans is discussed in Section 2.7 above.

The conservation of remnant vegetation, and the inclusion of native species in revegetation programmes, is discussed in Section 4.9 of the CER. ISK Minerals' successful mining to within a few metres of mature Red Gum (Eucalyptus calophylla) trees at Waroona is discussed above in Section 3.4. While specific details are yet to be developed, it is planned that some such trees will also be avoided (and ore forgone) in mining operations at Dardanup (see Section 3.4).

There is no intention to disturb remnant vegetation which does not require removal for project facilities and operations. In particular, a fenced-off area of native vegetation to the north of the orebody will not be impacted by mining and ancillary activities.

The jarrah dieback disease is prevalent throughout the area and, where practicable, dieback hygiene will be used to protect vegetation potentially affected by mining activities. In this context, advice on protectability and hygiene procedures will be determined in consultation with CALM.

Waterfowl may be disturbed by changes in water levels, but the area of impact will be restricted to within a few hundred metres of dewatering operations (see Sections 5.1.1 and 6.2.1 above). However, there are many alternative waterbodies in the area, and the mine water storage facility will create another - it is therefore unlikely that waterfowl populations will be significantly affected.

Potential effects of dewatering on vegetation are discussed in Section 3.4 above, in relation to comments from CALM. Again, these effects will be localised (because of the restricted influence of the draw-down effect of mine dewatering) and can be managed by supply of supplementary water to vegetation threatened by dewatering, particularly in summer.

6.7 TRAFFIC

The question of traffic resulting from the transport of heavy mineral concentrate has been addressed by the proposal to extend Dowdell's Line to the South West Highway in the north. It is proposed that the new Dowdell's Line section not be connected with the existing road.

Some heavy traffic may use other routes during construction, but the effects will be small and temporary - a small construction operation and a short construction period are anticipated.

The estimated 10 deliveries per week for supplies other than fuel will generally not involve heavy traffic, and are considered unlikely to significantly affect road use and safety.

Employees will use private vehicles to travel to work, the routes used naturally depending on residential location. With three shifts operating, and with car-pooling likely to occur, light vehicle movements are likely to be no more than six or seven at each shift change.

With regard to the use of roads by dairy herds, it is considered that existing arrangements should be able to be continued. The permanent increase in traffic as a result of the mine will be small, especially if local people seek work at the mine, so that dairying operations should be substantially unaffected.

Should traffic problems develop, ISK Minerals will consult with the Shire of Dardanup and other relevant parties to develop appropriate management programmes.

6.8 REHABILITATION

The rehabilitation programme for the Dardanup Project will be developed progressively. Commencing with the strategic aim of re-establishing agricultural productivities at least equal to those which currently exist, detailed prescriptions will be developed for individual areas as they become available for revegetation. The possible use of native vegetation, agroforestry and other land uses will be evaluated in consultation with the relevant instrumentalities, landowners and community groups.

Land will be rehabilitated as quickly as practicable after it ceases to be required for project activities. To a considerable extent, seasonal influences are likely to determine short-term rehabilitation time-frames, although the use of irrigation in summer periods may enable vegetation to be established prior to normal planting times for temperate species.

With regard to soil permeabilities and soil reconstruction, ISK Minerals plans to consult with the Agriculture Department to ensure that agronomic aspects of the rehabilitation programme are appropriately addressed. Within certain logistical bounds, there is capacity to replace backfill materials in preferred vertical and horizontal relationships, with the 150-250 mm of topsoil material being replaced last.

As outlined in Section 5.3 above, the advice of the Agriculture Department in particular will be sought in determining the technical elements of rehabilitation. These elements include, in addition to the soil formation question discussed above, fertiliser types and rates, plant species, cultivation techniques and other agronomic strategies such as green manuring.

6.9 RADIATION

The radiation safety aspects of the Picton Plant are discussed in Section 2.5 of the CER and in Section 2.3 of this document. Once in the operational phase, the ongoing application of the relevant occupational health and safety legislation will address the question of radiation levels in the Dry Separation Plant.

For the Dardanup minesite, radiation evaluations have been restricted thus far to assessment of samples used in metallurgical testwork. A ground surface gamma-radiation survey will be carried out over the Dardanup orebody prior to mining taking place, and radiation will continue to be monitores as part of metallurgical testwork. The results of the survey will be provided to the EPA and the Mines Department.

6.10 TOURISM

It was noted in Section 6.3 above that elevated overviews of mining operations, like that provided by sections of lower Henty Road, are in many instances seen as advantegeous from the point of view of tourism. The same does not necessarily apply for permanent residents in similar locations, so that ISK Minerals has no intention of maximising the visibility of the Dardanup operation.

A tourism operator in the area and ISK Minerals are arranging continued access to an operating dairy, as this aspect of the region's activity is of considerable interest to some tourists. ISK Minerals is initially seeking to facilitate continuation of this practice on a property or properties it plans to purchase for mining.

Dust from mining operations could detract from tourism value to be gained from the use of Henty Brook Road. The dust management programmes described in Section 6.4 above are relevant in this regard.

Based on a visit to Boulter's Heights, it is difficult to appreciate that the mining operation will detract from the view of the coastal plain from that vantage point.

6.11 WATER MODELLING DATA INPUTS

A detailed response to the Agriculture Department comments on water modelling is contained in Section 5.1 above. In particular, it is noted here that rainfall data input to the model was indeed Dardanup data, with a directly-applicable value for evapotranspiration being obtained from the Mackie Martin report.

6.12 WORKFORCE AND EMPLOYMENT

The workforce data given in Section 2.8.2 of the CER remain valid. Confusion about workforce numbers may have arisen from comments made by ISK Minerals at Open Days and other public forums in relation to employee vehicle movements per shift.

A total Dardanup workforce of 35-40 (including contractors) has been identified, depending on the technique used for mining - sluice mining or dry mining. The Dardanup mine will quickly replace the existing Waroona operation as the sole source of heavy mineral concentrate, and some Waroona employees may elect to transfer to Dardanup. However, the number of jobs created by the Dardanup operation significantly exceeds the number of jobs at Waroona (35-40 versus 22, respectively), and not all Waroona employees are expected to transfer to Dardanup.

An additional 8 jobs will be created at the Picton plant.

A peak on-site construction workforce of 80 is anticipated.

Enquiries about employment have already been received from Dardanup and Burekup residents, and ISK Minerals sees local people as suitable potential employees. As noted in the CER, the

nature of the work means that practical people with farming backgrounds are well-suited and quickly trained to become safe and efficient mineworkers.

6.13 MANAGEMENT OF MINING IN SOUTH OF PMA

ISK Minerals is aware that property owners/occupiers to the South of the PMA are concerned about potential disturbance from mining activities. Concerns are presumably about noise, light spill, dust, visual impact, water supplies and traffic, which have been addressed in the CER (Sections 4.3, 4.4, 4.5 and 4.6) and the November response to public comments (Sections 6.1, 6.2, 6.3, 6.4, 6.5 and 6.7).

A particular concern is understood to be the means by which mined ore will be transported to the concentrator. Several options are available to the proponent: these include belt conveyor, slurry transport and trucking. Moreover, it is possible to relocate the concentrator as mining progresses. At this stage of planning, no definitive plans have been made for the southern sections of the orebody. The areas in question are not scheduled to be mined for at least the first five years of the project, with detailed mining and ore-transport plans being developed on the basis of closer-spaced drilling results, operational experience and other similar factors.

Whatever methods are ultimately employed to transport ore to the concentrator, the commitments and management programmes mentioned above are considered capable of protecting nearby residents from disturbances.

6.14 ACCESS TO LAND

As pointed out in the CER and in the November response to public comments, ISK Minerals plans to sell of the land purchased for project activities as soon as is practicable after mining and rehabilitation. Such purchases represent a sizeable capital investment, and the proponent will be keen to recoup the outlays as expeditiously as possible, allowing for the fact that the land needs to have been stabilised and be demonstrably on the way to re-established agricultural productivity.

With regard to continued approaches to landowners to negotiate access to land for mining, ISK Minerals will professionally and ethically make representations to any owner until it is made obvious that the owner no longer wishes to receive such approaches.

The proponent is aware of interest in plans for obtaining access to land for mining. Commercial considerations make it inappropriate for property-specific plans to be discussed, but it can be re-stated that ISK Minerals intends to purchase land, arrange land swaps and/or leases and seek mining compensation agreements with various landowners.

Appendix 2

Proponent's commitments

SUMMARY OF ENVIRONMENTAL COMMITMENTS

As described in the previous sections, ISK Minerals is committed to responsible management of the environmental affairs of the Dardanup Mineral Sands Project.

The major environmental commitments by the company are as follows:

(1) Consult with landowners, the Department of Agriculture and the Water Authority of Western Australia to ensure that operations at Dardanup do not unreasonably affect agricultural enterprises in neighbouring properties, especially in relation to surface and groundwater.

(2) Continue hydrogeological and technical studies, including regional monitoring of water bores, to facilitate pre-emptive prediction of impacts of mine dewatering on local and regional hydrogeology.

(3) Dispose of excess water in a manner agreed in consultation with the Water Authority of Western Australia and the Department of Agriculture.

(4) Ensure that backfilled mine areas have the capacity to transmit water from east to west in a fashion similar to that which currently occurs.

(5) Rehabilitate land disturbed by mining activities to restore agricultural productivity to levels at least equal to those which currently exist.

(6) Consult with the Department of Agriculture, the Water Authority of Western Australia and landowners to include native vegetation in rehabilitation strategies, with a view to contributing to the management of the localised and regional hydrogeological problems of high water tables and salinity.

(7) Construct facilities, stockpiles and the like with consideration to visual impact from both public and private locations in the area and region.

(8) Minimise clearing and land disturbance, consistent with safe and efficient operations.

(9) Licence all bores and other water supply and water management facilities in accordance with the requirements of the relevant legislation, particularly the Rights in Water and Irrigation Act 1914.

(10) Consult with the State Energy Commission of Western Australia and relevant landowners to determine the most acceptable means of extending the existing 22 kV agricultural supply transmission line to the mining area.

(11) Enrich and establish native vegetation alongside existing permanent public roads and roads developed or disturbed as a result of project activities.

Summary and recommendations

ISK Minerals Pty Ltd proposes to mine a deposit of mineral sands at Dardanup, approximately 15 kilometres east of Bunbury (Figure 1). The proposal, which was referred to the Environmental Protection Authority, has been assessed at the Consultative Environmental Review level.

The proponent currently operates a mineral sands mine and concentrating facility at Waroona and a dry separation plant at Picton, near Bunbury. The proposed mining operation at Dardanup, which would progressively replace the Waroona mine, has an expected life of at least 10 years.

The Dardanup heavy mineral sand resource is a low grade deposit and covers an area approximately 5 kilometres in length and 0.5-1.5 kilometres in width. Mining would be carried out using sluice or dry methods, at a rate of about 40 hectares per year. Water for mining operations would be provided from water removed from the mining area prior to mining and supplemented as necessary by pumping from deep bores. Areas to be mined would be mainly cleared farm land, and would be rehabilitated with the aim of returning agricultural productivity to levels at least equal to those which currently exist.

Primary separation of the ore to form a concentrate would occur on-site prior to transport. The heavy minerals concentrate would be trucked to the existing Picton plant via an extension of a gazetted easement called Dowdell's Road to South West Highway. The Picton plant's facilities would be expanded to accommodate the increased throughput of heavy minerals concentrate. This expansion would be reviewed separately.

The proponent undertook a public consultation programme to inform nearby residents and landowners of the proposed mine. Many of the matters raised during early public consultation were incorporated into the proposal during the planning of the project. Towards the later stages of the public review, concern was voiced about a lack of opportunity for the community to discuss long term planning issues related to the project. The proponent intends to extend the consultation through the construction and operational phases of the project.

During the public review period 18 submissions were received. The submissions include comments from individuals, a local community group and government departments.

Several issues were raised by the public, the proponent and the Environmental Protection Authority in response to the proposal and these have been addressed either by the proponent or the Authority. The major environmental issues considered during the assessment of the proposal have been addressed as follows:

- **Surface water**

  Agricultural enterprises on neighbouring properties depend on water levels in drains, irrigation channels and streams which could be significantly affected by any major disruption to the water supply system.

  On a regional scale, water from the proposed mining operations is not expected to significantly affect the surface waters in the area. On a local scale, the operations could impact downstream properties, especially during the wet winter season. The proponent has detailed monitoring and management procedures to minimise the impact of surface water level fluctuations on the environment throughout the construction and operation of the mine, including commitments to:

  - dispose of excess water in a manner agreed in consultation with the Water Authority of Western Australia and the Department of Agriculture (eg use existing irrigation channels to prevent flooding in the wet season and release water into water courses from on-site dams if required during the dry season); and
  - consult with landowners and relevant government departments to ensure that operations at Dardanup do not unreasonably affect agricultural enterprises in neighbouring properties, especially in relation to surface and groundwater.

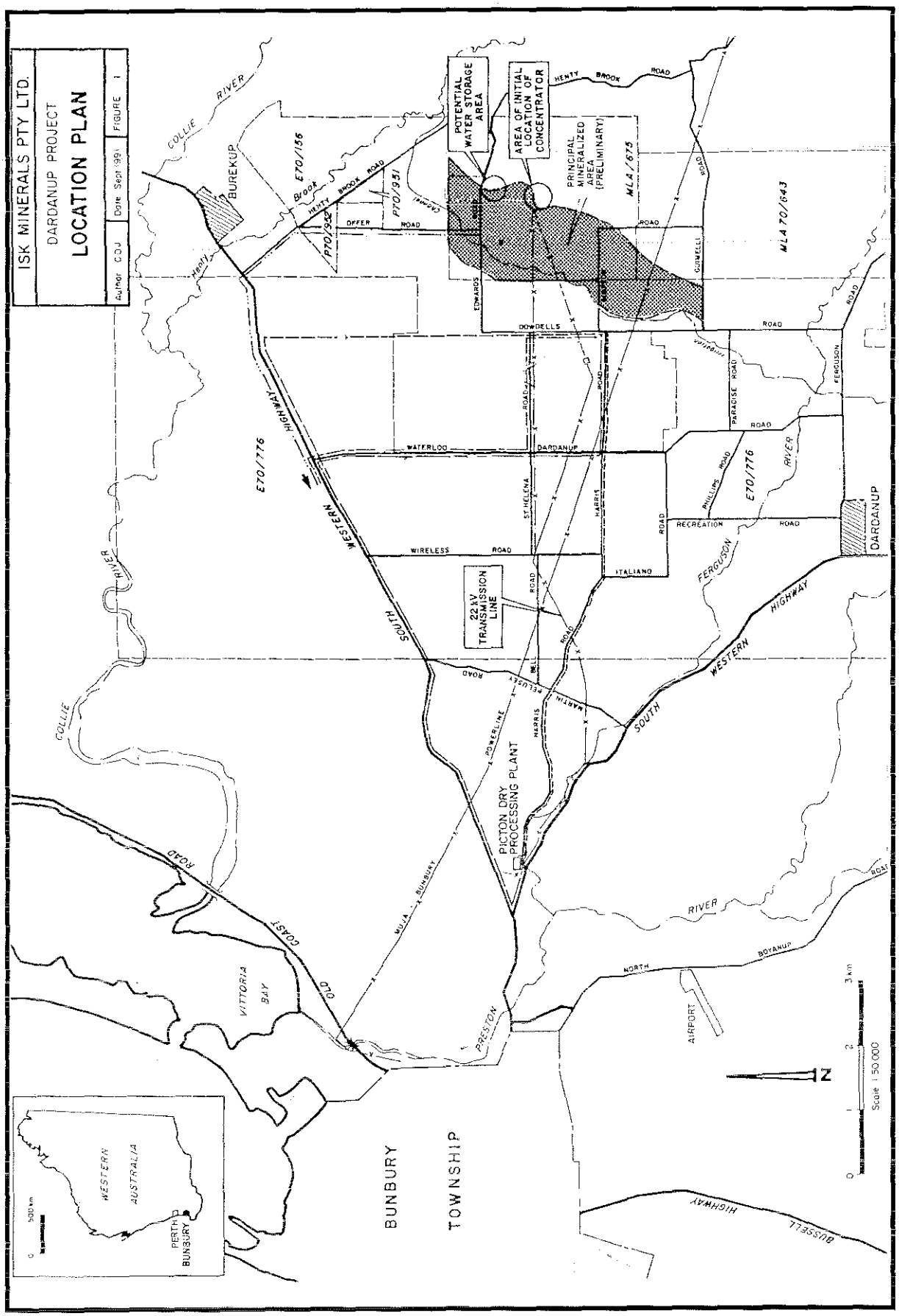

Figure 1. Location of proposed Dardanup mineral sands mine