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AUGUSTA--BLACKWOOD RIVER

HEAVY MINERALS MINING PROPOSAL

June 1973
32/71

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1. SUMMARY

- Project Mining Corporation have pegged five mineral claims and four dredging claims in the Augusta-Blackwood River area.
- Objections against the mining have been received from numerous local and non-local organisations and individuals.
- Most of the objections to the proposed dredging in the estuary have claimed that it would destroy the natural fish and bird populations. In fact no scientific evidence for this exists for this area, and since natural processes (eg flooding) already increase the turbidity back upstream as far as Alexandra Bridge, we technically consider that urgent research is needed to resolve the matter.
- Aesthetic objections to the dredging are valid to some extent for the one year when the dredging would be near the townsite.
- The town of Augusta is developing as a retirement, tourist and holiday town and the encroachment upon this life style of a "hard" industry is one of the major objections to the project.
- The Company has delineated "areas of interest" and "potential ore zones" which may form an economic mining proposal IF economic up-grading processes are developed.
- The deposits are in three different environments, viz; estuary, low-lying timber, coastal dunes.
- Little is known about the ecology of Hardy Inlet and the possible effects of the mining proposal on it. No scientific references can be found relating to this particular estuary and only limited research has been done in other possibly comparable areas. Most of this latter work has been specific to particular organisms rather than the overall structure and balance of the estuary system.

- Some information is available on the economic value of estuarine fish catches but data is lacking on the true value of tourism and other possible uses of the estuary for comparison with the calculable value of the mining proposal both to Augusta and the State.

2. RECOMMENDATIONS OF THE EPA

2.1 MC 4196

The potential ore zone within this mineral claim approaches to within ten chains of the beach and is in a dune zone exposed to prevailing strong southerly winds. Several mobile blow-outs occur in the dunes along this coast and mining of this deposit is likely to cause severe wind erosion which is very difficult, if not impossible, to control. It is therefore RECOMMENDED that no mining be allowed in this area.

2.2 Other Mineral and Dredging Claims

The potential ore zones in the mineral claims are in low-lying timbered areas adjacent to Hardy Inlet and, in the case of the dredging claims, within the Inlet itself. Dredge mining of these deposits may have detrimental effects on the ecology of the Inlet, the tourist potential of the district and/or the way of life of the local residents.

It is RECOMMENDED that no mining be allowed on these claims, and they not be listed for hearing in the Mining Warden's Court until further research has been undertaken as outlined hereunder.

2.2.1 Further Research

If the above proposals are accepted by the Government, the EPA proposes to direct the Estuarine and Marine Advisory Committee to undertake a detailed investigation of the Hardy Inlet. Such investigation should include a study of the ecology of the estuary and its environs, and lead to an assessment of the multiple uses of the estuary with respect to such factors as commercial fishing, birdlife, tourism, recreation, the mining proposal and the aesthetic effects for local residents.

It is envisaged that such a programme would entail at least one year of field studies in collaboration with various Government Departments and Instrumentalities.

3. HISTORY

3.1 Initial Pegging

In January 1970 Northwest Development Corp Ltd, a subsidiary of Project Mining Corp Ltd, pegged and applied for 25 mineral claims and 14 dredging claims in the Augusta-Blackwood river area. The claims were pegged for "heavy minerals" viz; ilmenite, rutile, zircon, monazite, leucoxene and xenotime.

The dredging claims pegged covered the complete extent of the Hardy Inlet, extended up the Blackwood and Scott Rivers about $1\frac{1}{2}$ km northwest of Molloy Island and also included the area from the coast for $1\frac{1}{2}$ km seawards from the mouth of Hardy Inlet for about 5 km eastwards.

The mineral claims pegged covered the land area up to the edge of Hardy Inlet, directly opposite the township and other land areas including the coastal land for about one km inland in a five km strip centred near Ledge Point about seven km east of Augusta.

3.2 Claim Evaluation

During 1970 and 1971 closer investigation of the leases by the company resulted in its withdrawing applications for nineteen mineral claims and ten dredging claims, these areas being found to contain insufficient heavy minerals to be of interest to the company.

The areas currently under application by the company are shown in the attached plan and consist of about 396 ha of dredging claims and 494 ha of mineral claims.

More detailed investigation of these claims by the company has delineated "areas of interest" within the claims where potentially economic deposits of heavy minerals may occur. These areas of interest consist

of approximately:

30 ha of Hardy Inlet opposite the Augusta townsite

100 ha of the upper reaches of Hardy Inlet near Molloy Island

75 ha of land on the eastern side of Hardy Inlet and north of Swan Lakes

20 ha in sand dunes west of Ledge Point.

Thus the areas of interest total about 40% of the claims currently applied for.

3.3 Objections to Claims

Objections to the dredging claims were lodged during 1971, 1972 and 1973 by various bodies as set out below.

3.3.1 Leeuwin Conservation Group

Objections have been lodged against MC's 4191H, 4192H, 4194H, on May 27 1971 and DC's 367H, 374H - 376H, on June 18 1971.

3.3.1.1 MC's 4191H, 4192H, 4194H

"This area is a very important part of the holiday resort at Augusta. The beautiful groves of peppermint and forest trees along the river are one of the most beautiful features of Augusta. The residential area of Augusta is high and overlooks the river, this forest region and the Swan Lakes area. If this is interfered with, the whole setting of Augusta will be spoilt".

3.3.1.2 DC's 367H, 374H - 376H

Objections to these dredging claims are not all identical but the points raised are:

- (a) The area is "a national asset of extreme importance" and the "playground of an estimated 50,000 tourists each year".

- (b) The area is a "natural feeding and breeding ground for fish and water birds" and "mining would be detrimental to the habitat"; this could "cause the disappearance of some species and have a detrimental effect on the remainder".
- (c) Boating and fishing are major tourist activities on the river and "mining would despoil the natural unspoiled beauty" of the area.

3.3.2 Country Women's Association

Objections have been lodged to DC's 367H, 374H - 376H and MC's 4191H - 4194H by the Country Women's Association of Western Australia (Incorporated) Augusta Branch on January 25 1973. All objections are identical, viz:

- "1. Many retired people have invested their life savings to enjoy the peace and tranquillity of Augusta, free from the noise and activity which would accompany dredging operations.
- 2. The area has tremendous tourist potential in its present state, and provides a relaxing haven for those seeking refuge from the stresses of business activities.
- 3. This is one of the few remaining coastal areas which retains its natural beauty, and which would be devastated by dredging and mining operations."

3.3.3 Tourist Bureau

The Augusta-Margaret River Tourist Bureau (Inc) has objected against mineral and dredging claims on December 27 1972 as follows:

3.3.3.1 DC's 367H, 374H - 376H

"This Bureau considers that the Blackwood River and its estuary in its natural state, has the greatest potential for tourism of any area in the

State of WA. Interference with this natural state in any shape or form would ruin its charm and beauty both from a residential and tourist aspect. The fact that over 47,000 people visited the Caves in the area in the 1971-72 season indicates the popularity of the District from a tourist point of view. With two boats established for pleasure cruises on the River, people would come to see something of natural beauty; not sand dumps and dirty muddy water. The River would have no appeal and these people would be forced out of business. The River and estuary is teeming with fish and bird life and this would be ruined by dredging or any mining activities in its proximity. It is also considered that people who have invested a life's savings in beautiful homes in the area would have the value of these assets seriously deteriorated."

3.3.3.2 MC's 4191H - 4193H

"This Bureau is of the opinion that any mining activities in this area will greatly detract its natural beauty and pollute the air with easterly winds on to the township of Augusta. Effluents from mining operations could seriously affect the natural state of the Blackwood River which is in close proximity; cause untold harm to the tourist trade in the District, and depreciate these aspects of its value."

3.3.3.3 MC 4194

"This Bureau considers that mining operations in this area would have a deleterious effect on the swan, pelican and other bird life, besides upsetting the water and plant life in this region. These features are inherent in the attraction of tourists to the locality."

3.3.4 Augusta Ratepayers' Association

This association has objected against DC's 367H,

374H - 376H and MC's 4191H - 4194H on October 1972. All objections are identical viz:

"Augusta caters for large numbers of holidaymakers and tourists and its main attraction is the river and its fishing.

The Blackwood River and its Estuary is unique, and if left comparatively unspoilt will continue to attract visitors, whereas mining and dredging for a few years could alter the environment to its detriment.

If mining was confined to the hinterland of the Scott River Basin, the Blackwood River and Estuary would remain untouched. The majority of Augusta residents are retired people who have no wish to see the district commercialised, particularly on such a short term project as proposed. It is to be realised that Tourism and Mining are incompatible and, of the two, the Association strongly favours the former."

3.3.5 Historical Society

The Royal Western Australian Historical Society (Inc) Augusta Branch lodged objections against DC's 367H, 374H - 376H and MC's 4191H - 4194H on September 26 1972. All objections are identical viz:

"The history of the Blackwood Estuary and associated country goes back thousands of years. The Estuary has come to us in a form that is unique, highly attractive and self-supporting. We owe it to posterity to preserve it by permitting only such development as will not destroy the essential balance of the estuarine conditions.

Furthermore, we consider that, in the absence of dredging and mining, the value of development in the area concerned in this Objection is an assured long term project which will greatly outweigh the possible value of short term, but destructive, mineral exploitation."

3.3.6 Forests Department

The Conservator of Forests has lodged objections against MC's 4191H and 4192H on November 27 1972. The objections are identical viz:

- "1. The Claim is situated on Timber Reserve No. 18644.
2. Mining Activity on the area of the State Forest or Timber Reserve would
 - (a) have a serious injurious effect on the forest estate;
 - (b) result in the loss of forest production;
 - (c) spread or facilitate the spread of various timber diseases, and in particular in the case of jarrah, of the disease *Phytophthora cinnamomi*;
 - (d) seriously affect the timber industry of the State.

The forest estate provides an important sanctuary for various species of flora and fauna. Mining activity of any kind would have serious injurious effects upon such flora and fauna and upon the habitat in the area which habitat provides nesting, feeding, breeding and shelter facilities for various species of fauna."

3.3.7 National Parks Board

The National Parks Board of WA has lodged an objection to DC 375H on October 10 1972 viz:

- "1. The application is situated on Reserve No. A25373 which is vested for the purpose of 'National Park and Recreation'.
2. Mining activity of any kind would seriously injuriously affect the reserve, and in particular the flora, fauna and fish, thereon and adjacent thereto, as well as the value of the reserve for the purposes of tourism and recreation."

3.3.8 Department of Fisheries and Fauna

The Director of Fisheries and Fauna, in a letter to the Under Secretary for Mines has stated:

"I hold firmly to the view that before these claims or any other claims involving the dredging of estuaries and inlets are allowed to proceed, the Government must be completely satisfied that it is in the best interests of the State for dredging to be carried out, taking into consideration the important role the estuaries play in the activities of the people of Western Australia.

In relation to our inlets and estuaries, the following general comments are relevant.

1. A great quantity of sport fish are taken from the estuarine environment.
2. Most fish, both commercial and sport fish, and prawns depend on the estuaries for survival. This environment provides essential feeding areas, relatively free from predators for juveniles of many species of fish and prawns, and, in some cases, is an important breeding area.
3. Estuaries are most important areas of recreation, providing accessible semi-enclosed areas of calm, protected waters for boating, fishing, picnics and sightseeing. They provide most attractive areas for exercising one's aesthetic appreciation of the environment.
4. Shallow banks in the estuaries provide essential feeding areas for migratory and resident wading birds.
5. Western Australian estuaries are characteristically shallow, experience small rises and falls of tide and usually have small openings to the ocean which are most often partially or completely blocked by sand bars. Collectively, these factors contribute towards limiting the water exchange between the ocean and the estuaries, making most Western Australian estuaries susceptible to changes in water quality.
6. Dredging and mining of the estuarine environment

is likely to release silt which smothers shell fish and other important filter feeding organisms, cuts down penetration of sunlight, changes water current patterns, and can create deeper holes which become low oxygen detritus traps. Mining is usually a short term project in comparison to fishing and other activities."

3.3.9 Others

There is an objection to MC 4193H by the owner of the land who claims to have title to the minerals thereon.

There is an objection to DC 367H which refers to "Busselton beaches" suggesting an error in the DC number objected.

Numerous other objections to possible mining have been received by this Department by organisations and individuals. Objections are usually based on similar grounds to those of the Leeuwin Conservation Group (LCG).

3.4 Historical Summary

The mineral and dredging claims were pegged by Northwest Development Corporation Ltd (a subsidiary of Project Mining Corp Ltd) in January 1970 and were first objected to by the LCG in May and June of 1971.

In April 1971 the Augusta-Margaret River Shire Council wrote to the Premier (then Minister for Environment and Conservation) requesting his "consideration and comments from an environmental and conservation point of view". This request was passed to the Under Secretary for Mines and the Director of Environmental Protection.

In May and June of 1971 the LCG wrote to the Director of Environmental Protection asking for his comments on the "mining proposal" and setting out details of their concern including "Case for Conservation of the Blackwood River and Adjacent Areas".

In October 1971 the Director received a letter from the LCG advising that Project Mining Corp Ltd were seeking discussions with LCG and asked the Director's advice as to whether such discussions should be held. LCG advised that they had also asked the advice of the WA Chapter of the Australian Conservation Foundation (ACF). The Director advised LCG to proceed with discussions with Project Mining so that each could hear more of the others' proposals and concerns.

A report on preliminary exploration and a "Tentative Development Proposal" for the dredging claims were received from Project Mining in June 1972 and in July 1972 their Exploration Manager held discussions with officers of the Department during which the Company advised that LCG had refused their invitation to hold discussions.

Efforts were then made by the Department to convene a meeting between LCG and Project Mining. The Director visited Augusta in December 1972 and held discussions with the LCG, Augusta-Margaret River Shire Councillors and a meeting of local citizens.

In February 1973 the meeting, suggested in October 1971, was held in Bunbury between Project Mining and representatives of the local Augusta objectors together with the Director of Environmental Protection and Sir Laurence Jackson who was instrumental in bringing the LCG to the meeting.

This meeting, held without prejudice to any possible later Warden's Court Hearing, was used as a forum for Project Mining to outline its possible future mining plans and for the objectors to put forward their concerns. A free exchange of ideas took place and although no firm decisions resulted from the meeting all parties concerned were pleased with resultant understanding of each others' proposals, problems and fears.

4. AUGUSTA AND ENVIRONS

4.1 Location

The town of Augusta lies on the west bank of the Blackwood River, close to the river mouth. North and northeast of the town the river widens out into the Hardy Inlet, a shallow body of water covering some 600 ha; however, the river east of the town is a deeper channel some 300 metres wide.

4.2 Demography

The following census data from the Bureau of Census and Statistics will be discussed in this context:

Census	1966	1971	Growth %
Persons	308	350	13.6
Dwellings	187	261	39.6
Occupied dwellings	107	138	29.0
Unoccupied dwellings	80	123	53.8
Persons per occ. dwelling	2.88	2.54	-11.8
Persons per dwelling	1.65	1.34	-18.6

Augusta is a small town with a population of about 370 permanent residents (based on 1971 census and 1966-71 growth rate), however, two unusual factors in the above census data point to two major features of the town:

- (i) The relatively large number of unoccupied dwellings (57% in 1966, 53% in 1971) is an indication of the "holiday home" component of dwellings in the town.
- (ii) The lower ratio of persons per occupied dwelling (2.54 in 1971) points to the increasing "retirement" sector of the resident population.

The combination of these two factors results in a persons per dwelling ratio for Augusta of 1.34 which is the second lowest in the State (Lancelin 0.89), the average for "south west" towns being 3.08.

The growth of the retirement and holiday features of Augusta can also be seen in the table above. The permanent population has grown about 14% between censuses but the growth in occupied dwellings has been 29% - the ratio of people per dwelling having declined by about 19%. Assuming 2.0 persons per occupied dwelling for the retirement sector of the community and 3.0 and 4.0 persons per dwelling respectively for the remainder, the following figures emerge on the number of persons in each category:

	1966	1971	Increase
2.0 per dwelling	26	128	392%
3.0 per dwelling	282	222	-21%
2.0 per dwelling	120	202	68%
4.0 per dwelling	188	148	-27%

The actual make-up of the town probably lies somewhere between these two sets of figures, however, it is immediately apparent that the "retirement" sector of the community is growing rapidly whilst the "normal" sector is declining, ie the town of Augusta is becoming a "retirement town".

4.3 Industries

There are no industries in the sense of factories, etc, in the Augusta area but the activities equivalent to local industry are:

4.3.1 Tourism

Augusta and its environs is a popular tourist area. No definitive figures on the number of tourists visiting Augusta are available; however, some 47,000

people visited the caves in the area in the 1971-72 season suggesting that the Leeuwin Conservation Group's estimate of about 50,000 tourists per year for the area is not unreasonable.

The Director of Tourist Development lists the following as being factors influencing "travellers into visiting - and remaining in - the area:-

- The natural scenic beauty of the coastline and Blackwood River estuary.
- Fishing (river, coast and deep sea).
- Availability of swimming and pleasure boating facilities.
- Climatic conditions and environment that encourage camping and caravan holidays.
- Caves in the Margaret River, Augusta area."

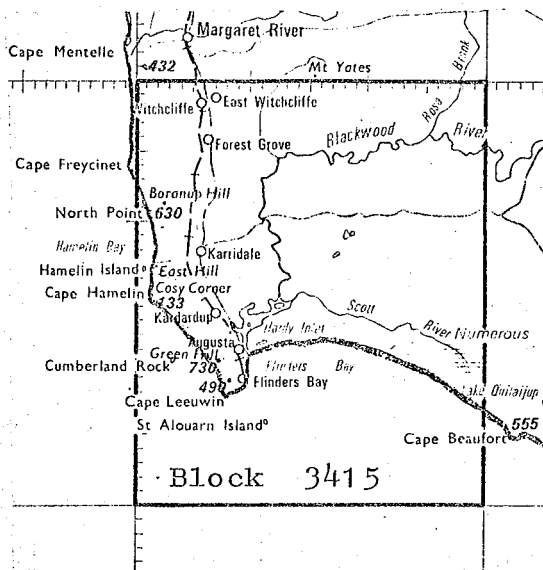
Residents of Augusta are very aware of the value of tourism to the town and there is rapid growth in accommodation facilities both in the hotel/motel and caravan park classes. Two tourist pleasure cruise boats have recently been brought into operation for use on the estuary and the Blackwood River. Historical sites in the township have been preserved, maintained and signposted and there is a general keenness to assist the tourist.

The Australian National Travel Association is undertaking an appraisal of the "south west" including the Augusta/Hardy Inlet area. This report may contain some more definitive data on the tourist use of the area but is not yet available. The Director of Travel Development of ANTA advises that the report will be "released in the near future".

4.3.2 Fishing

A small fishing industry exists in Augusta, based mainly on estuary fishing, with some ocean and abalone fishing. The industry supports some seven permanent professional fishermen in the town. Approximate fish catches for the year July 1971 - June 1972, as supplied

by the Department of Fisheries and Fauna for block No. 3415, are:



FISH PRODUCTION (CATCH)

July 1971 to June 1972

ESTUARINE FISH

SPECIES	POUNDS LIVE WEIGHT	
Pilchard	82	
Perth Herring	765	
Sea Mullet	4423	
Yellow-Eye Mullet	4320	
Tailor	10	
Ruff	732	
Western Sand Whiting	5117	
King George Whiting	2873	
Sea Garfish	244	
Cobbler	111	
Trevally	1381	
Black Bream	67	
Tarwhine	94	
Total	20199	lbs = 9 tons
Green Lip Abalone	42243	lbs = 19 tons

The total value of the fish being about \$3000 and of the abalone \$8500.

Recent information received from the Leeuwin Conservation Group gives the amount of commercial fish other than salmon, tuna, shark and abalone transported from Augusta by the WAGR in the same period as about 89,000 lbs. The weights quoted by the WAGR are probably total freight weight including packing but this is considered insufficient to account for the fourfold discrepancy in figures. A more detailed estimate of the actual value of fish caught in the estuary is required.

4.4 The Estuary

Hardy Inlet, the estuary of the Blackwood and Scott Rivers, is a shallow body of water covering about 600 ha. Cannels of deeper water lead from the estuary southwards to the Southern Ocean and north easterly round Molloy Island to the Blackwood and Scott Rivers.

Except where town or farming developments have taken place, the banks of the estuary are heavily wooded with eucalypts and peppermints (on the bank opposite the township). Aquatic bird life abounds in the estuary and flocks of upwards of 100 black swans are not an uncommon sight, together with large flocks of pelicans and numerous wading birds. The water is plentiful in fish and crabs.

The estuary bottom is generally muddy, with some weed cover in the shallow water; the deeper channels are more sandy and have less weed cover.

4.5 National Park

National Park and recreation reserve A25373 covers an area between the Scott and Blackwood Rivers northeast of Molloy Island and also an area southeast of Molloy Island. The area of interest in DC 375 extends along the northern side of the latter area.

4.6 The Future

As can be seen from the figures in Section 2.2, Augusta appears to be developing as a holiday and retirement

town. These two developments, together with tourism, probably constitute the most likely course for future growth of the town.

Housing development is growing rapidly along the western side of the estuary, north of the township and a proposal has been put to the Shire Council for a holiday resort on Molloy Island. The Town Planning Board has indicated that it is prepared to approve this project subject to conditions which would safeguard the character of the area, eg no road access, no overhead power lines, no development to the foreshore, integration of buildings with the forest setting.

The future of Augusta in terms of tourism, retirement, holidays and recreation appears to be one of continued growth. This growth, however, will probably affect the estuary's capacity to support commercial fishing as sport and holiday fishing increases.

5. MINING

5.1 Previous Proposals

Mining proposals are not new to the Augusta district. In October 1971, the State Government came to an agreement with Mineral Mining and Exports (WA) Pty Ltd and Heine Brothers (Australasia) Pty Ltd for the development of low grade iron ore deposits on the Scott River, about 10 km east of Molloy Island.

The proposal envisaged the establishment of a 500,000 tons/year processing plant and a port either in Flinders Bay or in the Blackwood River - the latter referring to the estuary neck along which Augusta is built. However, the project failed to materialise due to the low grade of the ore and competition from sources of bulk high grade lump ore.

5.2 Current Proposal

Project Mining Corp Ltd have supplied details of the anticipated mining plan which would be expected to be

put into operation if the deposits prove economic; however, they stress in their report "it appears that the grade and tonnage of heavy minerals are marginal. However, there is a possibility of these reserves being mined in the medium to long term provided that such development can be related to an economic up-grading process."

5.2.1 Deposits

There are three classes of heavy mineral deposits forming the reserves for the project:

- (i) deposits in the river-estuary
- (ii) deposits in timbered, low-lying land east of the Augusta townsite
- (iii) deposits in coastal dunes east of Swan Lakes.

The deposits in the water areas are mainly confined to the deeper channels, particularly in the vicinity of Molloy Island where the water is up to 7 metres deep. The mineral bearing sands generally extend to a depth of 3-4 metres below the bottom and are 30-60 metres wide. The possible extent of the deposits as outlined by reconnaissance work carried out by Project Mining Corp Ltd is shown in the attached plan.

5.2.2 Mining Method

The deposits in the water areas and low-lying land adjacent thereto, would be mined using a cutter suction dredge (similar to that in operation at Capel). The dredged slurry would be processed in a floating plant towed behind the dredge; the product from the floating plant (90% heavy minerals) would be pumped to shore processing facilities and the tailings (some 90% of the dredged material) returned to the channel from which it was dredged. This is one of the important differences between the proposed mining and the current PWD dredging.

The mining rate is expected to result in the dredge advancing about 1.5 km per year.

In higher land areas, such as MC 4196, a dry mining method would be employed, using bulldozers and loaders and a dry concentrating plant.

5.2.3 Conservation and Restoration

The Company will undertake to restore all mined areas as nearly as possible to conditions prevailing before mining commences and to this end is prepared to seek advice from Government departments and experts in relative scientific fields.

5.3 Effects of Mining

There are no documented records of dredging of a similar nature in an estuary such as Hardy Inlet, but the following comments indicate the areas where effects may be expected, and the possible nature of such effects.

5.3.1 Engineering

5.3.1.1 Previous Dredging

Dredging has been previously carried out in Hardy Inlet and is, in fact, currently in progress. This dredging is considered necessary in order to maintain a navigable channel through the shallow inlet to allow tourist craft to sail from Augusta into the deeper waters of the Blackwood River. Dredging and blasting in relation to this channel has been undertaken in four stages during the past 17 years, in order to maintain a navigable channel in the face of siltation.

The type of dredging undertaken in this work differs from the mining proposal in two major respects:

- (i) It is operated in very shallow mud banks

- (ii) Dredged material is removed and dumped elsewhere, sometimes forming low, exposed islands.

Under these conditions, it may be expected that there is considerable disruption of the plant and fish life on the shallow banks. However, it may be possible to predict some of the effects of the mining by an examination of the effects of channel dredging.

5.3.1.2 Possible Problems

Problems which may be encountered in the dredge mining programme are the scouring of the deepened channel, particularly during floods and the deposition of the scoured material in other areas where it may be detrimental. The Company suggests that there may be times such as during floods and storms when it would be undesirable to continue dredging operations due to the high rate of water flow and such restrictions would need to be taken into consideration in the mining plan.

5.3.2 Ecology

The Department of Fisheries and Fauna points out that the estuary is probably a breeding and juvenile feeding ground for many species of fish and that dredging and mining may "release silt which smothers shellfish and other important organisms and cuts down penetration of sunlight, change water current patterns and create deeper holes which become low oxygen detritus traps".

Concern has been expressed (ACF 28.3.73) that prolonged turbidity created by the disturbance of silt may initiate long term changes in the plant-animal association by destroying plant life and thereby breaking an essential link in the food chain. There is also the fear of long term effects which cannot be foreseen with the current state of knowledge of the area.

Local residents have advised that in times of flood or severe storms the river and estuary water is muddy as far upstream as the Alexandra Bridge. These are relatively short periods from which the system appears to recover. It should be pointed out that no scientific research has been carried out on the ecology of this estuary and only limited work has been done in other possibly comparable estuaries. Most of this latter work is specific to particular organisms, eg crabs or shellfish.

Other foreseeable short-term effects are the driving away of fish and bird life by the physical presence of the dredge and the temporary disruption of breeding and nesting areas. Evidence of these effects can be seen in the present channel dredging operation.

5.3.3 Social

Concern has been expressed by residents of the Augusta area that the dredging operation will be unsightly, noisy and smelly.

The Company has advised that the dredge will be operating in the vicinity of the townsite for about one year. It will be little larger than the PWD dredge currently operating and as such will not present a great visual impact on the estuary. They also point out that noise will be minimal since no crushing or grinding equipment is employed and noise generation will be confined to the dredge and processor engines which again are expected to be no noisier than the PWD dredge. Odour from the PWD dredging has been complained of by some residents. This is probably accentuated by the deposition of the dredge spoil in large exposed areas where decomposition of organic matter can take place, whereas the mining dredge would be returning spoil below water and it would be exposed to the air for only a short time in the processing unit.

5.3.4 Tourism

The presence of the mining operation may have an adverse effect on tourism though this would probably

be small, as indicated in 3.3.3 above. The Company have indicated that the mining would present little physical inconvenience to people boating on the Inlet and no navigable channels would be blocked. In the event that the dredge may cause an obstruction the Company would undertake to maintain a navigable passage around it.

The main threat to tourism posed by the mining would be possible changes indicated in 3.3.2 since tourism is based on the maintenance of an attractive and viable estuarine environment.

The Company has suggested that the mining operation may be an added tourist attraction in itself.

5.3.5 Economic

The economic effects on Augusta of the mining are related mainly to the employment created. During the construction phase of the operation it is anticipated that a large proportion of the labour force will be recruited locally. During mining operations about 15 men will be required to operate the floating wet plant on a 3 x 8 hour shift basis, and some 50 men would be employed on the shore based processing plant. The Company is keen to use local labour wherever possible and would do so except where specialist knowledge is required. It can therefore be expected that over 50 local men will have permanent employment for the duration of the operation which is expected to be 8-10 years.

Other economic benefits which may accrue are the building and upgrading of roads, increased business for local service industries and the building of some housing for Company employees.

Against this must be balanced the possible loss of income in the tourism and fishing industries, if indeed such a loss would eventuate which remains unproven.

5.3.6 Aesthetics

Social aspects of the proposed dredging were considered in Section 5.3.3. In the definition of the environment as in the Environmental Protection Act, 1971 "the social factor of aesthetics" is included. Inspections of the area and assessment of the life style of the permanent residents together with assessment of the objections by groups such as the Country Women's Association, the Leeuwin Conservation Group, the Historical Society, Tourist Bureau and the Augusta Ratepayers' Association, led to the impression being gained that the major objection to the proposed mining is fundamentally one of aesthetics and an objection to the unknown effect of such an industrial activity in such a quiet rural atmosphere. Such aesthetic objections cannot be quantified nor scientifically assessed. They remain very real objections nevertheless and it is considered only appropriate that retirement and other residents in the area who had anticipated a continuation of the natural environment in their surroundings should have some justification for, and quantitative measure of the possible disruption of this environment. It is considered that the present lack of knowledge cannot lead to the quantification of the ecological effects of the proposed dredging.