BOND OIL PTY HARRIET OILFIELD DEVELOPMENT

Report and Recommendation by the Environmental Protection Authority Report

Department of Conservation and Environment
Perth, Western Australia

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ENVIRONMENTAL PROTECTION AUTHORITY REPORT

HARRIET OILFIELD DEVELOPMENT

1. BACKGROUND

Bond Oil Pty. Ltd., as operator of WA-192-P has defined an offshore oil field north east of Barrow Island with recoverable oil reserves estimated at 1.6 to 1.9 million m^3. The company prepared a detailed Notice of Intent after the Authority requested the document from the previous operators, Australian Occidental Pty. Ltd.

In addition to the Harriet Oilfield, potentially economic oil has been encountered in wells between Barrow Island and Onslow in Wesminco's North Herald, South Pepper and Chervil fields. The Wesminco proposals are the subject of an ERMP (Maunsell and Partners, 1985). It is likely that further small oil fields will be developed in the future.

Barrow Island commenced oil production in 1967, reaching a peak of 7,900 m^3/d in 1970. Current production has declined to approximately 3,800 m^3/d. Barrow Island oil is stored in 5 storage tanks at the main terminal and is then loaded into tankers through a concrete coated steel pipeline to a tanker mooring facility located approximatley 10 km offshore.

The regional setting is presented in Figure 1.

2. THE PROPOSAL

The project would involve the production of crude oil at an offshore platform located approximately 5 km northeast of the Lowendal Islands and piping stabilised oil via a subsea pipeline to a suitable storage and tanker loading point. Three options, shown on Figure 2, have been considered, namely:

- piping oil to the West Australian Petroleum Pty. Ltd. (WAPET) storage and loading facility on Barrow Island.

- piping oil to a new tank farm on the main Lowendal Island with subsequent shipment via an offshore tanker mooring located 2 to 3 km east of the island. This is the option preferred by the company.

- piping directly to a storage tanker moored approximately 2 to 3 km from the platform.

As a variation of these options the storage tanker could be operated until comissioning of either the Barrow or Lowendal Island facilities.

Estimated production would be only 1,400 m^3/d with a life of 5 to 7 years.

A summary of various emissions and wastes from the operation is presented in Table 1.

3. THE ENVIRONMENT

The Notice of Intent provides a description of the environment based on a literature search, aerial photograph interpretations and a four day field reconnaissance.

The Harriet location is located north-east of Barrow Island in a water depth of 23 m. The area of the system evaluated by this study is bounded to the south-west by Barrow Island and by the Montebello Islands to the north. To the west, between these islands, are shallow reef areas, and open water exists to the south-east, east and the north-east. Water depths are less than 25m.

The locality is subjected in winter to the effects of strong easterly winds resulting from high pressure cells centred over central Australia, and the effects of an average of 2.4 summer cyclones per annum within 360 km of the site. These have had a marked influence on both the terrestrial and marine environments.

All the islands in the area are of low relief with low scrub vegetation, providing important habitats for a variety of life ranging from generally sea birds in the Lowendals to mammals, reptiles and sea birds in the Barrow group of islands.

Barrow Island is a significant environmental resource having been established as a Class A conservation reserve for many years. Its importance has been recognized by WAPET and techniques adopted both in management of its operations and in active restoration of disturbed habitats, have minimized disruption.

The Lowendals, currently a Class C conservation reserve, do not have the same diversity of fauna, having only several of the species found on Barrow and the other islands in the region. The Montebello Islands, while not in the same reserve condition as Barrow Island or the Lowendals, are also considered an important environmental resource.

TABLE 1

SUMMARY OF EMISSIONS AND WASTE (FROM NOI)

BARROW OPTION		VOLUME	COMMENT
Platform	Produced water	Max 4000m^3/d Average 1000 m^3/d	Oil max 72ppm, average monthly 48ppm. Temp 65^{o} Salinity, radiation, metals unknown.
	Deck drainage	Variable	Added to produced water stream
	Sea water cooling water	5500 m^3/d	Temp 42^{o}C, added bacteriacide
	Sewerage and domestic waste water	NA	To required standards
	Flared Gas	Max 1,200,000 m^3/d (6months) Average 20,000 m^3/d	Highly visible light produced at night
	Circulating Gas		Possibly corrosion inhibitors Discharge in sea water
	Solid Wastes	NA	Compacted returned to shore for disposal
Pipeline	Test Fluid	Variable	Corrosion inhibitor will discharge to sea
LOWENDAL OPTION			
As above also:			
	Tanker ballast water	NA	Discharge to sea at similar quality to produced water
	Sewerage	NA	BOD 20 mg/l susp solids 30 mg/l sludge removed from island
	Garbage	NA	incinerated, solid material removed from island
TANKER OPTION			
	As for BARROW OPTION also:		
	Tanker Ballast water	NA	discharged to sea at similar quality to produced water

The benthic community is dominated by macroalgae and coral rubble (see Figure 3). It appears to be a low diversity, early successional stage reef community which is heavily influenced by storms. The destructive action of the crown-of-thorns starfish is also considered to be exerting a significant effect on the reef environment.

The fringing reefs to the west of the Montebellos provide protection from wave action to those islands and are therefore of particular importance. The nearshore reefs in the vicinity of Barrow Island, being an area adjacent to a Class A reserve (which will soon be extended to include areas down to low water), are also significant resources due to the limited extent of this habitat within the region. The area is subject to periodic widespread damage due to cyclones.

In deeper water, near the Harriet well site, the bottom is mostly calcareous sand with a sparse cover of sea-grass, ascidians and sponges. Marine mammals including dugong, dolphin and whale, sea birds and reptiles including nine species of sea snake and five species of turtle (four of which are known to breed in the area) frequent these waters.

The area of unconsolidated sediment, macroalgal habitats and deeper water habitats cover larger areas than the fringing reefs.

This region of the north west Australian coast is of interest for petroleum exploration and development, wildlife conservation, commercial fishing, commercial pearl culture, recreation, navigation requirements and the National Estate. Private individuals, companies and State and Commonwealth agencies are involved.

4. ENVIRONMENTAL ASSESSMENT

4.1 Production Platform

At the platform the large volume of flared gas, particularly in the first 6 months, will result in a highly visible light. It is uncertain what phototrophic effects this might cause to turtles and sea birds, particularly those breeding in the Lowendal Islands some 6 km to the south west.

Produced water and cooling water with elevated temperatures and containing oil and biocides respectively are to be directed to the sea from the platform along with deck drainage, sewerage effluent and possibly corrosion inhibitors from the circulating gas. Before the production platform is brought into operation, experience from other parts of the world would be used to determine the environmentally preferred means of disposal of these waters. It is expected that effects should be localised.

4.2 Pipelines and Storage Facilities

The predominant construction disturbances will be in relation to pipelines and storage facilities.

Clearing of a 10m wide pipeline access will cause localised short term disturbance to the sea floors, including the removal of occasional coral heads and algal habitats. If a pipeline to Barrow Island is the chosen option, care should be taken to minimise disturbance to the nearshore corals, especially through the excessive turbidity which might occur during pipe laying. It will be necessary to provide further information on pipeline installation when a route decision is made. This should include a discussion of pipe test fluid disposal.

Of the routes considered, route 2, to the south of the Lowendal Islands appears satisfactory as it is reasonably sited, minimising disruption to terrestrial and benthic communities during construction.

It is proposed that the pipelines are to be laid on the sea floor in shallow waters up to 25m deep, rather than be buried. There are two concerns with this approach. Firstly there will always be the possibility of a ship anchor breaking the pipe, although the area is infrequently visited and pipelines will be marked on navigation charts. Secondly cyclones produce strong currents which could lead to localised stresses on the pipe, particularly in sandy areas subject to scour. In the Gulf of Mexico, pipelines in less than 60 m of water are expected to be buried to avoid these potential problems. However burial can double the cost of a pipeline and as a result the Authority considers that if it can be assured that pipeline damage would be unlikely, burial would not be necessary.

The Barrow Island option appears to present minimal impact of the kind routinely carried out now by WAPET. On the island the major disturbances would be dune destabilisation in the event of pipe burial and removal of habitat along the pipeline corridor. A pipe lay down and construction area would involve temporary disturbance close to the site of the pipeline beach crossing. The size of Barrow Island would allow the work to be undertaken without significant ecological effects.

Because of the main Lowendal Islands' small size, options involving either a pipeline crossing or establishment of storage and processing facilities would probably have a large impact on flora and fauna.

The preferred option, using the Main Lowendal Island for oil storage is only superficially discussed. For instance there is no detail of sea bird and turtle nesting locations and the occurrence of reptiles or other animals. The planned construction period includes 4 months of the known breeding seasons for shearwater and turtles. Further, approximately a third of the island would be influenced by soil and vegetation disturbance and by the proposed facilities. The proposed barge landing is close to the only mangrove stand on the island and the construction of storage tanks would probably result in removal of most of the island's Ficus stands. A resident workforce of 30 men for 5 to 7 years would be likely to have a large impact on the island and surrounding region, even if constraints were placed on movement outside the plant site. Because of phototrophic effects there would be a need to design lighting so as not to be visible to newly hatched turtles. The limited operation time followed by rehabilitation should ensure that nature conservation values are only reduced in the short term.

In the case of both the Lowendal storage or moored tanker options, tanker ballast water would be discharged to the sea at a similar oil content to produced water It is unlikely that disposal would cause environmental difficulties unless the oil-water separator malfunctioned.

4.3 Oil Spills

Oil spills are recognised as the most common cause of environmental pollution associated with offshore activity. However statistics indicate that the vast majority of spills are small. Spills may result from: pipeline accidents, oil well blow outs; explosion and fire; severe storms; and tanker accidents and operations.

4.3.1 Spill probabilities

The Notice of Intent discusses the possible volumes of pipeline spills and estimates the occurrence of platform operation spills and offshore pipeline spills. In table 2 the Bond figures have been compared with Wesminco predictions for their oilfields to the south west (from Maunsell and Partners Pty. Ltd., 1985). These figures show the low probability for large spills.

TABLE 2
COMPARISON OF OIL SPILL PROBABILITIES

SOURCE	SPILL VOLUME (M^3)	PROBABILITY
BOND 5-7 years production	any platform spill	3×10^{-2}
	any pipeline spill (7-750)	3×10^{-2}
WESMINCO 5 years production	Less than 4	1
	4 - 100	1×10^{-1}
	100 - 1000	2×10^{-2}
	1000 - 5000	4×10^{-3}
	more than 50000	6×10^{-4}

The probability of an oil spill may be higher for the moored tanker when compared to either land based storage options due to the storage of oil at sea and the need to purify ballast water at sea rather than on land. However the risk of a major tanker accident during a cyclone would be minimised by moving the tanker to a safe location when cyclone warnings are issued for the area. The risks would be further reduced if the tanker storage was only adopted for the short term, during construction of permanent land facilities.

4.3.2 Nature of the Oil

The Harriet reservoir fluid contains a large percentage of low molecular weight hydrocarbons and the Notice of Intent indicates that up to 75% would be lost through evaporation within a few days of a spill. However once gas and produced water are removed on the platform, the oil would have a higher molecular weight and only some 10% would be lost via evaporation in the first days of a spill.

4.3.3 Trajectory Analysis

Estimates have been made by Bond Oil Pty. Ltd. of oil spill trajectories under spring tide conditions. From the Harriet site a spill would generally not make land fall within 48 hours except under easterly gale conditons. In this situation land fall would be on the eastern side of the reef bounding the western side of the Montebello Islands after 36 hours. From near the Lowendal Islands or between them and Barrow Island, oil releases would make land fall within 48 hours. Because of relatively rapid evaporation and vertical mixing by wind and wave action, volumes of oil actually making land fall would probably be small.

Under neaptide conditions, not covered in the analysis, winds drive water currents more effectively and predictions could be significantly altered.

During a cyclone the most likely spill would be due to a pipeline failure. As the production facilities would be shut in and the pipeline depressurised, volumes of oil released would be small. If moved rapidly southwards they might have a slight impact on the environmentally sensitive islands south of Barrow.

4.3.4. Habitats at Risk

The trajectory analysis showed that all of the following habitats could be affected within 48 hours by a major oil spill:

- the beaches and shallow, biologically rich near shore areas of the Barrow, Montebello and Lowendal Islands.

- the Mangrove Communities on the main Lowendal Island and the Montebello Islands.

- the western fringing reef of the Montebello Islands.

- the Mary Anne Passage Islands and the mainland to the south and south east.

4.4 Management

The Notice of Intent briefly discussed proposed management procedures to minimise damage to environmental resources.

The considerable range of possible impacts from land based facilities, oil spills, waste discharges and gas flares require a reasonably detailed account of the distribution and types of habitats that occur in the region of possible impact. This should be followed by an appropriate monitoring programme that will allow an assessment of the project effects during its life and following decommissioning. The Notice of Intent concludes that such programmes should be developed. These should be formulated following discussions with relevant Government Departments, particularly the Department of Conservation and Environment.

The draft oil spill contingency plan for the project should be finalised once a development approach is decided upon. This plan should take into account the revised approach to the use of dispersants discussed in the forthcoming Department of Conservation and Environment publication, Bulletin No. 104. It should be noted that the figures in the draft plan relating to notification of spills are at variance with Mine's Department requirements and will require amendment. The plan should be developed with consideration of the degree of ecological importance of the various shallow water areas at risk.

In conjunction with the construction phase, a real time spill trajectory model should be developed to assist in the control of oil spills.

Bond Corporation have undertaken to abide by the environmental management programme to be developed for the Lowendal area if this option is undertaken.

4.5 Resource Management

The Notice of Intent discusses the possibility of the Harriet oilfield development being integrated with the WAPET Barrow Island facilities due to their spare capacity caused by the decline in the Barrow Island oil production. This would be highly desirable from a regional infrastructure point of view but requires a satisfactory commercial agreement between the companies. This agreement would need to cover use of Wapet's lease for extra pipework and storage as well as include sharing of existing facilities. However existing lease provisions do not allow for interactions between new and existing oilfield proposals. Such an agreement may reduce the need for development of petroleum facilities on islands in the region and the potential conflict with fisheries, tourism and navigation. However from the disposition of fields it is unlikely that there would be further island installations beyond Barrow, Lowendal and Airlie Islands. The agreement would also initiate planning with a regional view in the event of other oilfields coming into production.

Despite the desirability of the above a number of factors are understood to favour the Lowendal option.

1. Current negotiations between Bond Oil and Wapet would cause additional small discoveries in WA 192P to be uneconomic because of systems of charges if Barrow Island was used.

2. Shorter pipeline lengths to the Lowendals would allow concurrent development of Harriet and small marginal fields without the constraints of insufficient pipe capacity and it is economically undesirable to construct a large pipe immediately.

3. Shipping charges from Lowendal Island would be less due to the ability to accommodate larger tankers than those currently suited to the shallower Barrow loading point.

4. Refineries have indicated that Harriet and Barrow crude oils should be kept separate as the crudes may be destined for different refining ports.

5. Development of the Lowendal Island facilities would provide the company with a single facility to which any future discovery would be linked. There would not be the uncertainty of tanker loading caused by sharing Wapet facilities under the existing tanker use arrangements.

5. CONCLUSIONS

The low risk of oil pollution from the production platform together with its localised construction and operating effects are such that this aspect of the project would be environmentally acceptable with the development of a satisfactory oil spill contingency plan and monitoring programme. The Barrow Island development with its low environmental risks and desirable resource management aspects is preferred.

However in general terms the Lowendal option would be environmentally acceptable because of the short term nature of the disturbance. If this option was pursued, siting of installations would need to be based on the results of a detailed biological survey of the Lowendal Islands and an assessment of construction and operating impacts on the islands and surrounding waters. Site selection would need to consider rehabilitation at decommissioning of the project.

A moored tanker would be environmentally acceptable in the short term but because of the oil pollution risk it should not be regarded as a long term option.

Of the pipeline routes considered in the N.O.I, route 2 south of the Lowendal Islands or those involved with the tanker or Lowendal options would be environmentally acceptable. However more detail concerning the stability of the pipeline under storm conditions is required before the decision not to bury the pipeline could be accepted.

When a development option is finalised, background studies and monitoring programmes, on-going management and an oil spill contingency plan should be developed for the Authority's consideration. The monitoring would be related to disposal of waste waters, oil spills, land disturbance and gas flaring. As part of this presentation to the Authority, the company would need to provide details of produced water quality and proposed additives such as corrosion inhibitors and biocides. Also further trajectory analysis work covering neap tide conditions should be undertaken.

The Department of Conservation and Environment should acquire overseas information on shallow tropical water oilfield development, concentrating on monitoring approaches and satisfactory means of the disposal of waste waters.

During project construction a realtime oil spill trajectory prediction model should be developed to assist in controlling spills that might occur.

In order to follow the progress of the project, it is considered that annual reports to the Authority should be prepared summarising environmental aspects. Further a detailed report should be prepared each three years and at project decommissioning.

The existing barrow facilities have excess capacity that will increase as oil production continues to decline. Also Wesminco has proposed oil storage on Airlie Island. It would seem to be desirable to rationalise oil handling and storage facilities so that these two sites become the regional facilities for a number of offshore oilfields. However economic factors, the inability to mix Harriet and Barrow crudes and lease difficulties on Barrow indicate that the Lowendal Islands are preferable in a commercial sense.

The proposal highlights the unforseen interactions between existing and new petroleum developments and with other land uses such as nature conservation, tourist development, fisheries, heritage and navigation. There is a need for consideration of these interactions in future petroleum lease agreements. In this context there is a need to develop guidelines for development in this West Pilbara coastal region.

6. RECOMMENDATIONS

1. The Barrow Island option would be environmentally acceptable.

2. The Lowendal Island option probably would be environmentally acceptable.

3. If the Lowendal option is pursued, the company should provide the Authority with both the results of a detailed biological survey and a discussion of construction and operational impacts and proposed management. This should include a discussion of rehabilitation at decommissioning. Siting of installations should in particular take account of wedge tailed shearwater breeding locations.

4. A moored tanker system would be environmentally acceptable for short term use.

5. Pipeline route 2 is environmentally acceptable, as are those involved with the tanker and Lowendal options.

6. Details concerning the stability of pipelines under storm conditions must be provided before the authority could consider accepting the laying of pipelines on the sea floor without burial.

7. Once a development approach is finalised provide a report to the Authority outlining it. Include the following information: details of produced water quality and additives such as corrosion inhibitors and biocides; details of background and monitoring studies and detailed management considerations (developed in conjunction with the Department of Conservation and Environment); and an oil spill trajectory analysis conducted under neap tides.

8. During the construction phase finalise the oil spill contingency plan and develop a real time spill trajectory prediction model.

9. Following commissioning of the project the company should provide an annual report summarising environmental aspects of the project. A detailed report should be prepared each 3 years and following project decommissioning.

10. Future petroleum lease agreements should consider the interaction between existing and new petroleum developments and other land uses.

11. Government should establish an inter departmental committee to formulate resource management guidelines for the West Pilbara Coastal region. These should cover the use of the islands, waters and coastline.

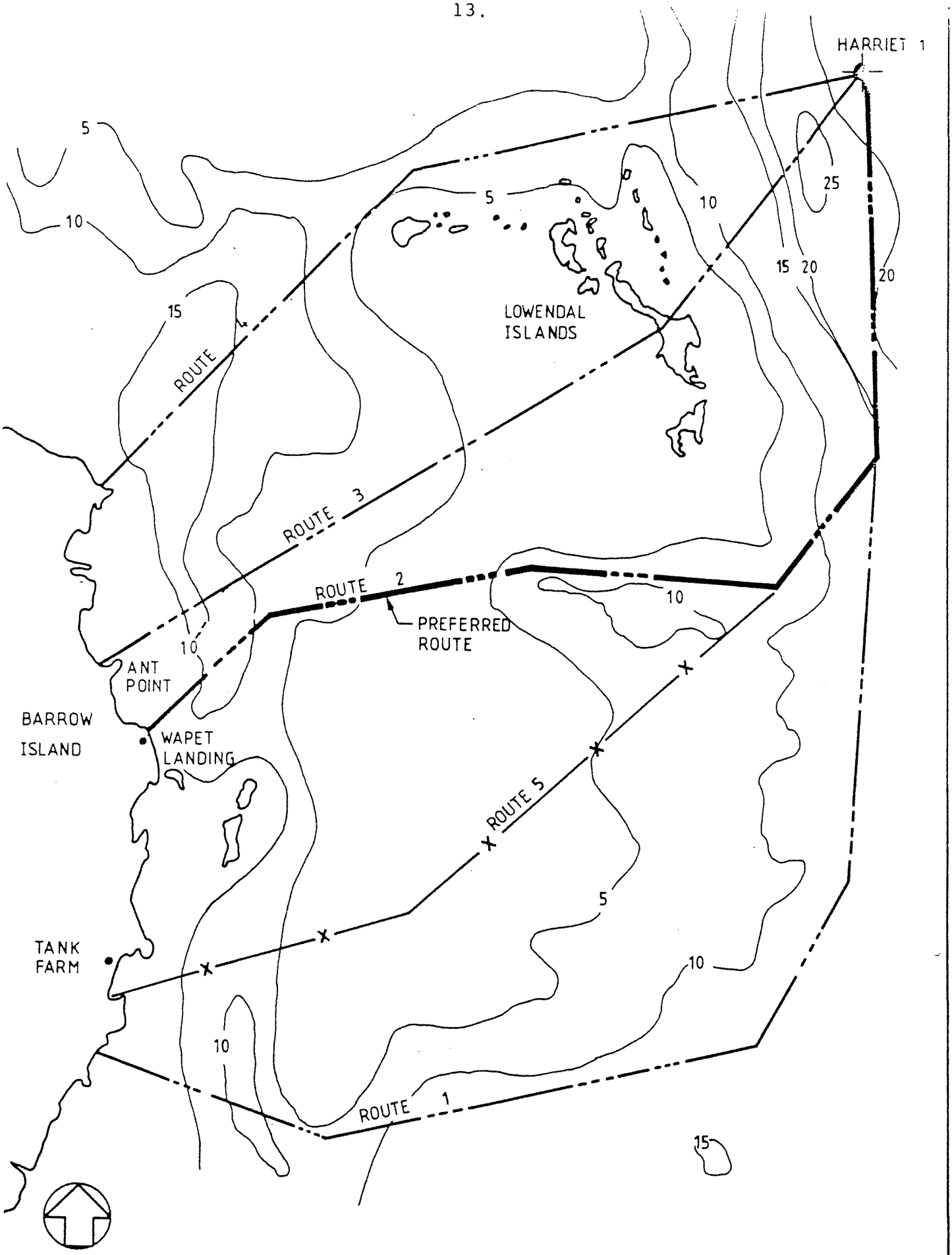
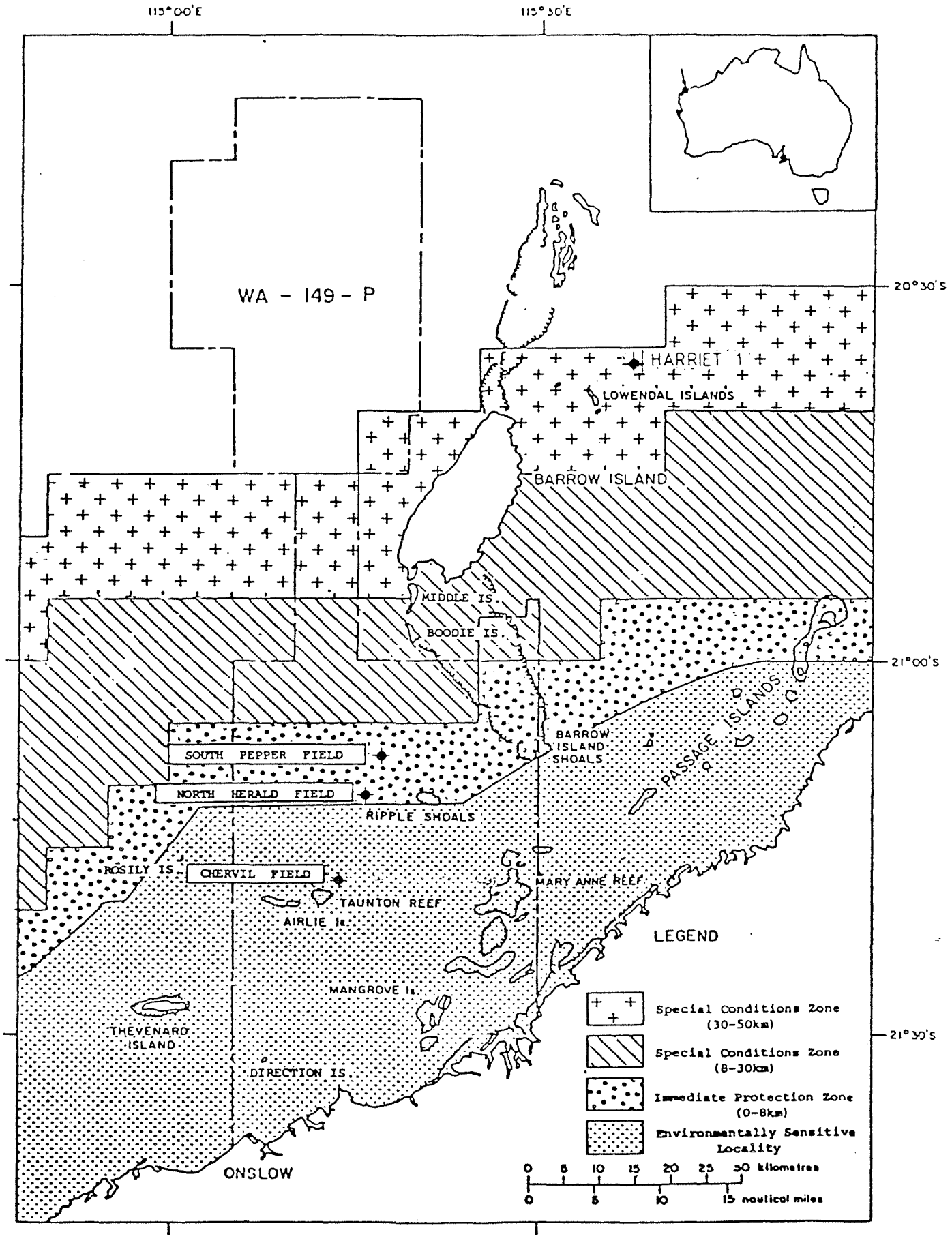


Figure 2
ALTERNATIVE
PIPELINE ROUTES



LOCATION

FIGURE 1

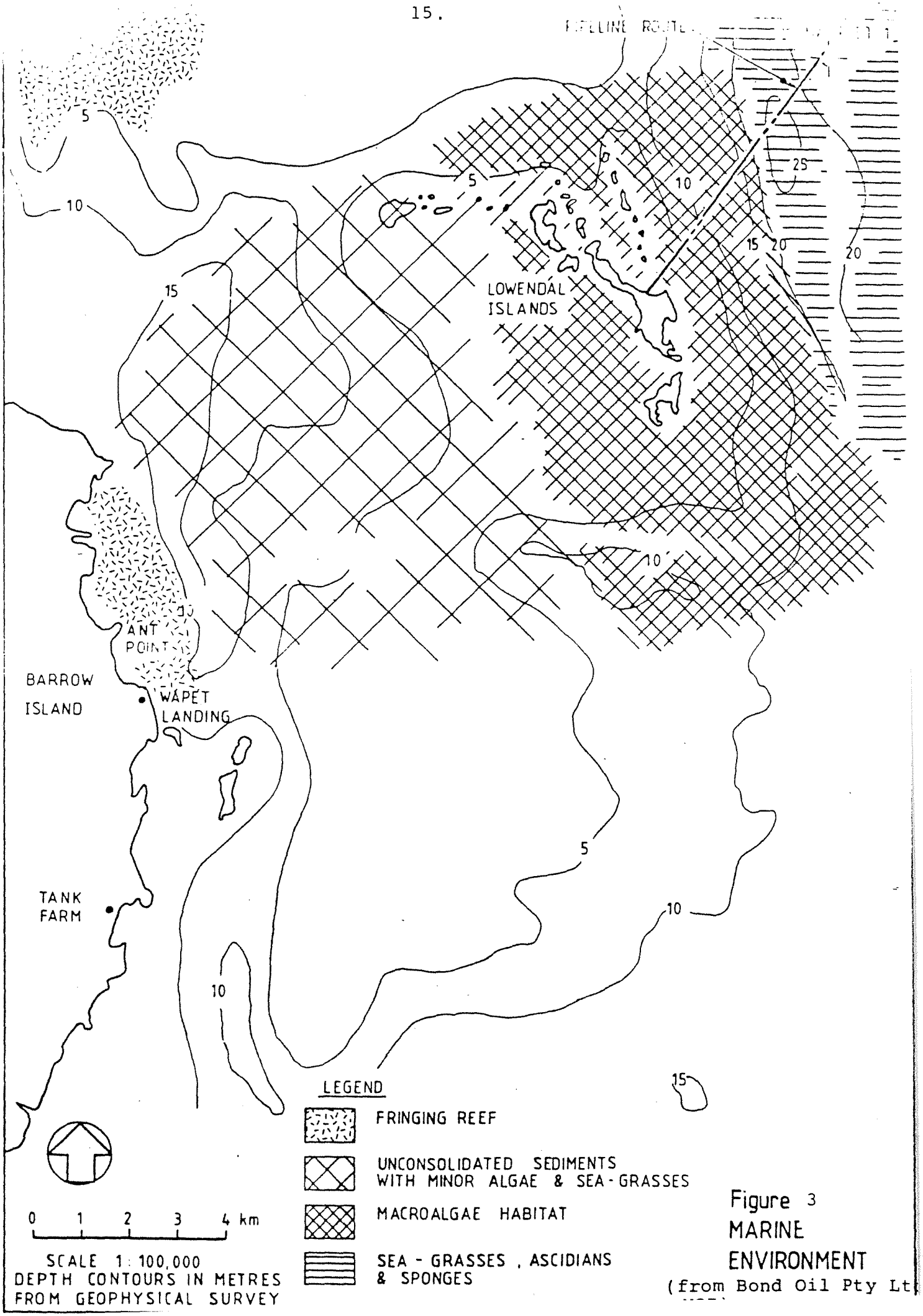


Figure 3
MARINE ENVIRONMENT
(from Bond Oil Pty Lt

SECTION B
EVIRONMENTAL PROTECTION AUTHORITY REPORT

BOND OIL PTY LTD SUPPLEMENTARY INFORMATION

1 BACKGROUND

At meeting 343 the Authority considered the Detailed Notice of Intent on the Harriet Oil field proposal. As a result of recommendations in the EPA report, the Company has now prepared supplementary information in the form of a report with appendices.

For reference, the recommendations of the Authority were as follows:

1. The Barrow Island option would be environmentally acceptable.

2. The Lowendal Island option probably would be environmentally acceptable.

3. If the Lowendal option is pursued, the company should provide the Authority with both the results of a detailed biological survey and a discussion of construction and operational impacts and proposed management. This should include a discussion of rehabilitation at decommissioning. Siting of installations should in particular take account of wedge tailed shearwater breeding locations.

4. A moored tanker system would be environmentally acceptable for short term use.

5. Pipeline route 2 is environmentally acceptable, as are those involved with the tanker and Lowendal options.

6. Details concerning the stability of pipelines under storm conditions must be provided before the authority could consider accepting the laying of pipelines on the sea floor without burial.

7. Once a development approach is finalised provide a report to the Authority outlining it. Include the following information: details of produced water quality and additives such as corrosion inhibitors and biocides; details of background and monitoring studies and detailed management considerations (developed in conjunction with the Department of Conservation and Environment); and an oil spill trajectory analysis conducted under neap tides.

8. During the construction phase finalise the oil spill contingency plan and develop a real time spill trajectory prediction model.

9. Following commissioning of the project the company should provide an annual report summarising environmental aspects of the project. A detailed report should be prepared each 3 years and following project decommissioning.

10. Future petroleum lease agreements should consider the interaction between existing and new petroleum developments and other land uses.

11. Government should establish an inter departmental committee to formulate resource management guidelines for the West Pilbara Coastal region. These should cover the use of the islands, waters and coastline.

2 DISCUSSION The following discussion of the Company responses will be in terms of the recommendations.

2.1 Recommendation 6. Pipelines. The Company has provided sufficient information to accept the laying of pipelines on the sea floor in water depths greater than 15m. In shallower water the Company has proposed laying the pipe in a trench. This would be acceptable.

2.2 Recommendations 3 and 7. Development Approach. Bond Oil has decided on the Lowendal option.

The range of issues asked for in the recommendation has in general been reasonably well covered. The major deficiency was in the discussion of monitoring studies. These will need to be developed as a result of discussions between the company, DCE and CALM In particular the monitoring will need to include monitoring to determine any seabird and turtle effects of the offshore flare.

Other specific points which need to be raised are as follows:

2.2.1 The company will have to alter procedures if monitoring shows problems.

2.2.2 Helicopter usage at 6 am and 6 pm could be in conflict with seabird movements. Timing may have to be adjusted to avoid this conflict.

2.2.3 Reverse osmosis brine should be disposed of under controlled conditions to the sea.

2.2.4 Saline fire fighting water should not be used for vegetation fires as this would be destructive for plant life.

2.2.5 No lights should be visible from turtle breeding beaches.

2.2.6 Details of proposed staff training and education on the environmental aspects of the project should be discussed with DCE and CALM. This training should cover both the construction and permanent work force.

2.2.7 The sewerage treatment plant outfall should be to the ocean to avoid excessive water ponding on the island.

2.2.8 The Lowendal Island facilities should be kept as compact as possible to reduce land disturbance.

2.2.9 There should be no unnecessary disturbances to Wedgetailed Shearwater colonies. As a result, the location of the fire/ballast water storage should be adjusted. The associated rookery/mangrove protection area should use the water storage bund wall as its south east boundary while its south boundary should be formed by the access road past the temporary Construction Camp to minimise sand disturbance.

In a similar vein, the rookery protection area to the east of the storage tanks should be defined to include all Shear-water burrows in that locality. The road to the land backed wharf should be aligned on the margin of the rookery and would then form part of the boundary to the protection area.

2.2.10 Rehabilitation is an important aspect of the project and Bond Oil should specify its aims and means of assessing the effectiveness of the rehabilitation work for acceptance by CALM and DCE prior to commencing rehabilitation.

2.1.11 The total oil concentration in discharged produced water and means of monitoring the discharge are acceptable.

2.1.12 Avoid exessive localised sand extraction from the north east beach area. The lack of sand supply could otherwise result in erosion of adjacent dunes.

2.1.13 Details of the disposal of treated pipeline test water should be discussed with DCE and CALM prior to testing.

2.1.14 It is noted that under neap tides, an oil spill could have more extensive effects on the western fringing reef of the Montebellos under easterly wind than those predicted under spring tides.

2.3 Recommendation 8 Contingency Planning. It is noted that the oil spill catingency plan is being developed. This should be finalised during the construction period.

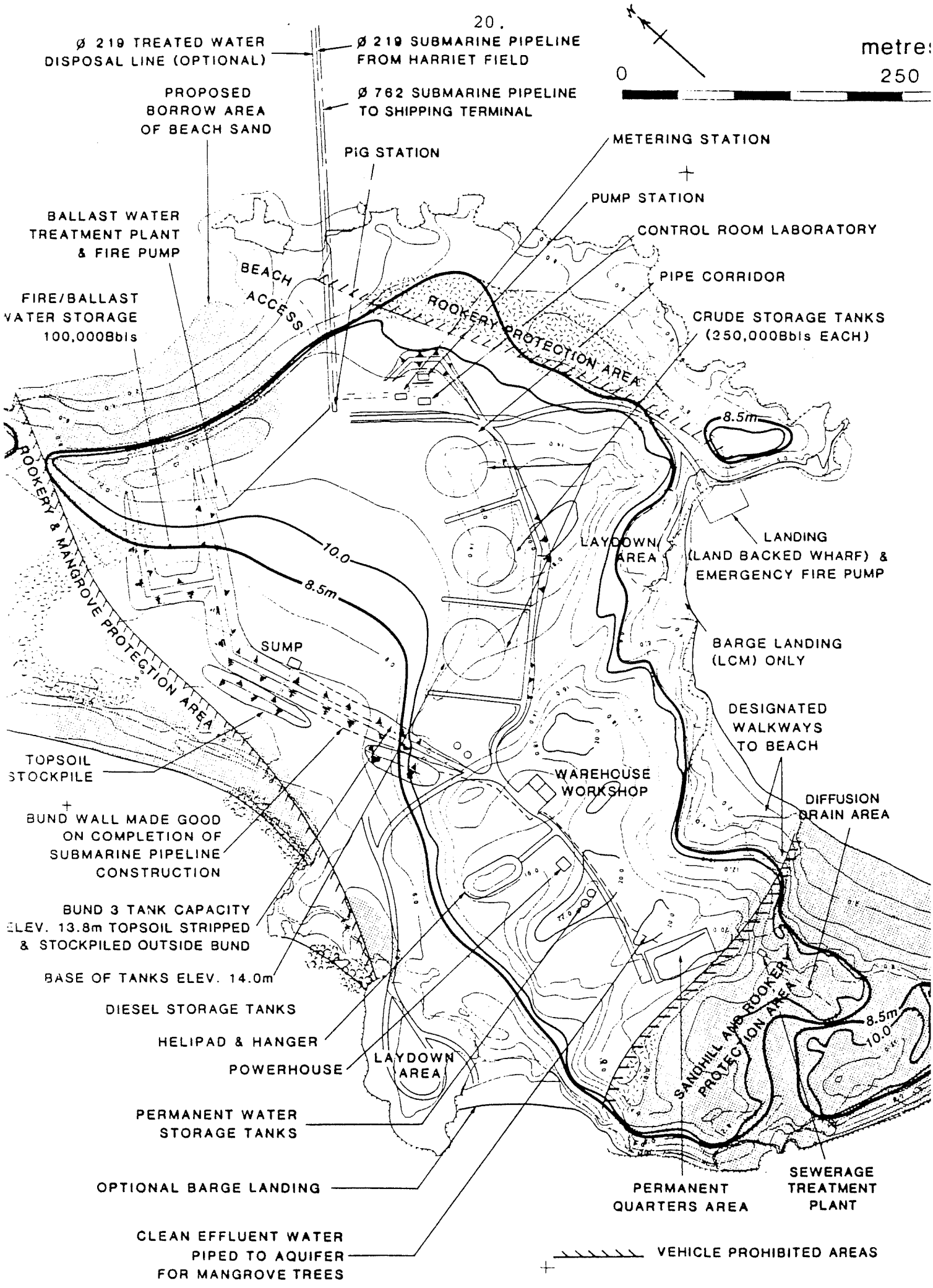
It is suggested that the Company could use the National Plan OSSM model as a basis for its spill tragectory prediction model.

2.4 Recommendation 10 Lease Conditions
Detailed conditions on the use of the main Lowendal Island should be developed in conjunction with CALM, DCE and Mines. If agreement cannnot be reached, the matter should be referred to the Authority for consideration.

A bond should be considered to ensure satisfactory decommissioning and rehabilitation.

3 CONCLUSIONS

If the recommendations followed in Section 2 are followed, it is believed that the projectwould be environmentally acceptable.



PRODUCTION FACILITIES