Red October Gold Project, 80 km south of Laverton

Sons of Gwalia Ltd

Report and recommendations
of the Environmental Protection Authority

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Summary and recommendations

Sons of Gwalia Ltd (Sons of Gwalia), proposes to develop an open-cut gold mine with associated infrastructure on Lake Carey, a naturally occurring salt lake, 80 km south of Laverton. This report provides the Environmental Protection Authority's (EPA's) advice and recommendations to the Minister for the Environment on the environmental factors relevant to the proposal.

Section 44 of the *Environmental Protection Act 1986* requires the EPA to report to the Minister for the Environment on the environmental factors relevant to the proposal and on the conditions and procedures to which the proposal should be subject, if implemented. In addition, the EPA may make recommendations as it sees fit.

Relevant environmental factors

Although a number of environmental factors were considered by the EPA in the assessment, it is the EPA's opinion that the following are the environmental factors relevant to the proposal, which require detailed evaluation in the report:

(a) Vegetation communities - potential impacts from land clearing on geographically restricted plant communities;

(b) Rehabilitation - successful rehabilitation of the waste dumps, void, causeway, access roads and other disturbed areas;

(c) Surface water quality - potential for alteration of Lake Carey surface water quality from mine water discharges;

(d) Lake Carey - potential impacts on the function of the lakes system and catchment ecology; and

(e) Aboriginal culture and heritage - clearing and disturbance of land, and consultation with local Aboriginal communities.

Conclusion

The EPA has considered the proposal by Sons of Gwalia to develop the Red October Gold Project on Lake Carey.

The EPA is aware that this proposal, which has an expected life of two years, could be regarded as a demonstration project in relation to mining in Lake Carey and other similar proposals for mining in salt lake environments.

The EPA has concluded that the proposal is capable of being managed in an environmentally acceptable manner such that it is most unlikely that the EPA's objectives would be compromised, provided there is satisfactory implementation by the proponent of the recommended conditions set out in Section 4, including the proponent's commitments.

Recommendations

The EPA submits the following recommendations to the Minister for the Environment:

1. That the Minister notes that the project being assessed is for the development of the Red October Gold Project, an open-cut gold mine with associated support infrastructure on Lake Carey.

2. That the Minister considers the report on the relevant environmental factors as set out in Section 3;

3. That the Minister notes that the EPA has concluded that it is most unlikely that the EPA's objectives would be compromised, provided there is satisfactory implementation by the proponent of the recommended conditions set out in Appendix 3 and summarised in Section 4, including the proponent's commitments.

4. That the Minister imposes the conditions and procedures recommended in Appendix 3 of this report.

5. That the Minister notes "under other advice" that the EPA has recommended that the Minister writes to her Ministerial colleagues regarding the desirability of undertaking a review of opportunities to secure salt lakes in the conservation estate.

Conditions

Having considered the proponent's commitments and information provided in this report, the EPA has developed a set of conditions which the EPA recommends be imposed if the proposal by Sons of Gwalia for the Red October Gold Project is approved for implementation. These conditions are presented in Appendix 3. Matters addressed in the conditions include the following:

(a) that the proponent be required to fulfil the commitments in the Consolidated Commitments statement set out as an attachment to the recommended conditions in Appendix 3;

(b) that the proponent be required to prepare and implement an Environmental Management Plan; and

(c) that the proponent be required to prepare and implement a Rehabilitation and Decommissioning Plan.

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1. Introduction

This report provides advice and recommendations of the Environmental Protection Authority (EPA) to the Minister for the Environment on the environmental factors relevant to a proposal by Sons of Gwalia to develop the Red October Gold Project on Lake Carey, 80 km South of Laverton.

The proposal was referred to the EPA in September 1998 and the level of assessment was set at Consultative Environmental Review (CER) in recognition of the limited information available on the ecology and function of salt lakes upon which to assess the impacts from mining.

The proponent's CER was made available for public comment for a period of approximately 4 weeks from 25 January to 22 February 1999.

Further details of the proposal are presented in Section 2 of this Report. Section 3 discusses environmental factors relevant to the proposal. The conditions and procedures to which the proposal should be subject, if the Minister determines that it may be implemented, are set out in Section 4. Section 5 provides Other Advice of the EPA. Section 6 presents the EPA's Conclusions and Section 7, the EPA's Recommendations.

A list of people and organisations that made submissions is included in Appendix 1. References are listed in Appendix 2, and recommended conditions and procedures and proponent's commitments are provided in Appendix 3.

Appendix 4 contains a summary of the public submissions and the proponent's response. The summary of public submissions and the proponent's response is included as a matter of information only and does not form part of the EPA's report and recommendations. The EPA has considered issues raised in the public submissions when identifying and assessing relevant environmental factors.

2. The proposal

The Red October Gold Project is located on the western shore of Lake Carey, 80 km South of Laverton (Figure 1). The proposal to mine approximately 16 million tonnes of ore and associated waste material over a two year period involves development of an open-cut gold mine and waste rock dumps on the lake bed, and construction of mine infrastructure and borrow pits on Angelfish Island adjacent to the mining pit. A causeway would be constructed across the lake from material sourced from the island borrow pits and would link to a haul road constructed along the shores of the lake. A plan of the proposed site layout is shown in Figure 2. The ore would be transported along this constructed haul road and via a series of public roads to the proponent's existing treatment plant at Laverton. Development and mining of the open-cut would require discharge of mine water to the surface of Lake Carey over the life of the operation.

A summary of the key characteristics of the proposal is presented in Table 1. A detailed description of the proposal is provided in Section 4 of the CER document prepared by Sons of Gwalia entitled "Red October Gold Project 80 km South of Laverton", January 1999.

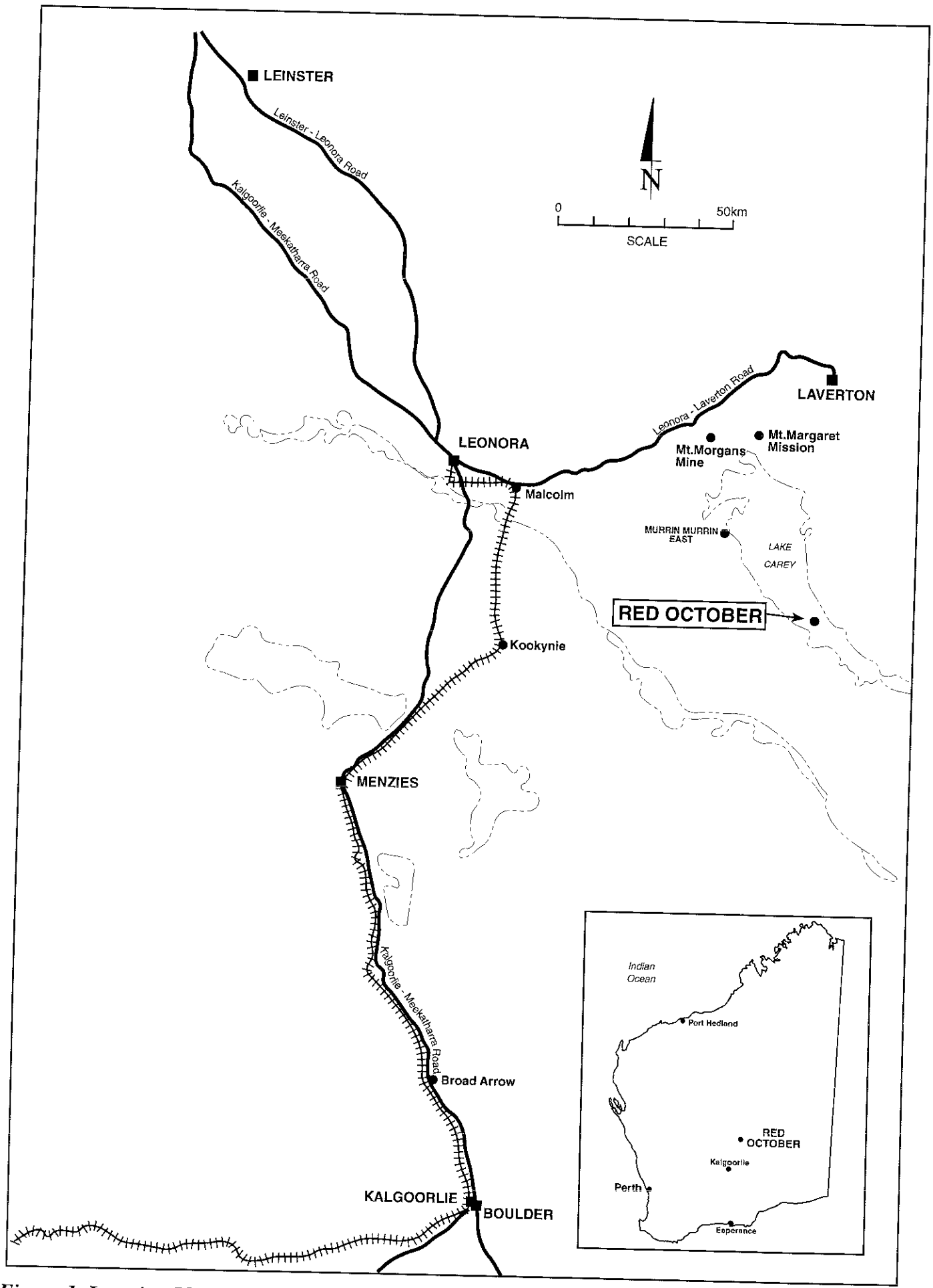

Figure 1. Location Plan Red October Gold Project.

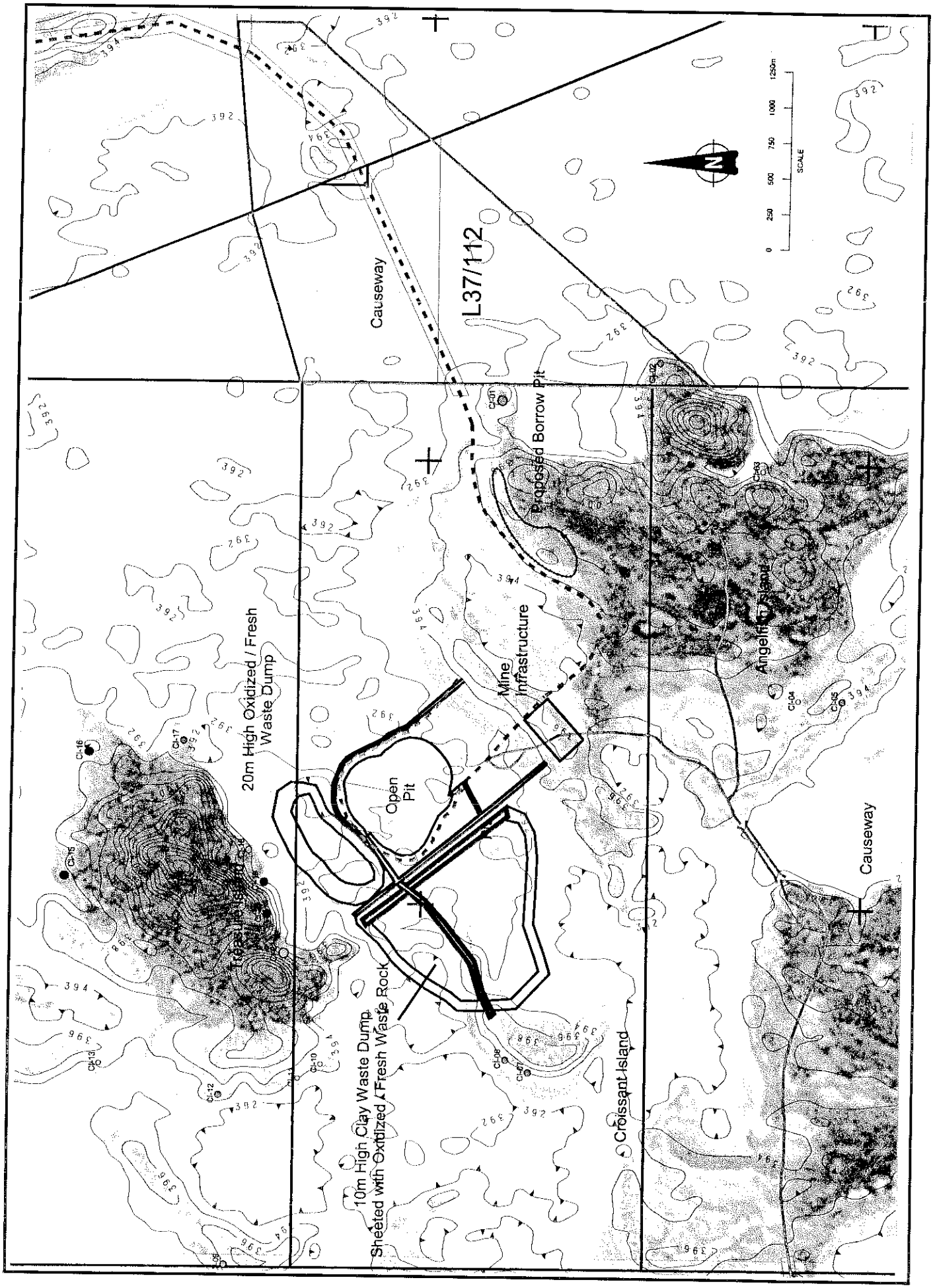

Figure 2. Site layout plan.

Table 1 - Summary of key proposal characteristics

Element	Description
Life of project	Approximately 2 years mining and 1 year development
Size of orebody	Approximately 16 million tonnes of ore and waste material
Mining rate	Approximately 275 000 tonnes (t) of ore and 7.75 million tonnes of waste per annum
Mining method	Truck and shovel
Depth of mining	Approximately 100 metres
Major components and area of disturbance (including access)	
Haul roads	36 ha
Causeway	20 ha
Open pit	36 ha
Waste dumps	80 ha
Infrastructure (workshops, stores and offices) and borrow pits	40 ha
Total estimated area of disturbance	212 ha
Water supply	Dust suppression - saline mine water: up to 800 kL/day Potable - from water supply dam: approximately 2 kL/day
Mine dewatering	800 kL/day discharged to Lake Carey
Water table depth	At surface
Fuel storage capacity	180 000 L (on Angelfish Island)

3. Relevant environmental factors

Section 44 of the *Environmental Protection Act 1986* requires the EPA to report to the Minister for the Environment on the environmental factors relevant to the proposal and the conditions and procedures, if any, to which the proposal should be subject. In addition, the EPA may make recommendations as it sees fit.

The identification process for the relevant factors is summarised in Table 2.

Having considered appropriate references, public and government submissions and the proponent's response to submissions, in the EPA's opinion, the following are the environmental factors relevant to the proposal:

(a) Vegetation communities - Potential impacts from land clearing on geographically restricted plant communities;

(b) Rehabilitation - successful rehabilitation of the waste dumps, void, causeway, access roads and other disturbed areas;

(c) Surface water quality - potential for alteration of Lake Carey surface water quality from mine water discharges;

(d) Lake Carey - potential impacts on the function of the lakes system and catchment ecology; and

Table 2 - Identification of Relevant Environmental Factors

FACTOR	PROPOSAL COMPONENT WITH POSSIBLE IMPACT	GOVERNMENT AGENCY AND PUBLIC COMMENTS	IDENTIFICATION OF RELEVANT ENVIRONMENTAL FACTORS
BIOPHYSICAL			
Biodiversity	Limited information is available on the ecology of salt lakes. Potential impacts may occur from discharges to the lake including impacts on biodiversity.	**Public:** Submissions expressed concern that there was a lack of information on biodiversity and that the full biodiversity of the area is unknown.	**Biodiversity is considered to be a relevant factor and is discussed under the factors of Lake Carey, Surface water quality and Rehabilitation.**
Vegetation communities	The proposal will result in the loss of native vegetation on Angelfish Island from the construction of infrastructure and borrow pits (40 ha) and on the shores of the lake from haul road and causeway construction (36 ha). Vegetation surveys identified two communities known as C5 and C6 on Angelfish Island, which may be locally restricted.	**CALM:** The intention to use saline water for dust suppression may impact on vegetation adjacent to the haul roads. 100 000 tonnes of gypsiferous sand have already been removed from Angelfish Island under DME approval. There is no indication as to what flora surveys were carried out prior to this extraction. Construction of haulroads can result in substantial regional impacts on vegetation communities from interference with drainage lines. It is unclear if the flora surveys of the islands and the haul road corridors are adequate. Lake frontage communities are poorly represented in the conservation reserves system and are heavily targeted for grazing. This proposal will further impact these communities.	**Vegetation communities is considered to be a relevant factor.**
Declared Rare and Priority Flora	No declared rare flora were found in the study area. One priority three species *Acacia kalgoorliensis* was located in the survey area. A *Halosarcia sp.* (Angelfish Island) that is as yet unidentified was also located on the fringes of Angelfish Island. The extent of its distribution is unknown.	**Public:** There is no information presented to support the claim that the poorly known *Halosarcia sp.* found around the fringes of Angelfish Island are secure at the site. **CALM:** Threatened flora searches should be extended beyond the immediate mine infrastructure footprint to ensure the risk of incidental damage is minimised. CALM has been supplied with copies of flora reports concerning *Acacia kalgoorliensis* by the proponent. CALM will discuss the results of the reports with the proponent once the information has been considered. *Halosarcia sp.* (Angelfish Island) is not currently listed as a CALM Priority species;	The proponent is required to comply with the CALM Act with respect to possible disturbance of Priority Three species, *Acacia kalgoorliensis*. An additional survey has been proposed by the proponent to confirm the extent of this species in the area of proposed disturbance. The results of the survey will be considered by CALM before any decision to disturb *A. kalgoorliensis* can be made. **Factor does not require further EPA evaluation.**

FACTOR	PROPOSAL COMPONENT WITH POSSIBLE IMPACT	GOVERNMENT AGENCY AND PUBLIC COMMENTS	IDENTIFICATION OF RELEVANT ENVIRONMENTAL FACTORS
Fauna	Clearing for construction of haulroads causeways and infrastructure will reduce fauna habitat in the short term. Causeways constructed across the lake can encourage the introduction of predators to the islands. Discharges to the lake have potential to impact aquatic fauna (eg. Brine Shrimps), which may potentially lead to subsequent impacts on breeding water birds.	**Public:** Submissions focused on the use of Lake Carey by water birds particularly during rainfall events, which are considered to be important triggers of biological activity. Aquatic fauna are known to be abundant during these rainfall events and there is known to be a correlation to water bird breeding events. Discharges from the mine may impact these important events. The ornithological study of Lake Carey conducted by Granny Smith mine recorded Banded Stilts using the lake. Sons of Gwalia made no reference in their report to this species of bird using the lake. There are concerns that studies of aquatic fauna have not been undertaken. It is understood that the Brine Shrimp (*Paratemia sp.*) may be found in Lake Carey. There is growing evidence of endemism of these species in the lake system. These species are apparently particularly susceptible to changes in pH and may be impacted by discharges from the mine. **Museum:** Recent work has shown that a unique subterranean aquatic fauna occurs in the ground waters of the Lake Way-Lake Carey paleo-drainage channel. **CALM:** With so little known about the ecology and function of Lake Carey, it is likely that the lake system plays a significant role in episodic water fowl breeding events. Available information from salt lakes in the region suggests that the habitat types found around this proposed mine (lake bays and wetlands) and Croissant Island, may be suitable as breeding sites for waterfowl. The islands are likely to support populations of vertebrate fauna. Ionic composition of water should be monitored at least once a year. The occurrence of salt lake Ostracods and to some extent Copepods is influenced by salinity, ratio of calcium to bicarbonate and sulphate levels. CALM understands that the aquatic fauna-sampling programme will sample for macro-invertebrates as well as micro-invertebrates. The sampling programme should survey for mobile invertebrates (such as spiders) that are found on the lake bed.	**Fauna is considered to be a relevant factor and is discussed under the factors of Lake Carey and Rehabilitation.**

FACTOR	PROPOSAL COMPONENT WITH POSSIBLE IMPACT	GOVERNMENT AGENCY AND PUBLIC COMMENTS	IDENTIFICATION OF RELEVANT ENVIRONMENTAL FACTORS
Lake Carey	Development of the mine may lead to local and regional impacts on the Lake Carey system. Discharges to the lake may impact on the aquatic fauna of the lake system. Construction of causeways and waste dumps on the lake bed can influence the surface hydrology of the lake. The creation of a mining void, providing a window to the water table, can influence the hydrology of the lake and lead to potential impacts on the quality of surface water in Lake Carey.	**Public:** Despite the small scale and short term nature of this project, there is potential for significant impacts on the lake system and catchment ecology. Particular attention needs to be focussed on haul road and causeway design, pit decommissioning minimising impacts on islands and minimising impacts on lake bed processes. The proponent refers to carrying out additional research investigations on Lake Carey. These studies should be undertaken before approval to mine is granted. **CALM:** The CER recognises there is a lack of basic understanding of Lake Carey faunal ecology and indicates the proponent and other companies are working cooperatively to improve this understanding. CALM supports this plan for cooperative investigations and should be involved in the design and review of the studies to ensure that the results provide adequate and relevant data for future environmental impact evaluations. There is concern about the mining void and causeways remaining after mining and the potential impacts this may have on lake hydrology. It was questioned as to how the void and causeway will affect water flow and hydrology of Lake Carey in the long term.	**Lake Carey is considered to be a relevant factor.**
Landform	Lake areas are relatively flat with a series of low islands on the lake. The mining void and waste rock dumps constructed on the lakebed will impact the landform of the local area.	**DME:** DME has discussed with the proponent the possibility of revising the conceptual mine plan to design the waste dump in such a way as to mimic the islands and features of the lake. DME has also been exploring alternative options for the relinquishment of the mining void that can ensure rehabilitation is consistent with safety and risk requirements of the Mining Act but may result in a landform appropriate to the salt lake environment.	**Landform is considered to be a relevant factor and is discussed under the factor rehabilitation.**

FACTOR	PROPOSAL COMPONENT WITH POSSIBLE IMPACT	GOVERNMENT AGENCY AND PUBLIC COMMENTS	IDENTIFICATION OF RELEVANT ENVIRONMENTAL FACTORS
Rehabilitation	Mining will result in construction of waste rock dumps on the lake bed and a mining void that will remain at the end of the mine. These areas will require rehabilitation. Haulroads and causeways will be constructed to provide access to the mining area. If these facilities are no longer required at the end of the mining operations they will also require rehabilitation.	**Public:** The proponent has indicated that they will not rehabilitate waste dumps in the normal sense. Given that the waste rock placed in these dumps is saline, how does the proponent intend for these dumps to be rehabilitated? Will the proponent investigate alternative rehabilitation options or carry out rehabilitation trials for the waste dumps? Has the proponent considered using the material from the causeway to rehabilitate the dump at the end of the mine life? What monitoring is the proponent proposing for the waste dumps and disturbed parts of the islands to ensure their rehabilitation is successful? The mining void should be backfilled with waste. **DME:** Mine closure and rehabilitation plans need to be provided prior to the start of operations. **CALM:** There are concerns that the proposed waste dump may not be stable. Given the flooding dynamics of the lake environment, erosion of the waste dump could lead to pollution of Lake Carey. What measures has the proponent proposed to prevent erosion of the waste rock dumps? What monitoring will be implemented to ensure the waste dumps are stable? CALM is unlikely to support retention of the causeway as it will interrupt the flow of the lake in the long term and introduce predators to the islands. The culverts installed to maintain the flow in the lake will require long term maintenance to ensure they do not become clogged in the future. If the proponent is proposing to retain the causeways, who will be responsible for maintenance of the culverts and how will predators be prevented from accessing Lake Carey via the causeway?	**Rehabilitation is considered to be a relevant factor.**

FACTOR	PROPOSAL COMPONENT WITH POSSIBLE IMPACT	GOVERNMENT AGENCY AND PUBLIC COMMENTS	IDENTIFICATION OF RELEVANT ENVIRONMENTAL FACTORS
POLLUTION			
Particulates/Dust	Mining operations, particularly transport along the haul road may generate dust. Air quality is generally of high quality in this remote location, although high levels of fugitive dust are a common occurrence during regular periods of high wind speed.	No comments were received.	It is noted that a DEP pollution control licence will apply to the proposal and that this can specify management and limits to control dust generation. The proponent is required to comply with the requirements of the DME with regard to dust. **Factor does not require further EPA evaluation.**
Greenhouse gas emissions	Anticipated emissions of carbon dioxide is estimated to be 14.5 tonnes per annum based on diesel fuel consumption of 5 million litres per annum. Minor CO_2 emissions will also result from vegetation clearing.	**Public:** Public submissions queried how the proponent will ensure that the contract for mining will be considered on environmental grounds and how will the company ensure the contractor implements their requirements to use efficient equipment.	The primary source of Greenhouse gas emissions resulting from internal combustion engines in mining equipment comprises a very small amount of Greenhouse gases. The contractor is required by the proponent to stipulate the equipment to be used in the mining and haulage contracts. Machinery can be selected from an efficiency perspective. Greenhouse gas emissions related to vegetation clearing are not considered significant given the sparse woodland and salt flats present. Rehabilitation of the cleared areas will reduce the total carbon dioxide losses in the long term. **Factor does not require further EPA evaluation.**

FACTOR	PROPOSAL COMPONENT WITH POSSIBLE IMPACT	GOVERNMENT AGENCY AND PUBLIC COMMENTS	IDENTIFICATION OF RELEVANT ENVIRONMENTAL FACTORS
Groundwater quality and quantity	Ground water abstraction to de-water the mine will lead to drawdown of the water table in the vicinity of the mine.	No comments received.	Ground water abstraction will require a Waters and Rivers Commission (WRC) licence. The proposed mine falls within the Goldfields Groundwater Area and any application for a WRC licence will require the proponent to demonstrate that the drawing of water from this mine would not have any effect on the water supplies of any other users in the area. **Factor does not require further EPA evaluation.**
Surface water quality	The mine will result in discharge of mine de-water to Lake Carey (800 kL/day). The local and regional impacts on surface water quality from discharging saline ground water to the environment can be significant. There is potential for mining operations to contaminate (hydrocarbons) the discharge water.	**Public:** The submissions discussed the effect that changes to the quality of surface water as a result of mine discharges, may have on the ecology of Lake Carey. It was noted that the quantitative effects of discharging volumes of saline water onto the lake surface are largely unknown. **CALM:** The CER identifies a settling dam for mine water but does not specify its design or location.	**Surface water quality is considered to be a relevant factor.**
Social Surroundings			
Risk and hazard	There is currently little human activity in the area. Almost all activity that exists is mining related. Public safety issues primarily relate to ensuring the remaining final void does not pose a risk.	**DME:** The proponent is required to comply with the Mines Act with respect to public safety and the remaining mine void.	The remaining final void is required to satisfy the Mines Act with respect to public safety. The proponent is investigating an alternative option to constructing a safety bund. This is discussed further under the factor 'Rehabilitation'. **Factor does not require further EPA evaluation.**

FACTOR	PROPOSAL COMPONENT WITH POSSIBLE IMPACT	GOVERNMENT AGENCY AND PUBLIC COMMENTS	IDENTIFICATION OF RELEVANT ENVIRONMENTAL FACTORS
Road transportation	Proposal will require construction of haul roads and additional access to the mine. Traffic in the area is almost wholly mining related or services the pastoral community.	No comments received	Access roads to the project area are subject to the requirements of the local government authority. Roads on the mine site are subject to the requirements of the Mining Act. The proponent has indicated it will consult with the DME and the Local Government Authority to ensure roads are adequately managed and sign posted. Some access roads may remain after project decommissioning if they have ongoing value as local infrastructure. **Factor does not require further EPA evaluation.**
Aboriginal culture and heritage	Mining operations will result in disturbance of two archaeological sites on Croissant Island. The local Aboriginal Community (Mt Margaret) has previously demonstrated cultural association with Lake Carey and its surrounds.	**Aboriginal Affairs Department:** The proponent has addressed the requirements of the Aboriginal Heritage Act 1972. The company has submitted a Section 18 application to the Aboriginal Cultural Materials Committee, to disturb two sites located on Croissant Island. The proponent has indicated the proposal is supported by the Mt Margaret Aboriginal Community.	**Aboriginal culture and heritage is considered to be a relevant factor.**

(e) Aboriginal culture and heritage - clearing and disturbance of land, and consultation with local Aboriginal communities.

Details on the relevant environmental factors and their assessment is contained in Sections 3.2 - 3.6. The description of each factor shows why it is relevant to the proposal and how it will be affected by the proposal.

The assessment of each factor is where the EPA decides whether or not a proposal meets the environmental objective set for that factor.

A summary of the assessment of the environmental factors is presented in Table 3.

3.1 Vegetation communities

Description

The project will involve clearing of vegetation for the development of mine infrastructure, borrow pits and the haul road (total 76 ha). Although other land will be required for the mining pit, causeway and waste dumps (136 ha), this part of the development will occur on the lakebed, which is not vegetated.

The mining proposal is located in the Laverton and Edjina sub-regions of the Austin Botanical district which is in the Eremaean Botanical Province.

The Eremaean Botanical province is typified by plants from the Mimosaceae (*Acacia spp.*), Caesalpiniaceae (*Senna spp.*), Myoporaceae (*Eremophila spp.*), Chenopodiaceae (Samphires, Bluebushes, Saltbushes), Asteraceae (Daisies) and Poaceae (Grasses).

The Austin Botanical District is essentially Mulga woodland (*Acacia aneura*) with perennial grasses such as Spinifex (*Triodia spp.*) and annuals such as daisies that are present in spring and late winter.

Flora surveys were completed in May and November 1998 (Mattiske 1998) for areas potentially impacted by this proposal. The areas surveyed included Angelfish and Croissant Islands, the shore of Lake Carey in the area where the causeway would cross, and extending inland following the route of the proposed haul road.

The results of the flora survey conducted by Mattiske (1998) were compared to the regional vegetation descriptions developed from surveys conducted by Hall et al. 1994, Howes et al. 1994 and Beard 1974, 1975.

A total of 30 families, 57 genera, 122 species and 129 other varieties and sub species were recorded in the study area. No Declared Rare Flora were located. One Priority Three species, *Acacia kalgoorliensis* was found in the survey area.

A series of vegetation communities were identified and mapped in the survey area (Figure 3). Angelfish Island recorded woodland communities of *A. aneura* and *Casuarina pauper* on the higher areas, with shrubland communities dominated by Chenopods on the island shores. The survey of the lakes edge recorded similar Chenopod dominated shrublands close to the shore with low woodlands of *C. pauper* higher in the landscape.

Two plant communities, C5 and C6 were identified in the consultant's report as being locally restricted. Community C5, a low shrubland of *Eremophila pantonii* with *A. kalgoorliensis* (Priority Three Species) was found along the Penny Weight Point camp access road that is proposed to be widened. Community C6, is a low Chenopod shrubland associated with clay loam soils in low-lying areas of Angelfish Island.

The consultant's report concluded that the vegetation communities identified in the survey area do not appear to be locally or regionally significant, with the exception of plant communities C5 and C6, which may be locally restricted.

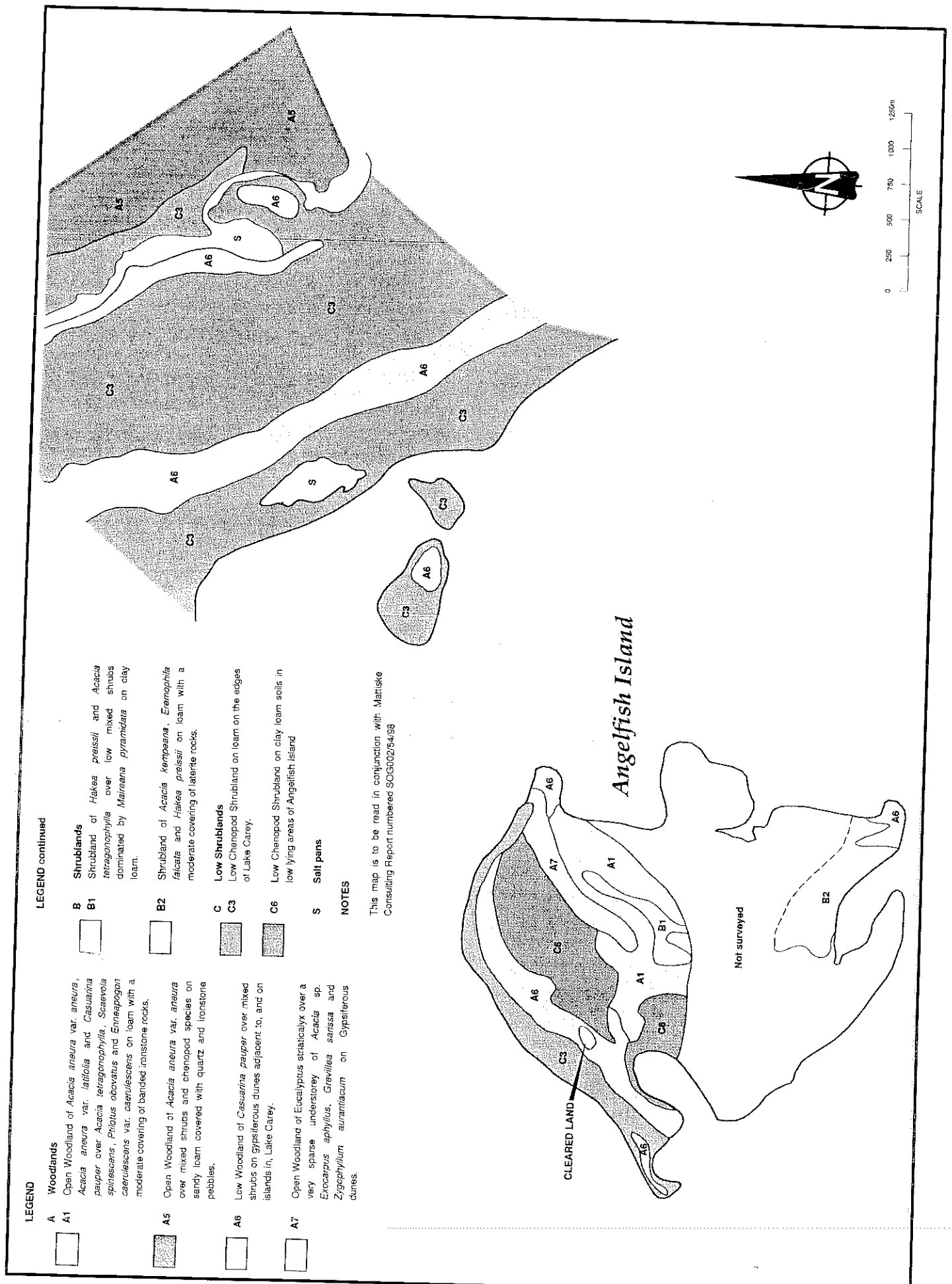

Figure 3. Vegetation map. Angelfish Island and Lake Carey (Source: Mattiske Consulting).

A survey of lakebed and fringing flora carried out by Actis Environmental Consultants (1998) discovered a poorly known *Halosarcia* species around the fringes of Angelfish Island. The Department of Conservation and Land Management (CALM) has advised that the species appears secure at the site at present.

Submissions on the CER

CALM raised concerns that the haul road could result in substantial regional impacts on vegetation from interference to drainage lines. The intention to use saline water for dust suppression on the haul road may also have impacts on adjacent vegetation.

CALM requested further information on the width of the corridor surveyed along the proposed route of the haul road to determine if the survey adequately represented the area potentially impacted by the construction of the haulroad and its future operation.

CALM advised that lake frontage communities are poorly represented in the conservation reserves system and are heavily targeted for grazing in this region. There is potential for this project to further impact communities already affected by grazing.

CALM confirmed that the *Halosarcia* species Angelfish Island identified during the flora survey of the lake bed is not currently listed as a Priority species.

Assessment

The area considered for assessment of this factor is the islands and foreshore of Lake Carey and the mining tenements covering the haul road (L38/76, L38/72, L38/98 and L38/99).

The EPA's environmental objective for this factor is to maintain the abundance, species diversity, geographic distribution and productivity of vegetation types and communities.

The EPA notes the results of the flora survey (Mattiske 1998) carried out in the areas potentially impacted by the proposal and that the vegetation communities identified in the proposal area are consistent with the regional descriptions of vegetation communities. The EPA also notes the conclusion of the consultant that it is likely the vegetation communities impacted by this proposal are well represented in the region, with the exception of the communities identified as C5 and C6.

In response to the issues raised by CALM, the proponent confirmed that a 70m wide corridor was surveyed along the proposed route of the haul road. The final width of the haul road is proposed to be 15 metres and hence it is considered that the area surveyed is adequate to identify potential impacts from its construction and operation. The proponent also confirmed in its response to submissions that the final alignment of the haul road would consider the local drainage lines identified during the vegetation survey. The final design would include culverts and floodways to ensure that diffuse drainage, known to be important to the survival of the vegetation of the region, is maintained.

The EPA notes that lake frontage communities will be affected by this proposal. The area affected is limited to a small area where the proposed haulroad crosses to the lake. The proponent has included a commitment to develop management procedures that restrict the area of disturbance (commitment 5). It is the opinion of the EPA that the area of lake frontage communities affected by this proposal is not significant.

The flora surveys identified communities C5 and C6 that were considered to be locally restricted. The proponent has committed to conducting an additional field survey to review the extent of plant community C5 that contains the Priority Three Species, *A. kalgoorliensis*. The impact on *A. kalgoorliensis* is limited to plants that will be disturbed as a result of widening the Penny Weight Point camp access road. Any decision to disturb *A. kalgoorliensis* would be subject to the requirements of the CALM Act. The EPA notes that the proponent is currently consulting with CALM in order to demonstrate that the species is secure in the area of the proposed disturbance.

Community C6, found on Angelfish Island, was also considered by the consultant to be locally restricted. The EPA notes that community C6 does not contain Priority species and that the species contained within this assemblage are common both locally and in the region. The impacts on community C6 would result from the establishment of mine facilities. The proponent has made a commitment (commitment 5) to ensure that the final plan for the placement of this infrastructure will limit unnecessary disturbance of this vegetation community by placing mining infrastructure on areas already disturbed on the island.

In summary, the area of vegetation proposed to be disturbed or cleared as a result of the proposal is limited to 40 hectares to develop infrastructure and borrow pits on the islands and an additional 36 ha to construct the haul road from the shore of Lake Carey to connect with existing roads in the region. The EPA considers that the vegetation communities impacted by the proposal are well represented in the region with the exception of locally restricted communities C5 and C6. The total area of vegetation disturbed (76 ha) is considered to be small in a regional context.

With regard to the impacts on the locally restricted communities C5 and C6, it is considered that careful planning and placement of mining facilities can manage the impacts on these communities, however any decision to impact plants of Priority Three species *Acacia kalgoorliensis,* will be subject to the proponent satisfying the requirements of the CALM Act.

The EPA notes that the plan that details the proposed location of mining facilities, infrastructure and the haul road has not been finalised.

The EPA considers that development of a management plan incorporating the measures identified by the proponent to limit the impacts on vegetation communities is essential. The management plan should be completed prior to the start of ground-disturbing activities to ensure that planning decisions take full account of the proposed measures to limit disturbance.

The EPA therefore recommends the development of an Environmental Management Plan, which will be required prior to the start of ground-disturbing activities.

Summary

Having particular regard to:

(a) the results of flora surveys which indicate the vegetation communities found in the project area are not regionally significant with the possible exception of communities C5 and C6;

(b) the proponent's commitment to conduct an additional flora survey to determine the extent of community C5 ;

(c) the requirement of the proponent to comply with the CALM Act with regard to disturbance of Priority Three species *Acacia kalgoorliensis;* and

(d) the small area of vegetation clearing required (approximately 76 ha),

it is the EPA's opinion that the proposal is capable of being managed to meet the EPA's environmental objective for vegetation communities, provided that a Environmental Management Plan, which incorporates the measures proposed by the proponent to limit impacts on vegetation communities, is prepared prior to the start of ground-disturbing activities (refer draft condition 3).

3.2 Rehabilitation

Description

The mining proposal will result in the disturbance of vegetation on Angelfish and Croissant Islands for the construction of mine facilities and borrow pits (40 ha) and along the proposed route of the haul road (36 ha). In addition to the areas of vegetation to be disturbed,

approximately 136 ha (0.18%) of the lake will be impacted by waste dumps, the mining pit and the causeway. At the completion of the project, the mine facilities will require decommissioning and the areas disturbed (a total of 212 ha) will require rehabilitation.

The mining operations will be subject to the requirements of the *Mining Act 1978* with respect to mining and rehabilitation. The Department of Minerals and Energy (DME) has existing guidelines for the rehabilitation of open-cut mining operations. The Mining Act will require the proponent to submit a rehabilitation bond that is calculated on the amount of area disturbed by the mine. The bond is held by DME until such time as the area is satisfactorily rehabilitated.

The proponent has acknowledged that guidelines for the rehabilitation of mining operations in the salt lake environment are not well established. In the absence of these guidelines the proponent has proposed to adopt the DME completion criteria for open-cut mining operations.

Submissions

Public submissions noted that saline rock in the waste dumps would be difficult to revegetate and it was suggested that rehabilitation trials should be conducted on waste dump materials. Further detail of the proposed rehabilitation monitoring programme referred to in the CER were requested.

DME suggested that alternative rehabilitation methods for the mining void and waste dumps should be considered.

DME specified that mine closure and rehabilitation plans need to be provided prior to the start of mining operations.

CALM raised concerns that the waste dumps may not be stable in an area where major flooding events are known to occur. Erosion of the waste dumps could lead to pollution of Lake Carey.

CALM is unlikely to support the retention of the causeway at the completion of mining as it is considered that it will interrupt the flow of water across the lake in the long term and may encourage the introduction of predators (such as cats and foxes) to the lake islands.

Assessment

The area considered for assessment of this factor is mining leases 39/411-413 (Angelfish Island, mining pit and waste dumps) and miscellaneous licences L38/76, L38/72, L39/99, L39/100 and L39/86 (causeway and haul roads).

The EPA's environmental objective for this factor is to ensure that the proposal area and any other area affected by the proposal, is rehabilitated to a standard consistent with the intended post mining long- term land use.

The proponent has acknowledged that there is a general lack of guidelines relating to the rehabilitation of mining operations in the salt lake environment and has proposed, that in the absence of these guidelines, they adopt the existing DME guidelines for rehabilitation of open cut mines.

The EPA notes however, that mining is currently occurring at Lake Lefroy, a salt lake near Kambalda, and that mining operations in this location are being rehabilitated on a progressive basis. There is therefore some experience available regarding rehabilitation in the salt lake environment although this experience is somewhat limited.

Although there are no specific guidelines for the rehabilitation of mining operations in the salt lake environment, it is the EPA's view that the components of this mining proposal (waste dumps, void, causeway and haul road) are not significantly different from the components of similar existing gold mining projects operating through out the State. Generic guidelines for mining and rehabilitation of open-cut mines prepared by the DME can provide a framework for rehabilitation in Lake Carey.

It may not be appropriate to impose the existing rehabilitation guidelines without first understanding the impacts that components of the proposal may have on the salt lake environment.

The following components of the factor were considered:

Causeway

The impacts of the causeway primarily relate to operational impacts during its construction and use over the life of the mine and the potential of the causeway to disturb surface water flows across Lake Carey.

The EPA notes the advice of CALM that the causeway may also lead to an increase in the number of predators on the islands.

The EPA's assessment of this factor has noted that the causeway will be constructed with culverts and the proponent has committed to developing a monitoring programme (commitment 3) to determine the effectiveness of the culverts in maintaining surface water flows. The EPA considers that the operational impacts of the causeway can be managed in this way.

At the cessation of mining, a decision will be required as to whether the causeway will remain or alternatively be removed, and the area rehabilitated. The proponent has expressed the view that the decision to retain the causeway is largely dependent on whether the causeway is required by the local community, hence they have proposed that the decision would be made in consultation with the Local Government Authority.

The EPA, whilst acknowledging that the causeway may provide community benefit if it is retained, considers that the decision will depend on the outcome of the proposed culvert monitoring programme and demonstration that the causeway is not significantly affecting surface water flows across the lake or leading to an increase in predators accessing the islands. At such time as this has been demonstrated, a decision on whether the causeway can be retained for community benefit can be made (commitment 7). If it is concluded that the causeway is significantly affecting water flows across the lake or leading to an increase in predators on the islands, it is the EPA's opinion that it will need to be removed and the lake bed rehabilitated.

Void

The EPA notes that the area of the mining void is approximately 36 ha which represents 0.05% of Lake Carey. The area affected by the void is considered small with respect to the size of Lake Carey.

Existing rehabilitation guidelines for mining voids as proposed in the CER involve the establishment of a competent safety wall around the pit to exclude access and ensure public safety. During the life of the mine, this wall would also act to exclude the lake water from the mining pit.

DME in their submission expressed a view that competent material for the construction of the safety wall may not be available. In this environment, it is also likely that a significant rainfall event may breach the bund and render it ineffective at some point in time.

The DME suggested an alternative method which could still fulfil the requirements of DME with respect to public safety, but which may achieve an outcome that is more consistent with the landscape and environment of the lake. The alternative method would involve contouring (reducing the batter angle) the upper levels of the pit to several metres below the expected final resting water level in the pit. In the CER it is indicated that the resting water level in the pit after mining ceases will be at or near surface. The proponent in its response to submissions has committed to reviewing the suitability of this option with the DME.

In considering the alternative method proposed by the DME, the EPA notes that it has been successfully used at mining operations in the south west of the State where the final resting water table is known to be close to the surface. The EPA also acknowledges that some caution is required before applying this method in the salt lake environment. This is due to the possible environmental impacts from allowing ground and surface waters to mix and the potential this exchange of saline water with the surface waters of the lake, may have on the function of the

salt lake system. This exchange may be of particular importance during high rainfall events where fresh water conditions are known to occur on the lake's surface. The exchange of saline water with the surface water during these events has potential to impact the life cycle of invertebrate species that are reliant on the prevailing freshwater conditions.

The EPA therefore considers that the alternative proposal for rehabilitation of the mining void has potential to provide a rehabilitation outcome which is more consistent with the landscape and environment of Lake Carey. This alternative rehabilitation method should be considered in further detail and compared with the existing DME guidelines for rehabilitation of open-cut operations before deciding if it is appropriate to apply this method in the salt lake environment.

The EPA recommends that the options for rehabilitation of the mining void and a framework for conducting a comparison of the potential impacts on the function of Lake Carey should be outlined in the Environmental Management Plan. The outcome of this review should be reported in a Rehabilitation and Decommissioning Plan and the preferred rehabilitation method that is best suited to limiting the impacts of a mining void in the salt lake environment can be specified.

Haul road, islands and borrow pits

The impacts from construction of the haul road and on the islands from development of mine facilities have already been addressed in some detail in section 3.1, under the environmental factor "Vegetation communities".

The DME's generic guidelines requiring these areas to be satisfactorily rehabilitated are not considered to require any specific adaptation to the salt lake environment. This is provided that the measures proposed to limit the areas disturbed and impacts on drainage, as discussed in section 3.1, are incorporated into the Environmental Management Plan. The EPA considers that rehabilitation objectives, a monitoring programme and performance criteria should be established for all disturbed areas and therefore recommends that the proponent include these details in the Rehabilitation and Decommissioning Plan.

Waste dumps

The DME's guidelines cover the construction and rehabilitation of waste dumps. The DME in its submission raised the possibility of modifying the generic design of waste dumps, proposed in the CER, with a design that would mimic the naturally occurring islands of Lake Carey.

The EPA notes that the alternative design may result in a greater area of impact (footprint) than the generic design, however it is considered that a design that mimics the islands is more appropriate to the landscape of Lake Carey and this can reduce the overall impact of the proposal. The company has committed to developing a revised design for the proposed waste dumps in consultation with the DME.

The issues of erosion of the waste dumps and the possible difficulties that may be encountered revegetating saline tailings, exposed at the surface, was also noted by the EPA. The proponent in addressing this issue has undertaken an initial review of the landscape and topography of the islands. It showed that sections of the islands are covered in basalt rock which prevents erosional processes occurring on the island. Plant communities were also found to be growing in the saline habitat with several species adapted to growing in saline soils.

The basalt rock found on the islands is also known to occur in the mining pit and hence will form part of the waste dump. It is now proposed by the proponent that through careful planning of the waste dumps, available rock and soil materials can be used to create a range of habitats that are resistant to erosion. Creation of habitat types similar to those naturally occurring on the islands should also encourage revegetation and provide habitat for fauna on the waste dumps.

The EPA supports the plan to design waste dumps to mimic the islands of Lake Carey. The EPA recommends that the final agreed design for the waste dumps should be included in the Environmental Management Plan and performance criteria for stability and vegetative cover of the waste dumps should be discussed in the Decommissioning and Rehabilitation Plan prepared by the proponent.

After considering the rehabilitation proposal presented in the CER, the EPA has concluded that the DME's generic guidelines for open-cut mining operations can provide a framework for the rehabilitation of the components of this proposal. The EPA notes however that this proposal presents an opportunity to modify these existing guidelines and thereby develop guidelines that are more appropriate to mining and rehabilitation in the salt lake environment.

The EPA supports the proposal to consider alternative rehabilitation options for the waste dump and mining voids, provided more information on the outcome of the review is presented in management plans.

The EPA recommends that the options for rehabilitation of the components of this proposal should be outlined in a Environmental Management Plan along with the criteria upon which the options to be considered will be evaluated. The Decommissioning and Rehabilitation Plan should report the outcome of the evaluation, specify the preferred rehabilitation method and establish criteria to monitor performance and in this way demonstrate that mining operations in the salt lake environment can be successfully rehabilitated.

Summary

Having particular regard to:

(a) the existence of DME guidelines for the rehabilitation of open-cut mining operations that provide a framework for rehabilitation in the salt lake environment;

(b) the opportunity to develop alternative rehabilitation methods for waste dumps and the mining void which can lead to rehabilitation methods that may be more appropriate to mining operations in the salt lake environment;

(c) the commitments of the proponent to develop a monitoring programme to determine the effectiveness of the culverts in maintaining surface water flows across the lake and reporting the results of that monitoring programme before a decision is made as to whether the causeway will remain at the end of mining;

(d) the proposal will be subject to the requirements of the Mining Act with respect to mining and rehabilitation; and

(e) the Mining Act also requires a rehabilitation bond to be provided by the proponent which cannot be released until such time as the area is satisfactorily rehabilitated,

it is the EPA's opinion that the proposal can be managed to meet the EPA's environmental objective for Rehabilitation, provided that the options for rehabilitation of the mining void, waste dumps and causeway, and a framework for their evaluation are included in the Environmental Management Plan (refer draft condition 3). Following evaluation of the rehabilitation options the proponent should prepare a Rehabilitation and Decommissioning Plan that details the objectives of the rehabilitation programme for the components of the mine. It should specify performance criteria and a monitoring programme upon which to assess the success of the rehabilitation programme (refer draft condition 4).

3.3 Surface water quality

Description

The development and operation of the mining pit in the bed of Lake Carey will require de-watering of the mining pit and discharge of an estimated 800 kL per day of saline water to the lake system.

The proponent investigated the impacts that this discharge may have on the surface waters of Lake Carey. The quality of the discharge water was compared to the quality of the surface brine found on the lake. The results indicated that the surface brine is not significantly different to the discharge water with the exception of calcium concentrations. The surface water has a high level of calcium due to the large deposits of gypsum on the surface.

Noting that surface conditions on the lake are not always saline (particularly during high rainfall events where fresher water conditions may prevail), the proponent has also considered the impacts that this saline discharge may have during these natural fluctuations in the quality of surface waters. The relative merits of a confined versus an unconfined discharge were examined. It was concluded that an unconfined discharge was the preferred option for disposal.

There is potential for contamination of the discharge water in the pit environment, primarily from hydrocarbons. An intermediate settling dam that includes suitable pollution control equipment has been proposed by the proponent to prevent the introduction of contaminants to the lake system.

Submissions

Public submissions discussed the effect that changes to the quality of surface water may have on the ecology of Lake Carey. Submissions noted that the quantitative effects of discharging volumes of saline water on to surface of Lake Carey are largely unknown.

CALM noted that a settling dam for mine water was proposed, but its design and location was not specified.

Assessment

The area considered for assessment of this factor is Lake Carey.

The EPA's environmental objective for this factor is to maintain or improve the quality of surface water to ensure that existing uses including ecosystem maintenance are protected.

The EPA has noted the results of the sampling programme showed that the mine water is not dissimilar to the quality of water found in the lake system, with the exception of calcium. However, the EPA also notes that the quality of surface waters are known to fluctuate in salt lake systems and are dependent on rainfall events that occur in the catchment. Therefore, an assessment of the impacts on surface water quality must also be able to demonstrate that discharges do not significantly impact the quality of water found in the lake during these cyclical fluctuations in water quality.

The environmental review prepared by the proponent has addressed the impacts on the quality of lake water during these cyclical fluctuations by estimating, through hydrological modelling, the total area that the discharge may disperse across Lake Carey during a series of scenarios. The proponent has then considered the relative merits of unconfined and confined discharge options to further limit dispersal of the discharge water across Lake Carey. It was concluded that an unconfined discharge, that is disposed to natural depressions in the lake, is the preferred disposal option.

The EPA has noted that the impacts of the mine discharge water are restricted to a localised area of approximately 150 ha. This area, which represents 0.2% of the total lake area (75000 ha), is considered small. The EPA notes that the preferred location of the discharge (natural depressions in the lake bed) can also ensure that the discharge will not inundate the vegetation of the lake shores.

The EPA notes the advice of the Waters and Rivers Commission (WRC) that has recommended the inclusion of hydrocarbon containment equipment to prevent the introduction of hydrocarbon contaminants to the lakes system. The proponent has included a commitment to develop a Hydrocarbon Management Plan (commitment 6) and the EPA would require Sons of Gwalia to consult the WRC when developing this plan.

The proposal will also require a licence under Part V of the Environmental Protection Act. This licence will specify limits to the quality and quantity of water discharged to Lake Carey. The licence requires reporting of monitoring data to the Department of Environmental Protection (DEP). Monitoring data will be used to confirm the prediction of the proponent that the discharge is contained to an area of approximately 150 ha.

Summary

Having particular regard to:

(a) discharge water is similar in quality to surface brines found on Lake Carey;

(b) the small expected total area impacted by discharge water of 150 ha;

(c) discharging the water to natural depressions in the lake surface can limit the area impacted and ensure the discharge does not affect shoreline vegetation;

(d) the project will require a pollution control licence issued under the provisions of Part V of the Environmental Protection Act that can establish limits for the quality and quantity of water discharged to Lake Carey;

(e) the proponent's commitment to prepare a mine dewatering monitoring programme; and

(f) the proponent's commitment to manage hydrocarbon use to prevent contamination of surface water,

it is the EPA's opinion that the proposal can be managed to meet the EPA's environmental objective for surface water quality provided that more detail of the mine dewatering monitoring programme is presented in the Environmental Management Plan (refer draft condition 3).

3.4 Lake Carey

Description

Lake Carey is a naturally occurring salt lake that is estimated to cover an area of 750 km^2 (75000 ha). In the past, there has been a view that salt lakes, such as Lake Carey, represent a degraded environment. More recently it has been shown that these salt lakes are not wastelands and in fact have intricate relationships with the groundwater, and with other wetlands (Actis 1999).

There are currently few salt lakes included in the conservation estate.

As the biology of saline wetlands is studied, it is becoming apparent that salt lakes vary and there is only a limited knowledge of the plants and animals that inhabit these environments.

Salt lakes are generally considered a hostile environment, particularly when they are dry and hence this has contributed to previous view that they were wastelands. It is now known that episodic rainfall events provide a window of opportunity for increased biological activity in the salt lake system. These rainfall events can lead to an accumulation of water in the lakes and during this window when fresh or brackish water is available, a number of species, particularly invertebrate fauna, can complete their life cycle. Given the vast areas covered by some of these salt lakes, rainfall events which lead to increased biological activity in invertebrates can be linked to significant breeding events for water birds.

Salt lakes are now acknowledged for the important habitat they provide, their largely unknown biodiversity and their role in breeding events of a number of species.

Contributing to a lack of knowledge on the ecology and function of salt lakes is the remoteness of many of these lakes. The irregularity and unpredictable nature of rainfall events combined with this remoteness provides limited opportunities to collect further information. Monitoring associated with this proposal represents an opportunity to increase the level of knowledge about salt lakes.

Development of the mine on Lake Carey may result in direct impacts to the lake system. Direct impacts are considered to include:

- the impact on surface and ground water hydrology from the construction of causeways, waste dumps and the mining pit on the lake;
- the impacts from the mine water discharge; and

- clearing of vegetation and loss of fauna habitat on the islands.

In addition to direct impacts, the mining proposal can also result in what are considered indirect impacts to the lake system. Indirect impacts are much more difficult to assess as they are likely to occur outside the project area.

The indirect impacts are considered to include:

- the regional impacts on surface water flows across the lake and the potential impacts this may have in areas away from the project area; and
- the impacts the discharged mine water may have on the lake system during rainfall events known to be triggers of increased biological activity. In particular, the potential impacts that this discharge may have on the largely unknown biodiversity of Lake Carey and hence the potential for impacts on the breeding events of other species.

The environmental factor "Lake Carey" considers the overall (direct and indirect) impacts of the mining proposal on the function and ecology of the lake system.

The proponent's CER includes information from a series of investigations aimed at defining the area of direct impact of the mining proposal and demonstrating that these impacts could be contained to the project area. Investigations included an examination of the background fauna information already available, flora surveys, studies of the hydrological processes of the lake and a prediction of the expected impacts on the lake system from mine water discharged to Lake Carey.

The proponent in its CER has acknowledged that there is a lack of background information available on the biodiversity of Lake Carey upon which to assess the impacts of this proposal. The proponent has included a commitment to participate in a research programme aimed at adding to knowledge of the Lake Carey ecosystem and the collective knowledge of the ecology and function of salt lakes (commitment 1).

Submissions

Public submissions expressed concern that there is a general lack of information presented by the proponent on biodiversity of the Lake Carey ecosystem, and that the full biodiversity of the area is unknown. Public submissions acknowledged the short term nature of this proposal, but it was still considered that there is potential for the lake system to be significantly affected.

Submissions discussed the possible impacts that a causeway across the lake may have on surface water flows and the impacts the mining void may have on the localised water table. Concerns were also raised about the impact water discharges may have on the biodiversity of Lake Carey. Discharges may also cause introduction of contaminants (such as hydrocarbons) to the lake system, elevate salt loads and impact the hydroperiod (period of time the lake remains wet) of Lake Carey.

Assessment

The area considered for assessment of this factor is Lake Carey.

The EPA's environmental objective for this factor is to maintain the integrity, function and environmental values of Lake Carey.

The factor Lake Carey considers the overall impacts on the ecology of Lake Carey. It therefore incorporates the outcomes of the EPA consideration of the environmental factors previously discussed in Sections 3.1 to 3.3.

In considering this mining proposal, the EPA notes that the lack of background information on the biodiversity of Lake Carey makes it difficult to assess the potential impacts this proposal may have on the function and ecology of the lake system. The proponent in their CER has also acknowledged this lack of information.

In the absence of this background information, the EPA has considered the results of investigations reported in the CER and the small scale of the operation compared to the extent of Lake Carey.

The investigations aimed to demonstrate that the impacts of this mining operation can be contained to the area of mining. In this way the EPA could have a level of confidence that the as-yet largely unknown biodiversity of Lake Carey would not be significantly impacted.

The EPA, after reviewing the results of the investigations and the area affected by the proposal, has noted what are considered to be the key outcomes. These are:

- Lake Carey has an estimated area of 75000 ha;
- hydrological investigations indicate the impacts from the mine de-watering are localised and contained to the area of the discharge (approximately 150 ha);
- the impacts on Lake Carey are confined primarily to 212 ha directly affected by the mine and infrastructure, and the 150 ha impacted by the mine water to be discharged to the lake, a total of 362 ha. This represents 0.5 % of the lake;
- the project will require a pollution control licence issued under the provisions of Part V of the Environmental Protection Act that can establish limits for the quality and quantity of water discharged to Lake Carey; and
- hydrological modelling carried out by the proponent indicates that the effects of the discharge will be dissipated within a short period (1 year) following cessation of mining.

The EPA has also noted the commitment of the proponent to participate in a cooperative research programme that has been established in conjunction with other mining companies operating in the Lake Carey catchment. The EPA considers that this research programme should be an integral part of the mining proposal and that it will be important for the proponent to incorporate the results of this research programme, as they become available, into the environmental management planning processes for this proposal.

The EPA after noting the assessment of the environmental factors discussed in sections 3.1 to 3.3 has already recommended the development of a Environmental Management Plan to be completed prior to the start of ground-disturbing activities and a Rehabilitation and Decommissioning Plan to be completed within 12 months from the commencement of productive mining. The EPA considers that in developing these plans, the proponent can address issues concerning the management and rehabilitation of the physical components of the mine (causeway, void, waste dump and haul road). These plans will also provide a mechanism to incorporate the results of the proposed cooperative biological investigations into the environmental management of the mining proposal.

The proposal will also require a DEP licence to discharge mine water to Lake Carey. The licence will specify water quality parameters and the quantity of water that can be discharged. It will also require annual reporting of water monitoring data to the DEP. The proponent will be required to use this data to confirm its prediction that the impacts of the mining proposal, particularly from the discharge, are contained to a relatively small area.

The EPA is aware that this proposal may be regarded as a demonstration project in relation to mining in Lake Carey and in salt lake environments in general. However, after considering the results of the hydrological and other investigations, it is the opinion of the EPA that the proponent has provided a level of confidence that the impacts of this proposal (particularly from the discharge) can be contained to a relatively small area of the lake (362 ha or 0.5%). The management plans recommended by the EPA will ensure that detailed planning of the mining operations will incorporate the measures already identified by the proponent to limit the impacts on Lake Carey. The Decommissioning and Rehabilitation plans will require annual reporting of the results of ongoing monitoring of the rehabilitation programme. The EPA expects that the results of the cooperative research programme will also be reported in the annual environmental reports.

The results of the cooperative research programme and the DEP licence monitoring data will provide an important basis upon which to assess future proposals in Lake Carey and other salt lake environments.

Summary

Having particular regard to:

(a) the size of Lake Carey (75000 ha);

(b) the expected area of impact is small in relation to the size of Lake Carey and is confined to 212 ha for the mine and infrastructure, and an additional 150 ha affected by the mine discharge, a total of 362 ha or 0.5%;

(c) the results of investigations that indicate the effects of the discharge (salt load) will be dissipated in a short period (estimated 1 year), following the cessation of mining;

(d) the project will require a pollution control licence issued under the provisions of Part V of the Environmental Protection Act that can establish limits for the quality and quantity of water discharged to Lake Carey; and

(e) the commitment of the proponent to participate in a cooperative research investigation ,

it is the EPA's opinion that the proposal can be managed to meet the EPA's environmental objective for Lake Carey, provided that adequate measures proposed to limit the impacts on the lake system are provided in the Environmental Management Plan (draft condition 3) and the Rehabilitation and Decommissioning Plan (draft condition 4).

3.5 Aboriginal culture and heritage

Description

Archaeological and ethnographic surveys have been carried out for the areas affected by the Red October mine site and the proposed location of the haul road.

The archaeological surveys conducted in February 1996 (Quartermaine and Mattner 1996) located 21 artefact scatter sites on the islands, primarily along the shore lines. The conclusion of the consultant is that the artefact assemblies indicate that occupation of the project area was spasmodic and transient.

The proponent proposes to disturb two artefact scatter sites on Croissant Island to allow for extraction of borrow material. Disturbance of these sites is subject to the requirements of the *Aboriginal Heritage Act 1972* which requires the proponent to submit a Section 18 application to disturb the sites to the Aboriginal Cultural Materials Committee. No other sites are proposed for disturbance.

An ethnographic survey of the Red October mine site and the proposed location of the haul road has been carried out with representatives of the North Eastern Independent Body (NEIB). Two ethnographic sites have been identified in the proximity of the proposed haul road. The representatives of the NEIB have advised that these areas must be avoided. The proponent has confirmed that these sites occur outside the corridor of the haul road and will not be disturbed.

In addition to the consultation with the NEIB, the proponent has consulted with the Mt Margaret Aboriginal Community. The proponent has indicated that the proposal is supported by the community.

Submissions

The Aboriginal Affairs Department (AAD) advised that the proponent has addressed the requirements of the *Aboriginal Heritage Act 1972* and that the company's Section 18 application submitted to the Aboriginal Cultural Materials Committee to disturb two sites located on Croissant Island, had been received.

Assessment

The area considered for assessment of this factor is Angelfish and Croissant Islands, Lake Carey and surrounds.

The EPA's environmental objective for this factor is to ensure that the proposal complies with the requirements of the *Aboriginal Heritage Act 1972* and ensure that changes to the physical environment resulting from the project do not adversely affect cultural associations with the area.

The EPA notes that the AAD has advised that the proposal complies with the requirements of the Aboriginal Heritage Act. The company submitted a Section 18 application to the Aboriginal Cultural Materials Committee of the AAD to disturb two sites located on Croissant Island. The application was considered in May 1999 and the AAD has advised that the application has been approved. The EPA considers that these matters are being satisfactorily dealt with by the AAD.

In relation to consultation with the Mt Margaret Community, the EPA notes that the company has provided a copy of a letter of support for the proposal from representatives of the Mt Margaret Community. The EPA expects that there should be provision for ongoing opportunities for consultation between the proponent and the community over the life of the project.

Summary

Having particular regard to:

(a) the proponent's compliance with the requirements of the Aboriginal Heritage Act 1972;

(b) the outcome of the consultation process with the Mt Margaret Community and confirmation that the Community does not oppose the proposal;

(c) the fact that there were no specific impacts on cultural associations within the area brought to the attention of the EPA during the public submissions period; and

(d) the proponent's commitment not to disturb identified ethnographic sites,

it is the EPA's opinion that the proposal can be managed to meet the EPA's environmental objective for Aboriginal culture and heritage.

4. Conditions and commitments

Section 44 of the *Environmental Protection Act 1986* requires the EPA to report to the Minister for the Environment on the environmental factors relevant to the proposal and on the conditions and procedures to which the proposal should be subject, if implemented. In addition, the EPA may make recommendations as it sees fit.

In developing recommended conditions for each project, the EPA's preferred course of action is to have the proponent provide an array of commitments to ameliorate the impacts of the proposal on the environment. The commitments are considered by the EPA as part of its assessment of the proposal and, following discussion with the proponent, the EPA may seek additional commitments.

The EPA recognises that not all of the commitments are written in a form which makes them readily enforceable, but they do provide a clear statement of the action to be taken as part of the proponent's responsibility for, and commitment to, continuous improvement in environmental performance. The commitments, modified if necessary to ensure they are enforceable, then form part of the conditions to which the proposal should be subject if it is to be implemented.

The EPA may, of course, also recommend conditions additional to those relating to the proponent's commitments.

Table 3 - Summary of Assessment of Relevant Environmental Factors

RELEVANT FACTOR	RELEVANT AREA	EPA OBJECTIVES	EPA ASSESSMENT	EPA ADVICE
Biodiversity	Lake Carey.	To maintain biological diversity meaning the different plants animals and the ecosystems they form, at the levels of genetic diversity, species diversity and ecosystem diversity.	Biodiversity is discussed below under the factors of Lake Carey, Rehabilitation and Surface water quality.	
Vegetation communities	Islands and foreshore of Lake Carey and mining tenements covering the haul road (L38/76, L38/72, L38/98, L38/99, L39/100 and L39/86).	To maintain the abundance, species diversity, geographic distribution and productivity of vegetation types and communities.	The EPA notes: • the proposal is subject to the requirements of the CALM Act. • the proposal is subject to the Mining Act regarding delegated authority to approve clearing and application of conditions to the mining lease requiring rehabilitation to be carried out; • the final plan that details the proposed location of mining facilities, infrastructure and the haul road has not been finalised. Careful planning (design and placement) for these facilities can limit the impacts on vegetation and in particular, on locally restricted communities C5 and C6; and • the total area of vegetation clearing is approximately 76 ha. The proponent has made commitments to: • undertake an additional flora survey to confirm the distribution of vegetation communities C5 and C6, and Priority Three species *Acacia kalgoorliensis* (commitment 4) ; and • minimise land disturbance and clearing to prevent unnecessary impacts on vegetation (commitment 5).	Having particular regard to: • the results of flora surveys that indicate the vegetation communities are not regionally significant with the possible exception of communities C5 and C6; • the proponent's commitment to conduct an additional flora survey to determine the extent of community C5 and C6; • the proponent's requirement to comply with the CALM Act with regard to disturbance of Priority Three species *Acacia kalgoorliensis;* • the small area of vegetation clearing required (approx. 76 ha); and • the requirements of the Mining Act (delegated authority to approve clearing and legally binding conditions on the mining lease requiring rehabilitation of disturbed areas), it is the EPA's opinion that the proposal can be managed to meet the EPA's objectives for vegetation communities provided a Environmental Management Plan is

RELEVANT FACTOR	RELEVANT AREA	EPA OBJECTIVES	EPA ASSESSMENT	EPA ADVICE
				prepared prior to the start of ground-disturbing activities which incorporates the measures proposed by the proponent to limit impacts on vegetation communities.
Rehabilitation	Mining Leases 39/411 - 413 (Angelfish Island, mining pit and waste dumps). Miscellaneous licences L38/76,L38/72, L39/99, L39/100 and L39/86 (haulroad and causeway).	To ensure the proposal area and any other area affected by the proposal, is rehabilitated to a standard consistent with the intended post mining long-term land use.	The EPA notes : • specific guidelines for the rehabilitation of mining voids and waste dumps in the salt lake environment are not well established; • the components of an open-cut gold mine operating in the salt lake environment (causeway, void, haul roads and waste dumps) are not significantly different from the components of open-cut mining operations elsewhere in the State; • the DME guidelines for open-cut mining operations can provide a framework for establishing rehabilitation objectives and performance criteria for mining operations in salt lake environments; • the proponent will be required by the Mining Act to provide a rehabilitation performance bond that will be held by the DME until such time as the area is satisfactorily rehabilitated; • there is an opportunity to examine alternative options for waste dump design and rehabilitation of the final void to achieve a stable and safe landform consistent with the existing surroundings of the salt lake environment; and • the causeway across the lake will include culverts that allow the surface water flows across the lake to be maintained. If at the end of mining, it is proposed to retain the causeway, then this decision will be dependent upon the results of the culvert performance monitoring programme (commitment 3). The results will need to provide sufficient confidence that the surface water flows across the lake are not being significantly affected otherwise the causeway will require removal and rehabilitation of the lake bed (commitment 7). The proponent has made commitments to:	Having particular regard to: • the existence of DME guidelines for the rehabilitation of open-cut mining operations that provide a framework for rehabilitation in the salt lake environment; • the opportunity to develop alternative rehabilitation methods for waste dumps and the mining void which can lead to rehabilitation methods that may be more appropriate to mining operations in the salt lake environment; • the commitments of the proponent to develop a monitoring programme to determine the effectiveness of the culverts in maintaining surface water flows across the lake and reporting the results of that monitoring programme before a decision is made as to whether the causeway will remain at the end of mining; • the proposal will be subject to the requirements of the Mining Act with respect to mining and rehabilitation; and • the Mining Act also requires a rehabilitation bond to be provided by the proponent which cannot be released until such time as the area is satisfactorily rehabilitated,

RELEVANT FACTOR	RELEVANT AREA	EPA OBJECTIVES	EPA ASSESSMENT	EPA ADVICE
			• develop and implement a monitoring programme to determine the performance of culverts in maintaining surface water flows across the lake (commitment 3); and • to determine if it is appropriate for the causeway to remain at the cessation of mining operations.	it is the EPA's opinion that the proposal can be managed to meet the EPA's objectives for rehabilitation provided that the Environmental Management Plan (draft condition 3) considers options for rehabilitation of the mining void and waste dumps and details a framework for there evaluation; and the proponent prepares a Rehabilitation and Decommissioning Plan that details rehabilitation objectives for the components of the mine, performance criteria and a monitoring programme (draft condition 4).

Surface Water Quality	Lake Carey including islands and foreshores.	To maintain or improve the quality of surface water and groundwater to ensure that existing and potential uses, including ecosystem maintenance are protected, consistent with the draft WA Guidelines for Fresh and Marine Waters.	The EPA notes:
			• the results of the water sampling programme indicate that the mine water is not dissimilar in quality to water found in the lakes system, with the exception of calcium;
			• the quality of surface water in the lake is known to fluctuate;
			• hydrological modelling has considered the impacts that the discharge may have during these cyclical fluctuations in lake water quality and the modelling predicts that the likely total area of impact from the discharge is confined to approximately 150 ha;
			• the proposal will require a Pollution Control Licence under the provisions of Part V of the Environmental Protection Act, which can specify the volume of water discharged to the lake environment and specify limits on water quality parameters; and
			• the advice of the WRC recommending installation of hydrocarbon containment equipment.
			
			The proponent has made commitments to:
			• prepare a mine dewatering monitoring programme (commitment 2) that will include monitoring of:
			  • discharge water quality parameters
			  • quantity of water discharged to Lake Carey
				Having particular regard to:
				• discharge water is similar in quality to surface brines found on Lake Carey;
				• the small expected total area impacted by discharge water is 150 ha;
				• discharging the water to natural depressions in the lake surface can limit the area impacted and ensure the discharge does not affect shoreline vegetation;
				• the discharge will be subject to management via Part V of the Environmental Protection Act; and
				• the proponent's commitments to prepare a mine dewatering monitoring programme and a Hydrocarbon Management Plan,
				it is the EPA's opinion that the proposal can be managed to meet the EPA's objectives for surface

RELEVANT FACTOR	RELEVANT AREA	EPA OBJECTIVES	EPA ASSESSMENT	EPA ADVICE
			• vegetation transects on the shorelines to monitor the impacts of de-watering; and • develop a Hydrocarbon Management Plan (commitment 6) to prevent contamination of ground and surface water from hydrocarbons.	water quality provide that more detail of the mine dewatering monitoring programme is presented in the Environmental Management Plan (refer draft condition 3).

Lake Carey	Lake Carey.	Maintain the integrity functions and environmental values of Lake Carey.	The EPA notes:
			• Lake Carey has been estimated to cover an area of approximately 750 km^2 or 75000 ha;
			• there is a general lack of knowledge on the ecology and function of salt lakes. Due to this lack of knowledge a conservative approach has been applied which demonstrates impacts are restricted to the local area of the discharge;
			• a coordinated research programme is gathering further information on the ecology of Lake Carey and potential impacts from mine de-water discharges;
			• hydrological investigations have been completed by the proponent. It was concluded that:
			  • the potential of mine de-water discharges to impact the function of the lake are restricted to localised impacts in the area of the discharge;
			  • a volumetric comparison study indicated that the volume of water discharged to the lake is unlikely to have an impact on the volumetric capacity of the lake;
			  • the volume of water discharged would not significantly affect the hydroperiod (period of time the lake stays wet); and
			  • the salt load and concentration will increase in the area of the discharge (approximately 150 ha). Ninety percent of the salt deposited would be removed following one years-average rainfall.
			• construction of causeways has the potential to impact the surface hydrology of Lake Carey. The impacts can be managed in the short term through installation of culverts, however retention of the causeway in the long term following cessation of the mining requires further investigation;
			• the proposal will be subject to a DEP licence under the provisions of Part V of the EP Act. Licence requirements will establish limits for water quality parameters, and the
				Having particular regard to:
				• the size of Lake Carey (75000 ha);
				• the fact that the expected area of impact is small in relation to the size of Lake Carey and is confined to 212 ha for the mine and infrastructure, and an additional 150 ha impacted by the mine discharge, a total of 362 ha;
				• the results of investigations that indicate the effects of the discharge (salt load) will be dissipated in a short period (1 year) following the cessation of mining;
				• the provisions of Part V of the Environmental Protection Act requiring a Pollution Control Licence; and
				• the proponents commitment to participate in a cooperative research investigations,
				• the proponent's commitment to prepare a mine dewatering monitoring programme,
				it is the EPA's opinion that the proposal can be managed to meet the EPA's objectives for Lake Carey provided that adequate measures proposed to limit impacts on the lakes system are provided in the Environmental Management Plan (refer draft condition 3), and the Rehabilitation and

RELEVANT FACTOR	RELEVANT AREA	EPA OBJECTIVES	EPA ASSESSMENT	EPA ADVICE

			quantity of water discharged to Lake Carey.
			The proponent has made commitments to:
			• participate in and contribute to a range of biological studies to be carried out by the Lake Carey Mining Environmental Group aimed at developing knowledge of salt lake ecology (commitment 1);
			• investigate if the retention of causeways at the cessation of mining will cause long term impacts on the surface hydrology of Lake Carey; and
			• prepare a mine de-water monitoring programme (commitment 2) that will include monitoring of:
			  • discharge water quality parameters;
			  • quantity of water discharged to Lake Carey;
			  • the performance of causeway culverts; and
			  • vegetation transects on the shorelines to monitor the impacts of de-watering.
				Decommissioning Plan (refer draft condition 4).

Aboriginal heritage and culture	Lake Carey	Ensure that the proposal complies with the requirements of the Aboriginal Heritage Act 1972; and Ensure that changes to the biological and physical environment resulting from the project do not adversely affect cultural associations with the area.	The EPA notes: • the Aboriginal Affairs Department has advised that the proposal complies with the requirement of the *Aboriginal Heritage Act 1972;* • the proposal will result in disturbance of two artefact scatter sites. The Aboriginal Affairs Department Cultural Materials Committee has approved a Section 18 Application to disturb these two sites; and • the Mount Margaret Community does not oppose the proposal.	Having particular regard to: • the proponent's compliance with the requirements of the *Aboriginal Heritage Act 1972*; • the outcome of the consultation process with the Mt Margaret Community and confirmation that the community does not oppose the proposal; • the fact that there were no specific impacts on cultural associations within the area brought to the attention of the EPA during the public submissions period; and • the proponent's commitment not to disturb identified ethnographic sites, it is the opinion of the EPA that the proposal can be managed to meet the EPA's environmental objective for Aboriginal heritage and culture.

4.1 Proponent's commitments

The proponent's commitments as set out in the CER and subsequently modified, as shown in Appendix 3, should be made enforceable conditions.

4.2 Recommended conditions

Having considered the proponent's commitments and the information provided in this report, the EPA has developed a set of conditions which the EPA recommends be imposed if the proposal by Sons of Gwalia to develop the Red October Gold Project on Lake Carey, is approved for implementation. These conditions are presented in Appendix 3. Matters addressed in the conditions include:

(a) that the proponent be required to fulfil the commitments in the Consolidated Commitments statement set out as an attachment to the recommended conditions in Appendix 3;

(b) that the proponent be required to prepare and implement an Environmental Management Plan; and

(c) that the proponent be required to prepare and implement a Rehabilitation and Decommissioning Plan.

5. Other Advice

The EPA notes that Lake Carey is a highly prospective mineral zone that currently has, in addition to the mining proposal of Sons of Gwalia, several other existing or proposed mining operations with the potential for impacting the lake. The EPA also notes that Sons of Gwalia is conducting further exploration with the intention of expanding mining operations on the lake.

It is becoming increasingly difficult for the EPA to determine the potential cumulative impacts of these mining operations on the Lake Carey ecosystem. Whilst it may be somewhat easier to consider the impacts of an individual operation, environmental impact assessment of mining developments on Lake Carey cannot continue to be considered in isolation where it is known that there are other mining operations which may potentially impact the lake system.

The assessment of the present mining proposal has also highlighted the limited information available on salt lake ecology upon which to assess environmental impacts. The EPA notes that the proponent, and several other companies operating on Lake Carey, have formulated a cooperative research programme which is aimed at improving the understanding of the function and ecology of Lake Carey, and of salt lakes in general. The EPA supports initiatives for joint research and considers that this cooperative approach, should be extended to consider opportunities for joint infrastructure developments that can further limit the cumulative impacts on Lake Carey.

The EPA considers that proponents of future mining proposals in Lake Carey will be required to demonstrate that they have an understanding of the cumulative impacts of their proposals. It will be important for proponents, through reporting of the results of the cooperative research programme, to provide the EPA with confidence that individual or successive mining developments are not significantly affecting the function and ecology of the Lake Carey ecosystem.

Salt lakes are the result of a distinctive set of physical processes and are periodically very biologically productive. As such it is important that the ecological functions of these systems are protected.

The present assessment has highlighted that salt lake ecosystems are poorly represented in the conservation estate.

The EPA recommends that the Minister for the Environment write to her Ministerial colleagues regarding the desirability of undertaking a review of opportunities to secure salt lakes in the conservation estate.

Until this can be achieved, the EPA will require proponents affecting salt lake environments to demonstrate that proposals do not significantly affect the salt lake environment or alternatively that the particular salt lake type is well represented.

6. Conclusions

The EPA has considered the proposal by Sons of Gwalia to develop the Red October Gold Project on Lake Carey.

The EPA is aware that this proposal, which has an expected life of two years, could be regarded as a demonstration project in relation to mining in Lake Carey and other similar proposals for mining in salt lake environments.

The EPA has concluded that the proposal is capable of being managed in an environmentally acceptable manner such that it is most unlikely that the EPA's objectives would be compromised, provided there is satisfactory implementation by the proponent of the recommended conditions set out in Section 4, including the proponent's commitments.

7. Recommendations

Section 44 of the *Environmental Protection Act 1986* requires the EPA to report to the Minister for the Environment on the environmental factors relevant to the proposal and on the conditions, to which the proposal should be subject, if implemented. In addition, the EPA may make recommendations as it sees fit.

The EPA submits the following recommendations to the Minister for the Environment:

1. That the Minister notes that the project being assessed is for the Red October Gold Project, an open-cut gold mine and associated infrastructure on Lake Carey;
2. That the Minister considers the report on the relevant environmental factors as set out in Section 3;
3. That the Minister notes that the EPA has concluded that it is most unlikely that the EPA's objectives would be compromised, provided there is satisfactory implementation by the proponent of the recommended conditions set out in Section 4, including the proponent's commitments.
4. That the Minister imposes the conditions and procedures recommended in Appendix 3 of this report.
5. That the Minister notes "under other advice" that the EPA has recommended that the Minister writes to her Ministerial colleagues regarding the desirability of undertaking a review of opportunities to secure salt lakes in the conservation estate.

Appendix 1

List of submitters

Organisations:

Aboriginal Affairs Department
Conservation Council of Western Australia
Department of Conservation and Land Management
Department of Minerals and Energy
Water and Rivers Commission
Western Australian Museum (Subterranean fauna)

Appendix 2

References

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Sons of Gwalia Ltd (1999) *Red October Gold Project 80 KM South of Laverton, Consultative Environmental Review.* January 1999.

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Appendix 3

Recommended Environmental Conditions and Proponent's Consolidated Commitments

Statement No.

STATEMENT THAT A PROPOSAL MAY BE IMPLEMENTED (PURSUANT TO THE PROVISIONS OF THE ENVIRONMENTAL PROTECTION ACT 1986)

RED OCTOBER GOLD PROJECT, 80 KM SOUTH OF LAVERTON

Proposal: The development of an open-cut gold mine, waste rock dumps and mine facilities on Lake Carey and a haul road along its shore approximately 80 kilometres south of Laverton and 110 kilometres east of Leonora, within the Mount Margaret Mineral Field and the Mount Morgan District, as documented in schedule 1 of this statement.

Proponent: Sons of Gwalia Ltd

Proponent Address: 16 Parliament Place, PMB 16, WEST PERTH WA 6872

Assessment Number: 1245

Report of the Environmental Protection Authority: Bulletin 936

The proposal to which the above report of the Environmental Protection Authority relates may be implemented subject to the following conditions and procedures:

1 Implementation

1-1 Subject to these conditions and procedures, the proponent shall implement the proposal as documented in schedule 1 of this statement.

1-2 Where the proponent seeks to change any aspect of the proposal as documented in schedule 1 of this statement in any way that the Minister for the Environment determines, on advice of the Environmental Protection Authority, is substantial, the proponent shall refer the matter to the Environmental Protection Authority.

1-3 Where the proponent seeks to change any aspect of the proposal as documented in schedule 1 of this statement in any way that the Minister for the Environment determines, on advice of the Environmental Protection Authority, is not substantial, those changes may be effected.

2 Proponent Commitments

2-1 The proponent shall implement the consolidated environmental management commitments documented in schedule 2 of this statement.

2-2 The proponent shall implement subsequent environmental management commitments which the proponent makes as part of the fulfilment of conditions and procedures in this statement.

3 Environmental Management Plan

3-1 Prior to the commencement of ground-disturbing activities, the proponent shall prepare an Environmental Management Plan to the requirements of the Environmental Protection Authority on advice of the Department of Minerals and Energy, the Department of Conservation and Land Management, the Department of Environmental Protection and, the Water and Rivers Commission.

The objective of this plan is to provide further detail of the environmental management measures which will be implemented by the proponent, and to ensure that these measures are incorporated into the final design of mine facilities and access infrastructure located on Lake Carey, its islands and shores.

This Plan shall address:

1. location and layout of mine facilities (stores, workshops, offices and roads) the access causeway, haul roads and borrow pits to avoid locally restricted plant communities;
2. measures (culverts and floodways) proposed to ensure that existing drainage is not significantly affected by the causeway or the haul road;
3. preliminary design criteria and location of waste dumps to ensure that the design is appropriate to the landscape of Lake Carey;
4. alternative options for decommissioning and rehabilitation of the open void and specification of criteria upon which the options will be evaluated to ensure that the options for rehabilitating the void are consistent with the landscape and environment of Lake Carey;
5. location of the mine water discharge point and provide details of the water and vegetation monitoring programme to determine the impacts of the mine discharge;
6. management measures to prevent an increase in the number of predators (foxes and cats) accessing the islands via the causeway;
7. details of the objectives and programme outline for the cooperative biological research investigations into salt lake ecology; and
8. progressive rehabilitation of areas disturbed by mining to agreed land use(s).

3-2 The proponent shall implement the Environmental Management Plan required by condition 3-1.

3-3 The proponent shall make the Environmental Management Plan required by condition 3-1 publicly available, to the requirements of the Environmental Protection Authority.

4 Decommissioning and Rehabilitation Management Plan

4-1 Within 12 months following the commencement of productive mining, the proponent shall prepare a Decommissioning and Rehabilitation Management Plan to ensure that the mining void, borrow pits, causeway, waste dumps, haul roads and other areas disturbed by the project are rehabilitated to the requirements of the Environmental Protection Authority on advice of the Department of Minerals and Energy, the Department of Conservation and Land Management, the Department of Environmental Protection and the Water and Rivers Commission.

The Plan shall address:

1. removal or, if appropriate, retention of plant and infrastructure;
2. the processes for rehabilitation of the project area;
3. the development of a 'walk away' solution for the decommissioned pit, waste dumps, causeway, borrow pits, haul roads and other associated infrastructure; and
4. identification of contaminated areas, including provision of evidence of notification to relevant statutory authorities.

Note: A 'walkaway' solution means that the site shall either no longer require management at the time the proponent ceases operation, or if further management is deemed necessary, the proponent shall make adequate provision so that the required management is undertaken with no liability to the State.

4-2 The proponent shall implement the Decommissioning and Rehabilitation Plan required by condition 4-1.

4-3 The proponent shall make the Decommissioning and Rehabilitation Plan required by condition 4-1 publicly available, to the requirements of the Environmental Protection Authority.

5 Proponent

5-1 The proponent for the time being nominated by the Minister for the Environment under section 38(6) or (7) of the Environmental Protection Act 1986 is responsible for the implementation of the proposal until such time as the Minister for the Environment has exercised the Minister's power under section 38(7) of the Act to revoke the nomination of that proponent and nominate another person in respect of the proposal.

5-2 Any request for the exercise of that power of the Minister referred to in condition 5-1 shall be accompanied by a copy of this statement endorsed with an undertaking by the proposed replacement proponent to carry out the proposal in accordance with the conditions and procedures set out in the statement.

5-3 The proponent shall notify the Department of Environmental Protection of any change of proponent contact name and address within 30 days of such change.

6 Commencement

6-1 The proponent shall provide evidence to the Minister for the Environment within five years of the date of this statement that the proposal has been substantially commenced.

6-2 Where the proposal has not been substantially commenced within five years of the date of this statement, the approval to implement the proposal as granted in this statement shall

lapse and be void. The Minister for the Environment will determine any question as to whether the proposal has been substantially commenced.

6-3 The proponent shall make application to the Minister for the Environment for any extension of approval for the substantial commencement of the proposal beyond five years from the date of this statement at least six months prior to the expiration of the five year period referred to in conditions 6-1 and 6-2.

6-4 Where the proponent demonstrates to the requirements of the Minister for the Environment on advice of the Environmental Protection Authority that the environmental parameters of the proposal have not changed significantly, then the Minister may grant an extension not exceeding five years for the substantial commencement of the proposal.

7 Compliance Auditing

7-1 The proponent shall submit periodic Performance and Compliance Reports, in accordance with an audit program prepared in consultation between the proponent and the Department of Environmental Protection.

7-2 Unless otherwise specified, the Chief Executive Officer of the Department of Environmental Protection is responsible for assessing compliance with the conditions, procedures and commitments contained in this statement and for issuing formal written advice that the requirements have been met.

7-3 Where compliance with any condition, procedure or commitment is in dispute, the matter will be determined by the Minister for the Environment.

Note

1 The proponent is required to apply for a Works Approval and Licence for this project under the provisions of Part V of the Environmental Protection Act.

Schedule 1

The Proposal

The Red October Gold Project is located on the western shore of Lake Carey, 80 km South of Laverton. The proposal to mine approximately 16 million tonnes of ore and associated waste material over a two year period involves development of an open-cut gold mine and waste rock dumps on the lake bed, and construction of mine infrastructure (workshops, offices, stores and access roads) and borrow pits on Angelfish Island adjacent to the mining pit. A causeway will be constructed across the lake from material sourced from the island borrow pits and will link to a haul road constructed along the shores of the lake. The ore will be transported along this constructed haul road and via a series of public roads to the proponent's existing treatment plant at Laverton. Development and mining of the open cut will require discharge of mine water to the surface of Lake Carey over the life of the operation.

Key Characteristics Table

Element	Description
Life of project	Approximately 2 years mining and 1 year development
Size of orebody	Approximately 16 Mt ore and waste material
Mining rate	Approximately 275 000 tonnes (t) of ore and 7.75 Mt of waste per annum
Mining method	Truck and shovel
Depth of mining	Approximately 100 metres
Major components and area of disturbance (including access)	
Haul roads	36 ha
Causeway	20 ha
Open pit	36 ha
Waste dumps	80 ha
Infrastructure (workshops, stores and offices) and borrow pits	40 ha
Total estimated area of disturbance	212 ha
Water supply	Dust suppression - saline mine water: up to 800 kL/day Potable - from water supply dam: approximately 2 kL/day
Mine dewatering	800 kL/day discharged to Lake Carey
Water table depth	At surface
Fuel storage capacity	180 000 L (on Angelfish Island)

Schedule 2

Proponent's Consolidated Environmental Management Commitments

June 1999

RED OCTOBER GOLD PROJECT, 80 KM SOUTH OF LAVERTON (1245)

SONS OF GWALIA LTD

Schedule 2: Proponent's Environmental Management Commitments (Assess. No. 1245)

TOPIC	OBJECTIVE	ACTION	TIMING	WHOSE ADVICE	MEASUREMENT/ COMPLIANCE CRITERIA
1. Salt lake ecology.	To understand the ecology of Lake Carey and facilitate development of appropriate management programmes.	The proponent will participate with other mining companies in biological studies and will provide an annual summary of the research in the Annual Environmental Report.	Annual summary in DME Annual Environmental Report.	CALM, DME	Performance and Compliance Report; and Include in DME Annual Environmental Report.
2. Mine water discharges.	To protect near shore vegetation and habitats for water birds.	(2.1) Confirm the proposed locations of mine water discharges; and (2.2) Develop a mine de-water monitoring programme that will include: • discharge water quality parameters; • quantity of water discharged to Lake Carey; • vegetation transects on the shorelines to monitor the impacts of de-watering.	Prior to discharge of mine water to the lake.	WRC, CALM, DME	(2.1) A map specifying the location of discharges; and (2.2) Letters from involved agencies .
3. Surface water flows, Lake Carey.	To allow natural hydrological processes to continue.	(3.1) Provide culverts in the causeway to permit through flow of a 100 year flood event; and (3.2) Develop and implement a monitoring programme to review the performance of culverts.	Before start of causeway construction.	DME, WRC	Letter from DME, WRC approving causeway and culvert design. DEP licence to incorporate culvert performance monitoring programme.

TOPIC	OBJECTIVE	ACTION	TIMING	WHOSE ADVICE	MEASUREMENT/ COMPLIANCE CRITERIA
4. Priority species and vegetation communities C5 and C6.	To protect abundance, diversity and geographical distribution of vegetation communities C5 and C6, and of *Acacia kalgoorliensis* and *Halosarcia sp.* (Angelfish Island).	(4.1) Conduct a wider regional survey to confirm that vegetation communities C5 and C6, and priority species A. *kalgoorliensis* are generally well represented in the region; and (4.2) Approval from CALM is required if *A. kalgoorliensis* is to be disturbed.	(4.1) November 1999; and (4.2) Prior to disturbance of *A. kalgoorliensis.*	CALM and DME	(4.1) Results of flora survey to determine extent of communities C5 and C6 will be reported in the DME Annual Environmental Report; and (4.2) Letter of approval from CALM is required if it is intended to disturb *A. kalgoorliensis*.
5. Land Disturbance and clearing.	To prevent unnecessary impacts on vegetation and reduce erosion risks.	(5.1) Disturbance on Angelfish Island will be minimised by establishing mine infrastructure on areas previously disturbed; and (5.2) Develop management procedures to restrict disturbance to the lake and surrounds.	(5.1) Prior to ground-disturbing activities; and (5.2) Prior to ground-disturbing activities.	DME, CALM	Incorporated into the Mine Environmental Management Plan (refer condition 3-1);and Reported in the DME Annual Environmental Report.
6. Hydrocarbon management.	To protect water resources.	Develop a Hydrocarbon Management Plan for the collection and management of waste hydrocarbons and spills including potentially contaminated run off from mine infrastructure.	Before finalisation of design plans for construction.	DME, WRC.	Letter of approval confirming that the Hydrocarbon Management Plan is accepted by DME and WRC. Significant incidents or amendments to the programme will be reported in the DME Annual Environmental Report.
7. Causeway.	To determine if it is appropriate for the causeway to remain at the cessation of mining operations.	Investigate the long-term effects of leaving the causeway on the hydrology of Lake Carey.	Decommissioning	DME, CALM, Local Authority.	Letters of acceptance of agreed outcome by involved Agencies.

Appendix 4

Summary of Submissions
and Proponent's Response to Submissions

RED OCTOBER GOLD PROJECT
(ASSESSMENT No.1245)
80 KM SOUTH OF LAVERTON
SONS OF GWALIA LTD
RESPONSE TO THE SUMMARY OF SUBMISSIONS

1. GENERAL COMMENTS

1.1 This proposal appears to be an experiment in mining a lake. There is insufficient information on biodiversity, cumulative impacts and potential impacts from the discharge. It is difficult to see how the EPA can assess the proposal in the absence of such information. Further information is required before the proposal can meet the EPA's environmental objectives.

The Consultative Environmental Review is a genuine attempt by SGW to assess the environmental impact of mining given the general lack of baseline scientific information on the biological values and functions of salt lake ecosystems.

In the absence of adequate information on the biological diversity of the salt lake SGW has focused on protecting and maintaining the functional aspects or processes of the salt lake system to minimise the potential for impact at the species level.

The CER discusses in detail the impacts of the dewatering discharge, which is considered to be one of the most significant aspects of the operation.

The CER demonstrates the low likelihood of significant impacts on the function of the lake.

The issues in relation to cumulative impacts are discussed in Section 7.1.

1.2 The CER is fairly comprehensive but relatively conceptual (DME).

SGW accepts that the mine development and closure plans are conceptual at this stage. This is unavoidable given the lack of formal guidelines for environmental and safety standards for mining and mine closure on salt lakes.

SGW commits to developing detailed mine operating plans and mine closure plans to the satisfaction of the DME and DEP prior to the commencement of mining.

1.3 There are concerns about the impact of the proposed mine on Lake Carey. The impact of the water discharge is unknown. The full biodiversity of the area is unknown. The impact of the remaining void is unknown. The cumulative impacts on Lake Carey from this proposal and other mining projects already impacting the lake were not discussed. Why were these cumulative impacts not discussed?

1.4 The CER indicates (page 40) that the quantitative effects of discharging volumes of saline water onto the lake surface are largely unknown. SGW also acknowledge that they have not undertaken terrestrial or aquatic fauna surveys. It is difficult to assess the impacts of this proposal given the lack of information.

The CER reports in detail the work done to predict and evaluate the impact of the discharge. These studies concluded that the predicted dewatering discharge is unlikely to have an impact on the function of the lake and are summarised below.

- (Section 5.3.1 page 41) Volumetric Comparison – the study compared the discharge from the mine operation with discharge from the Lake Carey catchment and the Linden subcatchment (the smallest subcatchment and the subcatchment in which the mine occurs). The volume of the predicted dewatering discharge is shown to be much smaller than run off from the Linden subcatchment for the average October monthly rainfall (the driest month)and it was concluded that the discharge is unlikely to have an impact on the volumetric capacity of the lake.

- (Section 5.3.3 page 42) Hydro-period – the report also considered the effect of the discharge water on the hydroperiod of the lake. Again the report concluded that the discharge would have an insignificant impact on the hydro-period.

- (Section 5.3.4 page 43) Salt Load and Concentration – a consideration of the salt load and salt concentration concluded that the discharge will increase the salinity of the immediate area around the discharge point. The increased area of salinity would extend over an area of approximately 150ha. The report also concluded that approximately 90 % of the salt deposited would be removed through dilution and infiltration following one years average rainfall.

The impacts of discharging water onto the lake have been considered and are shown in the CER to have minimal impact on the function of the lake.

The impact of the remaining void is difficult to assess. In the absence of guidelines or direction from government agencies SGW has adopted a conservative approach, opting to isolate the void from the lake by surrounding the pit with a bund. The bund will be designed to withstand a 1 in 100-year flood event. The saline water in the pit will not affect less saline surface water on the lake following a rainfall event.

Since making a submission the DME have suggested that some consideration be given to alternative closure options including not bunding the pit.

One alternative proposed is to leave the pit open to the lake and batter down the pit walls to a low angle to a level several metres below the final resting water level in the pit. Leaving the pit open and connected to the surface hydrology of the lake is not expected to create significant environmental impacts and would achieve an acceptable level of safety.

SGW commits to undertaking further evaluation of closure options to the satisfaction of the DME.

Terrestrial fauna surveys were not undertaken as it was agreed in discussions with representatives of DEP and DME that the project was unlikely to present any significant impact on terrestrial fauna.

A full study of aquatic fauna has not been carried out. Such a study requires a significant rainfall event to commence the wetting and drying cycles which trigger the activity of macro invertebrates and avian fauna. It has not been possible to carry out any work during the last few years; SGW however commits to completing a range of aquatic fauna surveys when the right conditions occur.

1.5 Lake Frontage communities are poorly represented in the conservation reserve system throughout the rangelands, and are generally heavily targeted for grazing. This proposal will further impact on these vegetation communities.

The low chenopod shrubland plant community found on the fringes of Angelfish Island is common both locally and regionally and is present around all salt lakes in the region.

1.6 Despite the small scale and short term nature of this project, there is potential for significant impacts on the lake system and catchment ecology. Particular attention needs to be focussed on haul road and causeway design, pit decommissioning minimising impacts on islands and minimising impacts on lake bed processes. How will SGW ensure that these issues are addressed during the planning of the mine, and that the environmental measures they propose will be implemented?

SGW has already commissioned studies to design the causeway and culverts to ensure adequate drainage. Investigations and planning to address drainage aspects of road construction have also commenced. SGW commits to the preparation of mine development and mine closure plans to the satisfaction of the DME and DEP.

2. ABORIGINAL HERITAGE ACT

2.1 SGW have addressed the Aboriginal Heritage Act 1972 (AAD). The Company has currently submitted a Section 18 application for the 9 February meeting of the Aboriginal Cultural Material Committee, to disturb two archaeological sites. Can SGW report the outcome of the Section 18 application?

An application to disturb two archaeological sites was submitted to the Aboriginal Cultural Material Committee and was considered at the meeting on 9 February. Sons of Gwalia has been advised that the Committee has approved the application.

3. MINING ACT

3.1 The Mining Act requires submission of a 'Notice of Intent' that follows the Department of Minerals and Energy (DME) guidelines, before approval from the DME can be granted.

SGW believes that the information submitted in the Consultative Environmental Review addresses many of the requirements of a Notice of Intent.

SGW will discuss the outstanding requirements with the Department of Minerals and Energy and agree on a process to address them to their satisfaction prior to the commencement of mining.

4. FLORA AND FAUNA

4.1 Biodiversity

4.1.1 There is a lack of information on biodiversity. The proposed ecological studies should examine this issue. What is SGW commitment to ensure the proposed studies are relevant and appropriate, to ensure a true perspective on the biodiversity of the Lake Carey system is attained?

4.2 Research Investigations

4.2.1 SGW refer to carrying out additional research investigations on Lake Carey. What additional investigations are proposed? How will SGW ensure that they gather regional and local information on Lake Carey? How will SGW ensure that their mining and rehabilitation practices will be continuously improved to reflect the information gathered from the research?

SGW has met with other mining companies working on and around Lake Carey to consider protocols for the sharing of the results of local (site-specific) studies and joint funding of regional research and surveys on Lake Carey.

The proposed ecological studies have been developed with assistance from Curtin University and the Western Australian Museum. The studies will examine micro algae, aquatic birds and aquatic invertebrates. The studies will cover sites extending from Placer's Granny Smith mine in the north to the Red October mine in the south and will be complemented by other biological work carried out separately by Placer, Acacia and Sons of Gwalia. It may be feasible to establish a scientific advisory body consisting of representatives from Curtin, the Museum and CALM to review and advise on the proposed studies.

At this stage three regional studies are proposed. These are: -

1. A study of islands and terrestrial survey of islands and salt marsh communities.
2. A survey of micro algae and aquatic birds.
3. A survey of aquatic invertebrates.

Curtin University will conduct the first two surveys while the third is the responsibility of the Western Australian Museum. Further information on these studies are given below.

Study 1 – Terrestrial Biology – Island and Salt Marsh Communities

A review and survey of the flora and fauna of the islands and fringing vegetation.

Study 2 – Aquatic Survey – Micro Algae and Aquatic Birds

The survey will focus on limnology, micro flora, macro invertebrates and an aquatic bird survey to obtain an understanding of the function of the salt lake following a major rainfall event, which usually triggers considerable biological activity.

The results of the work will increase our understanding of the biological activity on the lake and the potential for the mining operation to cause an impact.

The findings of these surveys will be submitted to the DME, CALM and DEP and discussed in the Annual Environmental Report or as required by Ministerial conditions.

4.2.2 SGW have listed in their commitments that they will undertake additional investigations. These studies should be undertaken before approval is given. What guarantee has SGW given that the additional investigations will occur?

SGW commits in the Consultative Environmental Review to undertake additional investigations. A commitment has also been made to other Companies to contribute funds and participate in joint studies.

4.2.3 The CER recognises there is a lack of basic understanding of Lake Carey faunal ecology and indicates SGW and other companies are working cooperatively to improve this understanding. CALM supports this plan for cooperative investigations and should be involved in the design and review of the studies to ensure that the results provide adequate and relevant data for future impact evaluations. Are SGW intending to involve CALM in the process to establish the additional investigations.

The scope of a number of studies has already been prepared and indeed some studies originally initiated by Placer Granny Smith have commenced. SGW is happy to involve CALM in the design and review of any additional investigations proposed to be carried out by the co-operative.

4.3 **Fauna General**

4.3.1 There is a lack of information on terrestrial and aquatic fauna. SGW have indicated they will support the studies undertaken by other companies in the area. What is SGW role in determining the scope of the additional investigations?

The initial studies have been planned with assistance from Curtin University and the WA Museum. SGW will work within the cooperative arrangements with the other Companies to determine the scope of future studies.

4.3.2 Terrestrial Fauna

4.3.2.1 There is no reference to the use of Lake Carey by Banded Stilts. This is reported in Granny Smith's Lake Carey study. Does the Banded Stilt use the area of the proposed mine? What are the potential impacts on migratory bird species using Lake Carey?

It is known that the wetlands of the Salinaland are important ephemeral breeding habitats for a group of Australian shore birds which includes the Banded Stilt. Breeding of these species is triggered by flooding. A few colonies have been documented however in recent years large colonies have been investigated on islands and salt lakes on the eastern Murchison.

A review by Curtin University in June 1997 concluded that although there were no records actually from Lake Carey, the habitat appeared to be suitable and colonies could easily have been overlooked in the past. There were sightings of the Banded Stilt in the areas of the proposed mine following Cyclone Bobby. However the birds were only present in small numbers, (approximately 10 pairs) and a nest was established on a causeway which was constructed for exploration. It is considered that the impacts on the Banded Stilt and other migratory birds using Lake Carey will be minimal because the area impacted by the construction and operation of the mine is less than 100ha, which represents less than 0.01% of the area of the lake. The islands and the landforms disturbed by the operation are also well represented in other areas of the lake.

4.3.2.2 With so little known about the ecology and function of Lake Carey, it is likely that the lake system plays a significant role in episodic water fowl breeding events. Available information from salt lakes in the region, suggest that the habitat types found around this proposed mine (lake bays and wetlands) and Croissant Island, may be suitable as breeding sites for waterfowl. Have SGW confirmed if waterfowl utilise the areas to be disturbed and impacted? Have SGW investigated opportunities to plan and rehabilitate the Waste rock dumps so as to establish favourable habitat for nesting waterfowl?

At this point in time SGW have not been able to confirm if waterfowl use the areas to be disturbed and impacted. Constructing the waste rock dump so as to establish favourable habitat for nesting waterfowl can be considered as part of the mine rehabilitation plan.

4.3.2.3 The sampling program should survey for mobile invertebrates (such as spiders) associated with dry and damp lake beds. Will SGW sample for these invertebrates?

The proposed biological studies will include surveying for mobile invertebrates.

4.3.2.4 The habitat found on Croissant Island may have a significant fauna population as it is a larger wooded island and has been spared the impacts of grazing and predation from feral animals. It is likely to support populations of species that feed on spiders occupying the lake bed, such as the Dunnart.

Croissant Island is in fact a small gypsiferous area. Treasure and Angelfish Islands are larger wooded islands on the lake. At this stage the impact on Angelfish Island will be confined to the shore line and fringing vegetation and it is not proposed to disturb Treasure Island through mining.

Our observations suggest that movement of animals from the mainland to the islands is common. On this basis it is unlikely that the islands will support populations of species that are unique or different when compared to the mainland. Indeed this has been confirmed by a recent study carried out by Placer Granny Smith on an island further north on Lake Carey.

4.3.3 Aquatic Fauna

4.3.3.1 There are concerns that studies of aquatic fauna have not been undertaken. Why is approval for mining being sought before such studies have been finalised?

SGW acknowledges the concerns that studies of aquatic fauna have not been undertaken. Approval for mining is being sought before such studies have been finalised because the conditions over the last two years have not been amenable to commencing such studies.

SGW commits to participate in regional studies in conjunction with other mining companies working on Lake Carey. This work will commence when the correct hydrological conditions occur and will be reported to appropriate agencies. In the meantime SGW does not believe that the proposed mining operation is of a scale or duration to cause significant impact on the lake.

4.3.3.2 It is understood that the Brine Shrimp (*Paratemia* sp) may be found in Lake Carey. There is growing evidence of endemism of these species in the lake system. These species are apparently particularly susceptible to changes in pH. What measures are SGW proposing to ensure that pH is maintained? How will SGW monitor the impacts of their mining operation on these and other species of aquatic fauna?

In a rapid and extensive limnological survey of saline lakes through the Wheatbelt and Goldfields region (Geddes et al. 1981) reported 8 species of the Australian Brine Shrimp *Paratemia* from the region. Seven of them were endemic to Western Australia. Most of the biomass in the larger lakes, which tend to be most saline, is made up of one species of *Paratemia* and perhaps one ostacod. Given the different set of biophysical constraints in some of the lakes surveyed including the likelihood of summer rather than winter rainfall resulting in higher temperatures, lower dissolved oxygen levels and higher evaporation rates it is difficult to extrapolate the findings of these studies to the faunal populations in Lake Carey.

The pH levels of surface waters sampled near the proposed minesite during studies on the lake have varied from 6.8 to 9.49. This range appears to be normal which may result from biological activity. The pH of groundwater sampled during the study was 7.2 which is within the range measured from surface samples.

SGW believe it would be very difficult to monitor the direct impact of the mining operation on any species of aquatic fauna. As stated above the surface water is subject to many variables and water quality parameters change constantly because of rainfall, evaporation and diffusion from wind.

The aim of SGW's monitoring program would be to ensure the water quality of the groundwater discharge water is within a range of parameters compatible with any surface waters. It is proposed to discharge the mine dewatering water into a settlement dam before it is discharged onto the lake. Residence time of 2-3 days would be sufficient to allow the settling out of sediment and sediment borne nutrients and trace metals.

SGW proposes to monitor the water quality of the discharge water at the point of discharge onto the lake. Parameters monitored would include pH, salinity, major ions, nutrients and trace metals.

The proposed parameters would be monitored quarterly. It is also proposed to photographically document the salt crust forming at the discharge point. This could be achieved using aerial photography. Potential impacts on fringing vegetation could be monitored to determine whether there is any impact from a change in groundwater depth or water logging. A number of transects would be established which would be photographed annually using colour and/or infra red photography.

It is proposed that a monitoring program be developed with input from consultants familiar with the saline aquatic environment and other agencies such as CALM. SGW commit to producing an environmental monitoring program for the approval of DEP, DME, CALM and WRC.

4.3.3.3 Ionic composition of water should be monitored at least once a year. The occurrence of salt lake Ostracods and to some extent Copepods is influenced by salinity, ratio of calcium to bicarbonate and sulphate levels. Calcium levels differ between groundwater and lake water and the lower levels of bicarbonate in groundwater may make conditions hostile for some naturally occurring species.

See above.

4.3.3.4 CALM understands that the aquatic fauna sampling program will sample for macro-invertebrates as well as micro-invertebrates. Can SGW confirm this understanding?

Yes. SGW confirms that the aquatic fauna sampling program will sample for macro invertebrates as well as micro invertebrates.

4.3.4 Subterranean Fauna

4.3.4.1 Recent work has shown that a unique subterranean aquatic fauna occurs in the ground waters of the Lake Way-Lake Carey paleo-drainage channel. The large amount of mining activity existing or proposed in or around Lake Carey, may impact on subterranean fauna. Has SGW investigated the presence or absence of subterranean fauna or its likely occurrence in the area proposed to be mined or impacted from mining operations? SGW have proposed coordinated fauna research in conjunction with other companies working in or around Lake Carey. Will these studies include an investigation of the region for groundwater fauna?

SGW has spoken to Mr Humphreys, the Senior Curator at the WA Museum regarding potential for subterranean aquatic fauna to occur in the proximity to the proposed project.

In general terms the fauna occur in the surficial calcrete formations in the upstream sections of paleo-drainage systems. Fauna has been observed in two sites – in Lake Way and upstream sections of Lake Carey paleodrainage channels. However there is very little else known about the potential for subterranean fauna to occur.

Some general estimates of the potential impact can be inferred.

The mine development drilling has identified deep clay profiles and no calcrete formations so it is unlikely that fauna will occur in the immediate vicinity of the mine.

The haul roads may have some impact if they traverse areas of surficial calcrete geology. However the surveys carried out so far have not identified this formation within the proposed extent of the roads and given the limited area proposed to be disturbed, road development is unlikely to have significant impact.

At this stage the tolerance of the fauna to increases in salinity and changes in hydroperiod are unknown. Discharge of the groundwater onto the lake surface should not have an impact if there are no contaminants in the water. However the proposed area for discharge also has a deep clay profile and is unlikely to host the fauna.

Mr Humphreys has suggested that a broad scale examination of the regional geology of the area be carried out to determine whether it is suitable to host such fauna. The results of this preliminary survey would establish whether it is worth proceeding with any further work.

SGW (through the co-operative group) is commits to funding the WA Museum to carry out the preliminary investigation.

4.4 **Flora**

4.4.1 Threatened flora searches should be extended beyond the immediate mine infrastructure footprint to ensure the risk of incidental damage is minimised. Are SGW proposing to survey for threatened flora outside the immediate mine area? What measures do SGW propose to ensure they contain their impacts to the areas they have identified in the CER?

Two flora surveys have been carried out so far. These surveys cover broader areas than that proposed to be disturbed by the development of the mine. The surveys were carried out by botanical consultants who are very familiar with the area, having carried out surveys for other mining companies working on and around Lake Carey. No declared rare flora was located in the study area. One priority three species (*Acacia kalgoorliensis*) was located in the study area within plant community C5. Other than a further survey proposed to be carried out in spring 1999 to review the extent of plant community C5 no further surveys are proposed. If there is a change in the mine plan as a result of discussions with the DME, SGW commits to conducting flora surveys prior to any disturbance.

The environmental management plan will include procedures for clearing and will identify the limits for disturbance.

4.4.2 Page 18 indicates that 100 000 tonnes of gypsiferous sand have already been removed from Angelfish Island under DME approval. There is no indication as to what flora surveys were carried out prior to this extraction. What surveys were carried out prior to extraction, and were the results of the survey's reported to CALM?

Approximately 100,000 tonnes of gypsiferous sand have already been removed from Angelfish Island under DME approval. The area disturbed by the extraction of this sand was less than 1ha. No flora surveys were carried out prior to this extraction.

4.4.3 SGW have supplied copies of flora reports to CALM. Further information has been requested by CALM regarding *Acacia kalgoorliensis*. CALM will discuss the results of the reports with SGW once additional information has been considered.

The species *Acacia kalgoorliensis* was located along the alignment of the existing Butcher Well – Red October track. The community including this species was recorded to occur in a 900m wide area along the track. In this area the track will be upgraded to a road approximately 15m wide. SGW will provide further information to the satisfaction of CALM.

4.4.4 Construction of haul roads can result in substantial regional impacts on vegetation communities. Preliminary review of the locations of the proposed haul roads indicates that the Binta Road and Butcher Well-Angelfish island upgrade and the Sunrise Dam detour are unlikely to result in significant impacts, due to their position in the catchment. However, The proposed northern haulroad has potential for significant impacts. Have SGW investigated the impacts this haulroad may have on vegetation communities? What measures have SGW proposed to minimise any impacts from the haul road? Have SGW investigated alternative locations for this haul road?

SGW has undertaken preliminary investigations to determine the potential for the haul road to impact on rainfall run off and downstream vegetation communities. Preliminary investigations suggest that some areas will require the construction of drainage works including either floodways or culverts to ensure that diffuse drainage common in acacia woodland areas is not cut off or diverted. Further investigations will be carried out as the exact road alignment is surveyed prior to construction.

4.4.5 It is unclear from the CER, the width of the corridor that will be investigated during vegetation surveys of the proposed haul road. The corridor surveyed needs to be sufficiently wide, to ensure that incidental impacts from the construction or use of the haul road do not impact on threatened flora. What is the width of the survey corridor? Is it adequate to ensure threatened flora are identified?

Vegetation surveys of the haul road corridors have been completed. The corridor surveyed was approximately 50 – 70m wide. Given the level of mapping it is considered that the survey carried out was adequate.

4.4.6 The intention to use saline water for dust suppression will increase the difficulty in achieving successful rehabilitation of disturbed areas, and may impact adjacent vegetation. If saline water is to be used, roads and access must be constructed to the highest possible standard to minimise impacts. What standards of road are SGW intending to construct? Have SGW investigated an alternative water supply, such as a bore, to supply water for dust suppression?

SGW proposes to construct a haul road of a suitable standard to carry high-speed trucks. The road will have a total width of approximately 15m with a running width of 10m. We are currently exploring for alternative fresh water supplies such as bores along the route of the northern haul road.

4.4.7 *Halosarcia sp* (Angelfish Island) is not currently listed as a CALM priority Species.

5. SURFACE WATER QUALITY AND QUANTITY

5.1 The section on cumulative impacts does not properly address the cumulative impacts from other mines operating in the area. These mines will be discharging to Lake Carey. What is the cumulative impacts of these discharges?

Cumulative impacts are discussed in Section 7.1.

5.2 SGW intend to install culverts under the causeway to ensure the natural flow of the lake is not affected. Are SGW proposing to monitor the effects on the lake of the causeway after culverts are installed, to confirm their impacts can be managed? What commitment have SGW made to monitor the impacts of the causeway after it is constructed?

The causeways have been designed to enable through flow from flood events and from wind driven movement. The causeways would be monitored to ensure that culverts remained effective in enabling normal water movement. SGW commit to developing and implementing a causeway monitoring program as part of the environmental monitoring plan.

5.3 The CER identifies a settling dam for mine water but does not specify its design or location. Where will this dam be placed? How will SGW ensure the dam will be managed to prevent sediments and contaminants being discharged to the lake?

At this stage the location of the settling dam has not been finalised. The dam would be designed to have 2-3 days residence time to allow for the settling of nutrients and trace metals. The dam would also include a hydrocarbon boom to reduce trace hydrocarbons that may be discharged from the open pit. The dam would be subject to routine observations to ensure sufficient capacity and if appropriate would be fitted with an electronic sensor to ensure the dam did not overflow. The location of the dam and final design will be discussed in the mine environmental management plan.

5.4 The CER models dewatering during the life of the mine, but it does not address the long term impacts from evaporation of water in the mining void, and the potential effects this may have on the flooding-drying cycle of the lake. What are the likely impacts on the lake from (ie drawdown) exposing the groundwater to evaporation?

Evaporation from the open pit will be the same regardless of whether the pit is open or closed to the surface of the lake.

Evaporation from the pit is likely to have some impact on the groundwater surrounding the pit resulting in the creation of a small cone of depression in the water table in the adjoining profile. Empirically the drawdown is considered to be inconsequential as the void is less than 0.1% of the area of the lake and the total groundwater resource. The extent of cone of depression would be extremely difficult to calculate, however given the low transmissivity of the clay profile it is not expected to extend very far beyond the perimeter of the pit. They dryer profile within the cone of depression is expected to be recharged from any flooding cycle.

6. CUMULATIVE IMPACTS.

6.1 Other mine sites are already operating or proposed on Lake Carey and its shores. There is no mention of the cumulative impacts on Lake Carey from these mines. What work have SGW done to determine if the cumulative (combined) effects from their proposed mine, and neighbouring operations does not impact Lake Carey?

6.2 The cumulative impacts from SGW and other mines on the lake have the potential to have a regional impact on waterfowl breeding capabilities.

The cumulative impact on Lake Carey from existing projects and the proposed project are not considered significant. The only operation currently on the lake is the discharge of mine dewatering water from the Granny Smith and Sunrise Dam mines (pg 42). The discharge water from the two mines is pumped to the same area. The total discharge is approximately 2.4 ML/day. When added to the estimated 2.6 ML/day discharge from Red October the cumulative total is less than 1% of the whole catchment runoff from average rainfall for the month of October (driest month of the year).

The two discharge sites are approximately 30km apart and the combined total of the estimated area of increased salinity around the discharge point is approximately 300ha which is less than 0.5% of the area of the lake.

On this basis it is considered that the cumulative impacts of the existing and proposed operations are not significant.

7. REHABILITATION AND MINE CLOSURE

7.1 Mine closure and rehabilitation plans need to be provided prior to the start of operations. What commitment have SGW made to developing mine closure and rehabilitation plans? When are SGW intending to develop these plans?

SGW recognises that the current mine closure and rehabilitation plans are conceptual. SGW will develop environmental management plans and rehabilitation and mine closure plans prior to the commencement of mining to the satisfaction of DME, DEP, CALM and WRC.

7.2 SGW have indicated that they will not rehabilitate waste dumps in the normal sense. Given that the waste rock is saline, how do SGW intend for these dumps to be rehabilitated? Are SGW proposing to investigate alternative rehabilitation options or carry out rehabilitation trials for the waste dumps? Have they considered using the material from the causeway to rehabilitate the dump at the end of the mine life?

If the waste rock dumps are established on the salt lake there is no topsoil available to sheet the waste dumps in the normal sense. Sheeting the dumps with competent waste rock will contribute to stability especially on the proposed low slope angles. DME have requested an investigation of alternative locations for the waste dumps, which in some cases could result in topsoil material being available.

Some materials from the causeways can be used to rehabilitate the dumps at the end of the mine life. SGW commits to include details of proposed trials and waste dump rehabilitation in the rehabilitation plan.

7.3 The mining void should be backfilled with waste. Do SGW intend to backfill the void? If not, why wont SGW backfill the void at the completion of mining, with the material deposited on the lake?

SGW does not intend to back fill the open pit. This is not a normal requirement of mining in Western Australia. Should exploration being carried out by Sons of Gwalia be successful and more mines are developed on the floor of Lake Carey there may be the potential to back fill the void with the waste rock from another mine.

7.4 There is concern about the mining void and causeways remaining after mining and the potential impacts this may have on lake hydrology. If they remain, how will the void and causeways affect water flow and hydrology of Lake Carey in the long term.

The main lake flows on Lake Carey are from north to the south and the main channel is to the east of Treasure and Angelfish Islands. The passage between Treasure and Angelfish Island is not to be considered to be important hydrologically. In the current mine plan however SGW proposes to maintain limited channels between the two islands.

The current conceptual plan envisages the mining void being isolated from the lake surface hydrology by the construction of a large bund completely surrounding the pit. This would limit any impacts on surface water quality from mixing of void water and lake surface water.

The causeway may remain after mining has been completed. The causeway has been designed to provide sufficient capacity to allow the water in the lake to achieve equilibrium within an acceptable time. The placement of culverts will also enable wind driven water to flow through the causeway as required. It is not possible to construct a causeway to have no impact however the proposed design is considered to be the best option in allowing equilibration of flood waters and wind driven water within a reasonable time.

7.5 CALM is unlikely to support retention of the causeways as they will interrupt the flow of the lake in the long term and introduce predators. The culverts installed to maintain the flow in the lake will require long term maintenance, to ensure they do not become clogged in the future. If SGW propose to retain the causeway's, who will be responsible for maintenance of the culverts and how will predators be prevented from accessing the lake via the causeway?

SGW will retain responsibility for the maintenance of the causeway while actively mining in the Lake Carey area. Following completion of mining it is intended to undertake a review of the performance of the causeway and in co-operation with the Shire of Leonora and other agencies as appropriate to decide whether the causeway should remain and who would be responsible for maintenance.

The Shire of Leonora has already expressed a view that the infrastructure established for the Red October Project should remain in the long term. Clearly, however, the decision to retain the causeway would need to be referred to other parties and to be based on some consideration of the performance and long term viability of the causeway.

Our observations suggest that there is already significant movement across the lake by fauna and it is therefore impossible to prevent access to the lake.

7.6 There are concerns that the proposed waste dump may not be stable. Given the flooding dynamics of the lake environment, erosion of the waste dump could lead to pollution of Lake Carey. What measures have SGW proposed to prevent erosion? What monitoring will be implemented to ensure the dumps are stable?

Erosion and deposition is a natural part of lake dynamics. The waste rock material does not contain metals that would cause pollution of lake waters. SGW proposes to construct waste dumps at low angles to reduce the amount of run off onto the lake. SGW proposes to monitor erosion and deposition from the dumps to ensure the dumps do not significantly contribute to siltation of the lake floor.

7.7 Who will be responsible for deciding if the causeway will stay? Will this be part of SGW plan for closure?

See above

7.8 SGW have indicated that they will construct a safety bund around the pit that will remain when the mine finishes. What other alternatives have SGW investigated, instead of constructing a safety bund? Will SGW commit to investigate alternatives to building the bund when developing mine closure and rehabilitation plans?

7.9 Has SGW considered alternative options to constructing a safety bund? For example, earthworks at the completion of operations which contour the pit walls to several metres below the final resting water level in the pit. This could achieve a compromise between safety and an acceptable environmental outcome. There is a precedent for this type of rehabilitation at the open cut coal mines in the south west of WA.

As discussed in Section 1.4 SGW has adopted the terrestrial guidelines for the construction of a safety bund. This decision has been taken in the absence of guidelines in relation to operations on salt lakes. SGW acknowledges there are other options for mine closure including contouring of the pit walls to several metres below the final resting water level in the pit. This option would allow the mixing of pit water with surface water and some investigations on the impacts of water quality would need to be carried out.

However it is accepted that this is one option which potentially requires less work when compared with the potential for ongoing remediation work of the pit bund. SGW commits to undertaking further investigations of the alternatives for mine closure. A mine closure plan will be prepared to the satisfaction of the DME, DEP, and CALM prior to the commencement of mining.

7.10 What monitoring is SGW proposing for the waste dumps and disturbed parts of the islands to ensure their rehabilitation is successful?

A program will be designed to monitor the stability of the waste dumps and rehabilitation of other areas. Work would include monitoring for erosion and siltation of the salt lake floor and diversity and density of revegetation. SGW commits to preparing and submitting a monitoring program as part of the mine closure plan.

8. FERAL ANIMALS AND WEEDS

8.1 There is no mention of the potential to introduce or increase feral animals and non indigenous weeds to the islands and the lake bed. What measure's does SGW propose to prevent the introduction or increase of weeds and feral animals? Given that SGW have indicated the causeway may remain, what measure are proposed to prevent the possible introduction or increase via the causeway after mining has stopped?

8.2 The causeways should be removed or at the very least breached, and the connection with the mainland broken on completion of mining, to control predation from feral animals. Will the causeway be removed at the completion of mining? If not, what measures do SGW propose to prevent the increase or introduction of feral animals to the lake and environs?

Studies carried out by Placer Granny Smith on terrestrial fauna supported by the islands confirmed that islands on Lake Carey do not support fauna populations distinct from those on the mainland. Our observations also confirm there is considerable movement of fauna across the lake between the islands and from the mainland to the islands that supports the view that the islands do not support any unique populations.

Weed control will be carried out on an as needs basis as a standard operating procedure.

9. GREENHOUSE EMISSIONS

9.1 SGW are proposing to use a contractor to carry out mining. As the contractor is likely to be the most significant source of greenhouse emissions, and SGW have indicated that the contract will be considered on environmental grounds, how will SGW ensure the contractor implements the requirements to use efficient equipment?

10. CONTRACTOR MANAGEMENT

10.1 What are SGW requirements of the contractor to protect the environment?

Under the mining contract the contractor is required to carry out operations as directed by the principal. Where infrastructure is to be provided by the contractor this is done to the standard required by the principal. In short the contractor will carry out his operations as directed by SGW. The contractors are required to stipulate the equipment to be used in the mining and haulage contracts. Some consideration will be given to the age and fuel efficiency of the equipment when selecting a contractor.

Summary of Commitments

Throughout the response to submissions SGW has made several commitments to undertake further work to address issues raised in the submissions. These are summarised below.

Mine Environmental Management Plan

SGW commits to the development of a detailed mine environmental management plan to include the following: -

- Examination of alternative options for waste dump design, location and rehabilitation and plans and criteria to manage the agreed option.
- Examination of alternative options for mine closure and decommissioning of the open void and plans and criteria to manage the agreed option.
- Preparation of an environmental monitoring program to include; the monitoring of discharge water and the development of the salt crust at the discharge point; water quality of lake water; the performance of the causeway culverts; and vegetation transects to review the impacts of dewatering.
- Preparation of environmental induction and management procedures to ensure workforce awareness of environmental management issues.

SGW commits to developing the environmental management plan to the satisfaction of appropriate agencies prior to the commencement of mining.

Mine Decommissioning

- SGW commits to the preparation of a mine closure rehabilitation plan and completion criteria to the satisfaction of relevant agencies prior to the commencement of mining.

- SGW commits to involving CALM and other relevant agencies in a process to decide the future of infrastructure including the causeways and haul roads at the completion of mining.

Ecological Studies

- SGW commits to contributing to and participating in a range of biological studies to be carried out by the Lake Carey Mining Environmental Working Group and reporting the findings of the studies to DEP and CALM as appropriate.

- SGW commits to assisting the Museum to carry out preliminary investigations on the potential for subterranean aquatic fauna on Lake Carey.

DME's Requirements for further information

- SGW commits to addressing the outstanding requirements identified by the DME to their satisfaction.