ENVIRONMENTAL, SOCIAL AND ECONOMIC REVIEW OF THE GORGON GAS DEVELOPMENT ON BARROW ISLAND

SUBMISSION PREPARED BY THE DEPARTMENT OF CONSERVATION AND LAND MANAGEMENT

TABLE OF CONTENTS

EXECUTIVE SUMMARY

This Department is opposed to the use of Barrow Island for an industrial complex as proposed by ChevronTexaco on behalf of the Gorgon proponents. This opposition is based on the unacceptable risks to the unique biodiversity values of Barrow Island, which are of international conservation significance, and the failure of the proponents to demonstrate either their full appreciation of those values or that these values would be adequately protected or compensated for should 'in principle' support for the proposal be approved.

Barrow island is unique at a worldwide scale in terms of both its lack of introduced fauna of any kind, including house mice, or rats, cats or foxes, and its habitat for a unique array of 14 native mammal species, 6 of which are specially protected as being threatened with extinction. It has ecological and world scale reference values that cannot be replicated. The current oil field production poses significant risks for the island which can be managed, but which require additional safeguards in terms of independent on-site biodiversity management. Any future use of the island for an industrial and export complex of any kind will, however, greatly increase the risks of introduction of pests, weeds and pathogens. Even with greatly increased quarantine controls it is inevitable that there would be an eventual failure of such systems. The ability of the management of the island to adequately detect and remediate the damage for such an incursion is questionable and, given the enormous reference and conservation value of the island, is a risk that should not be taken.

In addition, it is our belief that approval for the proposed development on Barrow Island will inevitably lead to pressure for further expansion, just as the claimed management performance of the current oilfield is being used to, in part, justify this development proposal.

Using Barrow Island as a heavy industry platform should be avoided while there are other alternatives. This Department believes that the Environmental, Social and Economic (ESE) Review of the Gorgon Gas Development lacks an adequate analysis of the use of alternative sites for locating the Gorgon development, and evidence in the ESE Review (page 49) supports the fact that Barrow Island was selected as being the most commercially viable option, with comparisons weighted too heavily to capital costs rather than environmental costs.

ChevronTexaco failed to adequately justify the elimination of other potential sites from consideration. Of the alternative sites presented in the ESE Review, the Department's first preference for locating the gas processing facility is on the mainland, namely Cape Preston or Maitland Estate. Should the mainland be deemed impossible or unacceptable, the Department proposes the next option should be Thevenard Island as the preferred location of all the island options, and then on the Montebellos Islands, on the condition that the potential threats to the conservation values of these islands could be adequately managed and Net Conservation Benefit criteria are applied.

Building a gas processing facility on Barrow Island will inevitably lead to incremental increases in disturbance and degradation of the natural system; pollution (including light pollution which interferes with turtle nesting); clearing of vegetation; increase in roading; higher levels of recreational fishing and access; and most importantly a greatly increased quarantine risk. There are many real and known risks and potential consequences that will arise from establishing additional industry on Barrow Island that may prove difficult to impossible to manage. Uncertainty surrounding other yet unknown risks and outcomes is also of concern. Practices in the past that seemed appropriate at the time are now unacceptable. For instance, it is possible that current management of the oilfield will be seen as environmentally unacceptable in the long term, in respect of the current known level of oil pollution in shallow ground waters.

There is a significant risk that if gas processing is established on the island, a downstream processing cluster will be attracted around the gas facility, causing added degradation and risk.

ChevronTexaco has argued strongly that its demonstrated environmental management should be a strong basis for the approval for further use of Barrow Island for the Gorgon development. It has had the ability to restrict access to the island. This has enabled the control of information, both in terms of the selection of those invited or supported to work on Barrow Island, and through the incomplete release of reports commissioned by West Australian Petroleum and ChevronTexaco. Copies of some reports relating to the environment at Barrow Island have not been provided to this Department as a matter of course (e.g. Trudgen, 1989, quoted in the ESE Review), and have not been open to peer review. A rigorous analysis of the impacts of 40 years of oilfield development will, in this Department's view, show that biodiversity values on Barrow Island has been compromised, and that ChevronTexaco has failed to implement adequate management to remediate the long term impacts of threats such as weed invasion, destruction of large areas of valley floor communities, and pollution of shallow fresh water aquifers. The addition of the Gorgon gas processing facility to the existing impacts should be considered to be unacceptable for biodiversity conservation.

It is a matter for Government to decide whether it finds the impacts and risks of impacts associated with the proposed development of a Gorgon gas processing facility on Barrow Island to be acceptable. Cabinet has determined that should it give 'in principle' support for the proposal to locate on Barrow Island, that the project would need to demonstrate Net Conservation Benefits (NCB). In this Department's view, a combined system of best practice performance, environmental conditions and offsets and NCB outcome projects for the use of Barrow Island as proposed would encompass at the least all of the following features:

(i) Best practice environmental performance for all aspects of management on Barrow Island in terms of minimising undesirable impacts to conservation values through:
    - New standards of quarantine control, monitoring, incursion response;
    - Best practice environmental performance in siting developments, including pipelines etc., and in all stages of construction, operation and maintenance;
    - Elimination of threats to native species by eradication of weeds, elimination of light source and marine pollution risks to turtle nesting and other terrestrial and marine species; and,
    - Full cost recovery for a new Department of Conservation and Land Management permanent conservation management presence on the island and in surrounding waters, including net conservation value compensation payments through an independently calculated conservation lease fee for the entire lease area (see section 9, below);

(ii) Direct and full net present value compensation for the lost conservation land and water taken up by, and diminished in conservation value by, infrastructure, roads, gravel pits, oil facilities, loading platforms etc.;

(iii) A major 'icon' conservation project that will produce a biodiversity conservation outcome of permanent conservation significance and is directly relevant to the biodiversity conservation values of Barrow Island that will be lost or at risk of being lost from the proposed development; and

(iv) Other significant conservation outcome projects (possibly through a Gorgon Environmental Foundation (with a suggested budget in the order of c. $2 million per year, linked to CPI) voluntarily put forward by ChevronTexaco in addition to the above for NCB outcomes.

1. INTRODUCTION

This submission has been prepared addressing the major issue in the ESE review of relevance to the Department of Conservation and Land Management, namely the attempted justification for 'in principle' support for the establishment of a Gorgon gas processing facility on Barrow Island. It is of major concern to this Department that the ESE review of the proposed Gorgon development has focussed on a justification of the use of Barrow Island, rather than a full and detailed treatment of the various possible outcomes for development of Gorgon gas should infrastructure be situated on Barrow Island or elsewhere in the region.

ChevronTexaco has not adequately acted upon the advice from the Minister for State Development in his letter to the company on 20 November 2001 (ESE Appendix 1) that "the reports relating to environmental, social, economic and strategic ramifications would include comparisons with outcomes that would occur if alternative locations were used for the project". It is our appraisal that in attempting to justify the position that 'it is Barrow Island or there is no project', ChevronTexaco has understated the biodiversity values of Barrow Island in both absolute and comparative terms, and have under-valued these in comparison with economic values.

Barrow Island is a class A nature reserve of immense value to nature conservation on a world scale. Its key values include:

- Unique natural reference area with complete absence of introduced vertebrate pests including the otherwise ubiquitous black rat and house mouse;
- A total of 6 mammal species specially protected under the *Wildlife Conservation Act 1950* as threatened fauna, and a further 3 with very significant isolated populations amid a total of 14 native mammal species;
- Regionally and internationally significant nesting habitat for 2 marine turtle species that are specially protected as threatened fauna;
- A total of 53 bird species including one which is specially protected as threatened fauna ;
- A total of 28 subterranean fauna species, 12 of which are specially protected as threatened fauna including the only known troglobytic reptile, *Ramphotyphlops longissimus*;
- Approximately 350 terrestrial flora species, including one listed as a priority species for conservation status investigation by this Department;
- A variety of native land snails including one species believed to only occur on the island;
- A sensitive marine environment that is regionally significant and the focus of a marine conservation reserve proposal that is well advanced.

Throughout the remainder of this submission the Department has detailed instances where the biodiversity conservation values of Barrow Island have been under-valued by ChevronTexaco. We have focussed on the key areas of the document relating to biodiversity values, namely:

- evaluation of alternative sites;
- assessment of the conservation values of Barrow Island;
- current environmental performance on Barrow Island;
- quarantine;
- fire management;
- management of greenhouse gases;
- Net Conservation Benefit;
- rental and management cost recovery; and,
- relationship of the project to the draft State Sustainability Strategy.

We have also provided information available to this Department and to ChevronTexaco that demonstrates the greatly reduced biodiversity impacts and risks that would be realised were the

project to be sited at other locations, many of which are relatively benign in impacts compared to the Barrow Island proposal.

It is this Department's view that creative thinking in terms of alternative development proposals and alternate sites may well produce an economically viable project off-Barrow, particularly if the true costs of environmental offsets and Net Conservation Benefits for each of these locations are factored into the economic analysis.

A major general failing in the ESE document is the lack of specific commitments and undertakings by ChevronTexaco. The entire document is filled with language discussing what could be done, or processes that would be followed to determine what would be done. A case in point is the discussion on page 137 relating to "Potential Additional Quarantine Measures". No commitment is given to implement any of the 18 possible additional measures. Rather, ChevronTexaco advise that they will protect the environment through the "pursuit of improvements that will reduce the risk of introducing invasive species and further increase the success of detection and eradication" (page 138 section 7.6). There is a clear need for unambiguous and enforceable performance criteria in regard to any future industrial access approval.

Recommendation

1.1 Should the Government decide to give 'in principle' support to the proposal to site the development on Barrow Island, a full range of firm requirements relating to management actions and best practice environmental performance should be made conditions on any future access.

2. EVALUATION OF ALTERNATIVE SITES

In its comments on the Scoping Document for the ESE Review, the Department identified that the proponent needed to provide detailed information on the process of selection and comparative justification for the Barrow Island site. It is fundamental that, for a project of such high national significance, and with such extremely high nature conservation values at stake, a full investigation of alternative proposals to the use of Barrow Island be undertaken by the proponent. Any investigation of alternatives needs to present comparable data on the environmental, social and economic implications of each alternative proposal. While ChevronTexaco attempted to do this to some degree, it has failed in the ESE Review to provide adequate environmental and social reasoning, supported by reliable data, for the selection of Barrow Island for the gas processing project over the alternative locations. Detailed information is presented in the ESE Review only on the preferred development site (Barrow Island), making it difficult for any proper evaluation of alternative sites. Given that the use of Barrow Island for the development presents risks to its rich biodiversity, it would have been expected that much more detailed justification would have been undertaken for the elimination of alternative sites.

The sections below demonstrate that the proponent's evaluation of alternative sites was inadequate.

2.1 METHOD OF ANALYSIS OF ALTERNATIVES

The key constraints (economic, social and environmental) identified in Table 4.1 (pages 37-38), which were measured against each of the alternative locations in Table 4.2 (pages 42-45), were not given a weighting in terms of their importance or significance. That is, it was not clear from the proponent's assessment of alternatives whether the environmental constraints (e.g. presence of fauna species and habitat) at each location were considered more or less important in the assessment than the economic constraints (e.g. pipeline distance to Gorgon gas field). It would be useful if the constraints were made quantitative as well as qualitative and given a measure of 'importance' in order to assess the true suitability of the alternative locations.

Figure 4.3 (page 46) is misleading and inconsistent with some of the information provided in Table 4.2. Figure 4.3 is largely simplified and does not provide adequate means of comparison between

sites. For instance, the environmental constraints are considered to be at the same level at Barrow Island and the Montebellos, when Barrow Island is known to be a class A nature reserve of international significance and the Montebello Islands are a Conservation Park that has been the site of nuclear testing. The two areas are not equivalent as argued by ChevronTexaco. Furthermore, the 'combined' level of constraint for each site provides a means for the proponent to 'offset' high environmental constraints with low economic constraints, in order to provide an overall moderate level of constraint for sites. This is inappropriate.

As it stands in the ESE Review, it appears that the economic constraints of each site were valued as more important than the environmental constraints. On this basis, it can be argued that the selection of Barrow Island for the gas processing facility was based on economic grounds. For instance, Table 4.3 summarises the analysis of the economic, social and environmental constraints at each site, and concludes that because the economic and social constraints are 'low' at Barrow Island, they compensate for the environmental constraints which were rated as 'high', therefore identifying Barrow as the only acceptable location where "*the development would be commercially competitive*". This is reinforced by the proponent's listing on page 49 of the key benefits of locating the gas facility on Barrow; all but three points are based on the economic viability of the site.

Appendix C, *Identification of suitable locations for a land-based gas processing facility linked to the Gorgon gas field*, details the rationale behind the environmental, economic and social constraints used in Tables 4.1 and 4.2. Some of the criteria appear somewhat arbitrary, and are used to favour Barrow Island as an outcome. For example:

- FAUNA AND HABITAT
  The components of this criterion incorporate a size factor (i.e. islands less than 1,000 ha), where smaller islands have limited capacity for loss of habitat without a significant impact on the natural ecological balance. Islands in general should not be considered to be able to absorb impacts based on their size alone. For instance, the potential impacts on a large island with populations of threatened species are greater than on a smaller island where there are no occurrences of threatened fauna.

  The components of this criterion recognise the values of Barrow Island due to it hosting no introduced species, and supporting an undetermined extent of rare subterranean fauna. However, there is no recognition of the diverse mammal fauna inhabiting the island, including six threatened species.

- CONSERVATION RESERVES
  All conservation reserves (excluding national parks and marine parks) were considered to have a 'moderate' suitability constraint, notwithstanding the variation in their conservation significance. National parks and marine parks are given a higher rating than other conservation reserves (e.g. nature reserves). This approach does not recognise that Barrow Island, a nature reserve, has great importance for biodiversity conservation, moreso than national parks, where ecosystems have been largely impacted by introduced species.

Furthermore, the scoring of the matrix in table 6.6 in Appendix C is open to question. For instance, for the socio-economic factors the following items need further explanation:

- URBAN: Capacity (e.g. housing): For both the Maitland and West Intercourse sites, the infrastructure base would be Karratha. It is difficult to see why these sites rate differently and have a higher degree of constraints than Barrow Island, when new housing will need to be constructed on the island for the Gorgon project. A large regional centre like Karratha clearly has a much greater capacity to accommodate a new influx of people.

- LAND USE CONFLICTS: Recreation/Tourism: Barrow is seen by ChevronTexaco to have no constraints. Chevron Texaco has used its existing petroleum permit to exclude others from the island for purposes such as tourism. Higgins Wood and Associates (1995) identified petroleum

leases as being a constraint on ecotourism development. It is therefore incorrect to say there are no conflicts with tourism or recreation on Barrow Island.

It is incongruous that the ESE Review on page 40 quotes that reasons for rejecting alternative sites for locating the Gorgon gas facility are due to their "*significant environmental values*" and the existence of "*Conservation and Land Management estate and proposed reserves*". It is therefore questionable as to why Barrow Island was assessed as the most suitable site for the development when other sites of lesser conservation value were eliminated for the above reasons.

Recommendation

2.1 ChevronTexaco should undertake a further full and detailed analysis of all alternative locations for the proposed gas processing facilities. Analysis should consider qualitative *and* quantitative environmental constraints of each location, and provide adequate and reliable data (qualitative and quantitative) on the costs and benefits of developing the facility at each site.

This Department is happy to provide input to this process. It should *not* be concluded that low economic and social constraints at a site are able to compensate or offset high environmental constraints (and vice-versa). The evaluation of alternative sites should be completed to the satisfaction of all relevant agencies.

2.2 COST COMPARISONS

ChevronTexaco states in the ESE Review on page 49 that "*Barrow Island was the only acceptable location where the development would be commercially competitive*", and claims that the cost of developing the Gorgon gas processing facility elsewhere would be prohibitive. Little economic analysis is presented to support this claim. Whilst table 4.3 (page 48) provides a comparison of the key cost driver components, the ESE Review does not provide any quantitative values on the derivation of the actual construction costs at each alternative site. Table 4.3 broadly estimates the relative cost for construction at each site, however, there is no indication of how the relative costs were calculated. If the development cost is a fundamental component of the proposal to develop on Barrow Island, this is a significant omission.

A report prepared for the Shire of Roebourne by Astron Engineering/Astron Environmental (Long *et al.* 2002) highlighted that some past cost estimates for development of the Maitland Industrial Estate, for example, have been excessive. This lack of information in the Gorgon ESE Review does not permit a direct comparison of cost estimates between sites. However, using the information that ChevronTexaco does provide in the ESE Review, the following discrepancies are noted:

- The Gorgon ESE Review (Table 4.3) indicates that an estimated 6.7 million m^3 of hard soils/rock would be required for dredging to develop on Maitland/West Intercourse Island.

- The report by Astron estimates that 1 million m^3 of material would need to be dredged, of which only 0.6 million m^3 is identified as Type II (hard) material.

As the cost of dredging is a major component of the Gorgon gas development, and the cost for hard material is more than $2^1/_2$ times that for soft material, this discrepancy would appear to suggest that ChevronTexaco's figures for development on Maitland Estate/West Intercourse Island are inflated.

Table 4.3 also fails to estimate any costs that would be required of ChevronTexaco at each site for covering net conservation benefit outcomes, quarantine management, site rental, and environmental management cost recovery. This Department would be interested in seeing whether an estimate of these costs would result in Barrow Island being less commercially viable overall than a site such as Thevenard Island or the Montebello Islands. There is also the question of how the comparisons would stand if alternative gas processing facilities were considered (e.g. stripping out harmful gases at a smaller plant and piping cleaner gas for processing on the mainland, or using alternative re-injection sites for the CO_2 gases rather than Barrow Island). It is understood that a number of alternative sites

are still under consideration by the GEODISC project team, coordinated through the Federal Government's Geoscience Australia. These alternatives have not been adequately considered in the ESE.

Recommendations

2.2 ChevronTexaco should provide a detailed cost estimate for developing the Gorgon gas processing facility on each alternative site. Costs should include all components of construction and operation.

2.3 Cost estimates in Table 4.3 should also include the particular costs that ChevronTexaco would be expected to cover at each site in quarantine management, rental and environmental management cost recovery, and in meeting net conservation benefit outcomes.

2.4 Alternative project proposals that do not involve export of a gas product direct from the raw product purification process should also be investigated, particularly the concept of initial stripping of CO_2 allowing pipeline transfer of cleaner gas to the mainland for further product processing.

2.3 DEPARTMENTAL PREFERENCE OF ALTERNATIVE SITES

Of the sites identified by ChevronTexaco in the ESE Review as alternatives for locating the Gorgon gas processing facility, this Department's order of preference is as follows:

1. Cape Preston
2. Maitland Estate

Should a site on the mainland be deemed impossible to locate the gas processing facility, the following islands could be considered by the Department:

3. Thevenard Island
4. Montebello Islands (provided marine values could be adequately protected)

A discussion on the above sites in terms of their suitability for the Gorgon gas project follows.

1. Cape Preston

Cape Preston was eliminated from full consideration due to the existence of mineral tenements in the area. The proponent either was unaware or did not mention that as part of the *Iron Ore Processing (Mineralogy) Agreement Act 2002* for the iron ore development at Cape Preston, third parties are permitted to have access provided that it "does not unduly prejudice or interfere with the activities of the Company" (clause 10 (5)). Furthermore, clauses 6 (4) and (5) of the Agreement Act allow for future third party use of port facilities and plant areas of the proposed iron ore development. At this stage, there is no real indication as to when the iron ore project at Cape Preston will commence, or even whether it will commence at all. Given this, there is no valid reason to eliminate Cape Preston as a potential site for locating the Gorgon gas processing facility.

The exclusion of Cape Preston from consideration is further not supported by the data presented in Appendix C for the following reasons:

- Figure 4.3 shows that the distance to deep water at Cape Preston is closer than that at Barrow Island. Furthermore, it also shows that Cape Preston is completely surrounded by a "sheltered coastline", which is a requirement for the location of the docking facilities associated with the project.
- Figure 4.7 shows that the Cape Preston area has the lowest level of overall constraints (including engineering and development cost criteria).
- Page 27 shows that a key feasibility criterion for the suitable site was "distance to deep (sheltered) water (>10 m) no further than 10 km from GPF plant". Figures 4.3 and 4.7 demonstrate that there are suitable locations around Cape Preston that meet this constraint, contrary to the statement on page 27 that the areas are too far inland.

This Department is of the view that Cape Preston would make a suitable site for the Gorgon gas processing facility in terms of the economic, social and environmental constraints listed in Table 4.1. ChevronTexaco needs to provide a thorough qualitative and quantitative analysis on the environmental, social and economic constraints of locating the facility at the site. In particular, the environmental constraints at Cape Preston are significantly lower than those at Barrow Island. This is demonstrated, in brief, in the following points:

- TENURE
  There are no existing or proposed conservation reserves at Cape Preston. A proposal does exist to develop a Dampier Archipelago/Cape Preston marine conservation reserve, which includes the Cape Preston area. However, this proposal does not preclude development. In comparison, Barrow Island is a class A nature reserve, and parts of its surrounding waters are also proposed to be designated as a marine conservation reserve.

- FLORA AND VEGETATION
  A vegetation and flora survey was conducted of the broader Cape Preston area as part of the environmental assessment of the iron ore proposal. No species of Declared Rare Flora (DRF) were recorded; five species of Priority 3 flora were recorded. Likewise, there are no known DRF species on Barrow Island, and one recorded Priority species. However, the 34 different plant formations on Barrow Island are of value for the significant habitats they provide for terrestrial fauna.

- FAUNA AND FAUNA HABITAT
  A fauna field survey at Cape Preston did not record any threatened fauna species, however several Priority listed fauna species were recorded. Barrow Island in comparison is known to be particularly diverse in terrestrial fauna (particularly endemic fauna), with 14 species of terrestrial mammal recorded on the island, six of which are threatened species under the *Wildlife Conservation Act 1950*. In addition, one threatened bird species and one Priority listed reptile occur on the island. Several reptile species are endemic to Barrow Island.

- INTRODUCED SPECIES
  The Cape Preston area contains at least 13 species of weeds, one of which is listed as a Declared Plant under the *Agriculture and Related Resources Protection Act 1976*. The declared weed, Mesquite *Prosopis pallida*, is widespread throughout Pilbara and is a particular problem in the Cape Preston area. The other weeds are common and widespread throughout the Pilbara. In comparison, Barrow Island is relatively weed-free with only a few species on the island, which are restricted to a small number of locations. There are no known species of introduced animals on Barrow Island, while several species of introduced mammals inhabit the Cape Preston area.

More information on the values of Cape Preston is outlined in the attached *Regional Perspective 2000: Dampier Archipelago/Cape Preston* (Attachment A).

2. Maitland Estate

Maitland Estate is of similar general proximity to the Gorgon gas fields as Cape Preston. Similarly, the conservation values at Maitland Estate are significantly lower than those at Barrow Island. As acknowledged in Appendix C, the area has already been set aside for industrial land use. The ESE Review fails to provide any verifiable argument as to why Maitland Estate was eliminated as a potential location for the Gorgon development, apart from the greater distance between the location and the Gorgon gas field (therefore resulting in greater costs). This is an inadequate reason to eliminate a site over another site that has values such as those of Barrow Island. The Department believes that locating the gas processing facility at Maitland Estate would be of similar suitability to locating the facility at Cape Preston, and therefore ChevronTexaco should provide a similar argument as to why Maitland Estate would or would not be a suitable site.

3. Thevenard Island

This island has intrinsic values that are important to conservation. However of all the island options, this Department believes that Thevenard is the most acceptable location. The terrestrial biodiversity values of Thevenard Island are lower than those of the Montebellos and significantly lower than those of Barrow Island. Thevenard is a cay of apparently fairly recent origin, derived from sand deposited from the Fortescue River. The animals on it have 'rafted' from the adjacent mainland and there are comparatively few species of vertebrates. The only species of significant conservation interest is the short-tailed mouse *Leggadina lakedownensis*, which on Thevenard has a higher body weight than mainland conspecifics. A dense population of the house mouse (*Mus domesticus*) is established on Thevenard Island, which established at the time that WAPET first worked on the island; however, the source could have been the Mackerel Islands venture which had been there for some time with no quarantine conditions attached to its DOLA lease. Therefore, the quarantine constraints at Thevenard are significantly lower than on Barrow Island. Furthermore, facilities such as an airstrip and accommodation already exist on the island.

The ESE makes it clear that there are no significant reasons for not having the gas plant on Thevenard except the additional costs associated with distance of the island from the Gorgon gas deposits. Limitations stated are (1) limited available area on the island, (2) potential impacts on recreation, and (3) lack of sheltered waters. These are discussed below.

(1) Thevenard Island has an area of 589 ha above high water mark (data from ChevronTexaco's GIS), well in excess of the area needed for a gas plant.

(2) Recreational use is limited and mainly confined to the Mackerel Islands tourist fishing venture. This co-exists with an adjacent oil processing facility operated by ChevronTexaco.

(3) Oil is currently exported from Thevenard Island via a subsurface pipeline and offshore tanker loading facility.

4. Montebello Islands

The Montebello Islands were rejected as a potential site for the Gorgon gas processing facilities for three main reasons: (1) the restricted area for development, (2) the limited sheltered waters, and (3) their history as a nuclear weapons test site. Limited information is provided by ChevronTexaco to justify these statements (see below):

1. The ESE Review states that the gas processing facility requires an area up to 200 ha and that a further 100 ha is required during construction. Trimouille Island (which is preferred over Hermite Island due to cost differentials; see Table 4.3) is stated to have a useable area of only 100 ha. The island's area is 522.4 ha (DOLA data; the ESE Review states that it is 450 ha). There is clearly an area exceeding 300 ha outside any elevated radiation zones (see below) that could be available for a gas plant.

   Hermite Island has an area of 1,021.8 ha (the ESE Review states it is 950 ha), and has, as the ESE Review states, a very convoluted shape. However, there is a substantial area, towards the southern end, which has been rejected in the ESE Review because of its distance to deep, sheltered water.

2. No data are presented in the ESE Review on the relative merits of the sheltered waters to the east of Trimouille Island versus the east of Barrow Island.

3. Two small areas of Trimouille Island have residual radiation levels above background. Both of these are confined in area, leaving the major part of the island unaffected. Both are in the northern half of the island (Manning *et al.* 2001) and the levels are continuing to decline with time. There are no areas with elevated radiation levels on Hermite Island. According to a recent Department of Health publication, gamma radiation levels on the vast majority of Trimouille are at background levels comparable with those on the coastal plain at Perth. In the two small areas with elevated radiation levels, those levels are low (Manning *et al.* 2001) and it is the Department's

understanding that radiation levels within the small 'above background' parts of Trimouille are lower than some areas of the Darling Range near Perth and lower than levels routinely encountered in the mineral sands industry. No surveys or detailed research appear to have been commissioned by ChevronTexaco on radiation hazards at Trimouille Island to support the statements made in the ESE Review. Recent and past data collected by the Department of Health's Radiation Health Section are not referred to; nor is the published paper included in the ESE list of references despite having been provided to the company during discussions on development of the ESE. No substantiation is given by ChevronTexaco to the claims that radiation is a significant industrial issue. From the scientific data available radiation is not a health issue and it would seem to be a matter for ChevronTexaco to educate prospective customers and staff.

Table 4.2 (pages 42-45), which compares the key attributes of possible alternative locations, does not appear to identify the Montebello Islands as having high environmental constraints (other than being a conservation park). However, Table 4.3, which summarises the findings of this analysis, identifies the Montebellos as having 'high' environmental constraints, of equal value to Barrow Island. It is unclear as to how the proponent came to such a conclusion. The Montebello Islands have been degraded through their use as a nuclear weapons test site (rubbish and structures remain in many places), are severely weed infested (particularly by buffel grass and kapok bush), and have lost at least four species of vertebrate animals due to the presence for more than 100 years of feral cats and black rats. In comparison, Barrow Island has immensely high biodiversity values, including a large number of listed threatened species, and it retains large areas of largely unmodified ecosystems.

Although the Montebello Islands have less terrestrial environmental constraints as a site for constructing the Gorgon gas facility in comparison to Barrow Island, they do have much greater environmental values than the mainland sites considered. In particular, the marine values surrounding the Montebellos are of high value for the following reasons.

- HABITAT – The waters surrounding the Montebello Islands contain a significant amount of sensitive coral reef communities that would be heavily impacted by vessel movements and are at risk in the event of any catastrophic spill.
- ZONING - Due to the presence of these coral communities, two sanctuary zones are proposed in the vicinity of the islands at each end of the group.
- DEEP WATER ACCESS – The only deep water access is along the eastern shoreline of Trimouille Island. There is no equivalent access point on the western side of the group for the proposed feeder pipeline. This would therefore necessitate dredging and blasting activities that would cause turbidity and mechanical damage, which would greatly impact upon the habitat values surrounding the island.
- NAVIGATION – As the Montebello group is made up of a number of islands, navigation for supply and maintenance vessels would not only be hazardous, but the likelihood of vessels grounding and impacting on the surrounding environment would be high, 'with water circulation resulting in severe contamination of surrounding waters.

More information on the values of the Montebello Islands (and Barrow Island) is outlined in the attached *Regional Perspective 2000: Montebello/Barrow Islands* (Attachment B).

Locating the Gorgon gas processing facility on the Montebello Islands is opposed by this Department due to their significant marine conservation values. However, if a decision were to be made between locating the gas processing facility on the Montebellos and on Barrow Island, the Montebellos would be of much less concern to this Department than Barrow Island. However, this Department's consideration of the Montebello Islands would be on the condition that the potential impacts and risks to the marine environment could be mitigated and adequately managed by ChevronTexaco.

Other alternatives

One of the reasons why ChevronTexaco opted for Barrow Island as opposed to mainland sites appears to be the high cost of the pipeline from the Gorgon gas fields to the processing plant. This pipe

transports a corrosive wet natural gas with a high CO_2 content. ChevronTexaco has not addressed the possibility of locating a small plant elsewhere, such as the Montebello Islands, that strips the CO_2 and dries the gas, with the resulting less-corrosive gas being piped to the mainland for liquefaction. Such an operation would have significantly less impact on the sensitive marine environment of the Montebello Islands.

There has been no mention in the ESE Review about the investigation of whether part of the gas processing facility could be located offshore, obviating the need for a tanker-loading jetty. Table 4.3 in the ESE Review states that an offshore platform would be required at Thevenard Island and two other sites, and it is questionable as to why one could not be built off Barrow Island, should the proposal be approved.

Summary
This Department opposes the use of Barrow Island for the Gorgon gas project. This Department's order of preference for locating the gas processing facility is as follows.

1. Cape Preston. This site has no significant environmental constraints.
2. Maitland Estate. This site is already set aside for industrial land use, and there is no verifiable evidence in the ESE Review as to why this site was eliminated for the development.
3. Thevenard Island. This island has intrinsic values that are important to conservation. However, of all the island options Thevenard is the most acceptable location.
4. The Montebello Islands. The development could have detrimental impacts on the marine environment. If a decision were to be made between locating the gas processing facility on the Montebellos and on Barrow Island, the Montebellos would be of much less concern to this Department than Barrow Island. However, this Department's consideration of the Montebello Islands would be on the condition that the potential impacts and risks to the marine environment could be mitigated and adequately managed by ChevronTexaco.

Recommendations
2.5 Cape Preston should be evaluated in terms of its qualitative and quantitative environmental, economic and social constraints as a potential site to locate the Gorgon gas processing facility. The existing mineral tenements on the site do not consitute an acceptable reason for eliminating the site from consideration.
2.6 Reliable quantitative and qualitative data should be provided by ChevronTexaco to validate its argument as to why Cape Preston, Maitland Estate and Thevenard Islands and the Montebello Islands would or would not be suitable sites. All cost estimates (construction, operation, net conservation benefits, site rental, environmental management cost recovery, quarantine management) should be compared between these sites.
2.7 ChevronTexaco should provide an analysis of 'other' alternatives, such as locating a small plant on the Montebello Islands, which strips the CO_2, dries the gas, and transports the resulting gas to the mainland for liquefaction; and locating part of the gas processing facility offshore, obviating the need for a tanker-loading jetty on Barrow Island.

2.4 MINISTERIAL REQUIREMENTS

The letter from the Minister for State Development (Appendix 1 of ESE Review) calls for ChevronTexaco to compare the potential outcomes that would occur if site locations were used other than Barrow Island for the development. Whilst there has been a superficial comparison in costs by ChevronTexaco in the ESE Review, there has been no attempt at a comparison in outcomes. This Department would also be interested in knowing what the potential outcomes are of developing at each alternate site.

3. ASSESSMENT OF CONSERVATION VALUES ON BARROW ISLAND

High quality documentation of the use of the island's biota is necessary in order to make valid predictions about the impacts that would be caused by the development on the island, such as the clearing of the project area and the potential introduction of invasive species. ChevronTexaco outlines the conservation values of Barrow Island in Chapter 6 of the ESE Review. However, on review of this information provided by ChevronTexaco, this Department found that it failed to provide adequate recognition of the conservation values of the island, and failed to provide reliable data to support its claims.

On a number of occasions throughout the development of the ESE documentation this Department identified the need for the document to be impartial and to accurately present the biodiversity values of Barrow Island and the constraints that these put on the development proposal. From our perspective ChevronTexaco has failed to present the information in the way required. The ESE understates the values of Barrow Island and overstates the environmental record of the company and its precursor (WAPET) in environmental management. This raises concerns about the real level of understanding of the need for protection of these values.

Below are issues related to the conservation values of Barrow Island that this Department has identified as being poorly recognised by ChevronTexaco in the ESE Review.

3.1. MARINE ENVIRONMENT

The marine environment that will be physically disturbed by the proposal by pipelines and Materials Offloading Facility (MOF) structures is of a minor concern. The main concerns for the marine environment involve the impacts and risks to mobile marine fauna, and the likelihood of quarantine (including ballast water) and pollution issues.

3.1.1 SEA TURTLES

The most comprehensive assessment of Pilbara sea turtle populations (Limpus 2002) is very clear on several points. Firstly, Pilbara populations of all sea turtle species are of national and/or international significance. Pilbara green turtles are one of the largest remaining populations in the world; the hawksbill population is probably the largest remaining in the world; and the population of flatback turtles comprises approximately one third of the entire world's stock. Limpus (2002) has concerns for the long-term sustainability of all of these stocks. All species are under threat, particularly from predation and anthropogenic activities. The habitats provided by islands are less subject to both pressures and are critical to the survival of these species.

Pilbara sea turtle populations are already subject to a range of pressures which are impacting on the long term survival of the species. The critical feature of sea turtle populations is that the crash of stocks may occur very rapidly, and long after the disturbance that has been the principal cause of the crash (Limpus, *pers.com.*).

The claim in the ESE Review (page 88) that "the regional sea turtle population is estimated to be over 49,000 animals (Prince *et al* 2001)" is incorrect. Prince *et al* (2001) actually estimated 8,481 turtles in the Exmouth Gulf and 49,039 along the Pilbara coast; bringing the total of the North-West shelf stock to 57,520. While this demonstrates a misinterpretation of the data by ChevronTexaco, it is also noted that it is inadequate to group all species and stocks into one population figure.

Turtle nesting

The importance of Barrow Island for green turtle nesting has been largely understated by ChevronTexaco. The rookery on Barrow Island is the second largest (behind the Lacepede Islands) of the North-West shelf stock, and has more than just "regional significance"; it is significant for the

survival of the overall population. The North-West shelf stock is likely to be at relatively low levels at present, given major impacts to the population 30-50 years ago (i.e. commercial turtle harvesting and atomic weapons testing). Furthermore, the impact on green turtle stocks due to indigenous hunting (in Australian and Indonesian waters) is largely unquantified.

Flacourt Bay in particular is one of several important nesting beaches on the west coast of the island. The ESE Review claims that turtle nesting activity on Flacourt Bay ranges from one to fifty nesting attempts per night, however there is no indication as to how this figure was determined. Even so, 50 nesting attempts per night equates to approximately 700 turtles nesting on this beach per breeding season (50 attempts x 14 nights inter-nesting period). We also question the proportion quoted in the ESE Review of nesting beach represented by Flacourt Bay. The ESE Review states that Flacourt Bay is 300 m long and represents one percent of total nesting beaches on the Island. This suggests that there would be 30 km of nesting beaches on the west coast of Barrow Island, however, the island is only 23 km long. Furthermore, the more southern beaches of the island comprise coarser sands and generally do not support large numbers of nesting turtles, so nesting effort is concentrated on the more northern beaches such as Flacourt Bay. This is not recognised by ChevronTexaco in the ESE Review.

The east coast of Barrow Island is also a significant nesting area for flatback turtles. The nesting effort at Terminal Beach could be as high as 640 turtles in a breeding season. Data on the nesting attempts at other suitable nesting beaches on the island are not provided in the Review. We would suggest that at least six other beaches on the east coast support significant numbers of nesting flatback turtles. Given this, up to 4,000 flatbacks may potentially nest on Barrow Island. This would make the island one of the largest rookeries in Western Australia. Consequently, the Department does not believe the Gorgon gas development would pose a "low risk" (page 90) to the east coast flatback rookeries on Barrow Island, as ChevronTexaco seems to suggest.

In its ecological review, ChevronTexaco fails to clarify what it means by "peak nesting times". The nesting season for sea turtles extends from September through to the end of April (encompassing nesting, incubation and hatching). The breeding aggregation time may occur as early as August, one month prior to nesting. ChevronTexaco commits to reducing disturbance during the peak nesting period, however this period is not defined.

Conclusions and Recommendations

3.1 The ESE Review fails to provide reliable data regarding the actual conservation status of sea turtles in the Pilbara region, and in particular, species that utilise Barrow Island for nesting activities. Furthermore, the ESE Review largely underestimated the value of Barrow Island for sea turtle nesting activities. These omissions and errors need to be addressed in the response to the ESE comments.

3.2 While the ESE Review identified Flacourt Bay as a sea turtle nesting beach, it did not provide data on the nesting attempts at other suitable nesting beaches on Barrow Island. ChevronTexaco should provide these data in order to estimate the overall utilisation of the Island for sea turtle nesting activities.

3.3 This Department questions the notion that disturbance to sea turtles during 'non-peak' periods is acceptable. We request that ChevronTexaco clarify the "peak" nesting periods it refers to.

<u>Potential impacts to sea turtles</u>

- LIGHTING

  ChevronTexaco in the ESE Review suggests that the potential impacts to sea turtles caused by the project will be either minimal or non-existent (pages 90-97). This Department challenges this notion. Limpus (2002) states that *"On turtle nesting beaches, the preferred management option needs to be darkness without alteration of the light horizons"*. Similarly, Salmon *et al* (2000) state that *"Lighting should be entirely excluded not only from the beach, but also from areas behind the beach in the form of a buffer (no development) zone"*. In Queensland, the recommended buffer is 1.5 kilometres of light-free zone behind the beach.

During the construction period, the ESE Review indicates that the remediation of light and noise disturbance on Flacourt Bay would occur only during the sea turtle "peak nesting season" (page 93). This is inadequate.

A 24 hour operation will be difficult and expensive to undertake without significant light pollution. While the west coast landfall for the pipe should be totally dark after construction (and kept so during any subsequent maintenance required during September to April), the east coast site will be inundated with massive light pollution, which will originate from the plant, the flare and load-out facilities. This presents significant potential for the distraction of adult and hatchling turtles by lights from any infrastructure near or on the east coast beaches.

The jetty and load-out facilities are built over water. The ESE Review states that night operations will require lighting of these areas. Lighting will act as an attractant to hatchling turtles, making them highly vulnerable to predation. It can be assumed that any hatchlings entering the water while the jetty structure is lit will be killed by predators from beneath the jetty. ChevronTexaco's commitments to reduce the impacts of lighting are not adequate to ensure the protection of these species.

Limpus (2002) is unambiguous regarding the impact of environmental light pollution on both nesting and hatchling turtles. Both are disturbed or disoriented by lighting, including indirect (over the horizon) lighting. Low pressure sodium lights are not a solution to the problem; while they are non-disruptive to loggerhead turtles, they do disrupt green and flatback turtles, which are the main species nesting on Barrow Island. Limpus (2002) recommends that the only acceptable outcome to maintain turtle nesting habitats is zero net ambient light increase during the nesting season. This Department agrees with this notion. While ChevronTexaco proposes to minimise potential impacts to turtle breeding activities on Barrow Island caused by lighting (page 94), impacts of any degree are unacceptable. This supports the Department's view that Barrow Island is an unsuitable site for locating the Gorgon gas processing facility.

Recommendations

This Department believes that an adverse impact on sea turtle populations as a result of this project should not be permitted. However, should the project be approved, the Department would expect that ChevronTexaco meet the following requirements.

3.4 The Department requires that no construction activities be undertaken on turtle nesting beaches at night during any period when turtles use the beach (adult or hatchling). In the event of approval for this project, an environmental specialist must be employed to oversee any operations during the breeding period (September to April inclusive), to ensure compliance with this requirement.

3.5 ChevronTexaco has not provided adequate information on how it will minimise the potential impacts to sea turtles during operations. While it commits to the strategies on page 94 of the ESE Review, further information should be provided on the following:

- how the proponent will shield the pilot flare, which will burn continuously;
- the height of the lights on the proposed plant and how ChevronTexaco plans to minimise light-fall from the plant;
- a commitment to the installation of fully shielded lights, time switches or motion detectors, low intensity lighting, lights installed at a low height, and physical barriers around lit areas; and
- the design of a lighting system that minimise all irradiance on the beach (i.e. will not reflect off large areas of plant back towards the beach and thus escape directional shielding).

3.6 It is expected that during operations, ChevronTexaco should meet its commitments on page 94 to minimise all potential impacts to sea turtles. Furthermore, regular audits by a dedicated environmental specialist (reporting to DCLM and DEWCP) would be expected, and regular inspections by Departmental personnel would be required in order to ensure compliance to these commitments.

3.7 Chevron Texaco should commit to undertake no night time operations on the jetty. Should it persist in requiring the jetty to be lit, ChevronTexaco should quantify the worst-case turtle hatchling kill for the jetty and meet any requirements for permits under the *Wildlife Conservation Act 1950* to take that number of turtles.

3.8 Inshore vessel movements and operations during the pre-nesting aggregation phase should be restricted at both the eastern and western nesting areas. Such activity would seriously disturb mating aggregations. Operations in inshore marine areas will need to be similarly supervised to ensure compliance with this requirement.

- FLARING

The ESE Review acknowledges that flaring may have an adverse impact on sea turtles and seabirds. While ChevronTexaco has committed to not scheduling faring during normal operations, there may be instances where flaring will be required outside daylight hours or during sensitive periods for fauna.

Flaring poses a real threat to hatchling turtles. Early versions of the flare located on Thevenard Island killed many hatchling turtles in the early 1990's. They were attracted by the light emission and then killed by the heat of the flare. This flare was subsequently enclosed, which solved this problem. However, any flaring of excess gas will create an enormous light emission into the surrounding environment. This will cause disorientation to both adult and hatchling turtles. Given the unpredictability of such flared emissions, the only acceptable alternative is to fully shield the flare.

Page 28 of the ESE Review indicates that in gas development projects in competing countries the lesser need to eliminate flaring is a reason for low production costs. Given that flaring has a major impact on wildlife, ChevronTexaco should investigate the option of eliminating the need to conduct flaring on Barrow Island.

Recommendation

3.9 In order to prevent any impacts of flaring activities on turtle hatchlings, ChevronTexaco should commit to either eliminating the need to conduct flaring on Barrow Island, or fully shielding the flare.

- VEHICLES

The use of vehicles on beaches results in the formation of heavy ruts, which cause problems for hatchling turtles long after the ruts are made. Hatchlings can get trapped in the ruts, presenting them as easy prey for crabs and birds; they also get disoriented by the ruts and can move along the ruts until they are exhausted or over-heated. The Department endorses the commitment by ChevronTexaco to deny vehicle access to beaches during the "peak seabird breeding and turtle nesting periods". However, given the persistence of this problem long after the formation of vehicle ruts, vehicle activity along all beaches must be restricted to areas only directly within the pipeline access easement.

Recommendation

3.10 Vehicle and machinery activity along all beaches should be restricted to areas only directly within the pipeline access easement.

3.1.2 MARINE MEGAFAUNA

The likely impacts of the operation of the proposed gas processing facility on larger marine species, such as whales and dugongs are negligible. However, during the construction phase, noise emanating from construction activities may act as an attractant to these species, given that this has previously been identified during offshore seismic operations. The use of observers (as identified in the ESE Review) to determine the presence of these species is critical during any activities that may have an impact on these species. It would be preferred, however, if shut-down operations be employed where possible if these species are found to be present in the vicinity of any activity.

The ESE Review states that routine management measures, such as using vessels to 'shepherd' fauna away, would be employed as a way of mitigating the risk to these species. It is the view of this Department that this should be discouraged, due to the potential for boat strike and the greater levels of direct disturbance to the species from the activity.

Recommendations

3.11 If larger marine fauna such as whales and dugongs are detected in the vicinity of construction activities, shut-down operations should be employed where possible, in order to avoid the risk of any direct impacts to the species.

3.1.3 SEABIRDS

ChevronTexaco fails to mention in the ESE Review the value of Barrow Island as a nesting site for large birds of prey (e.g. Osprey, White-bellied Sea-eagle), terns and gulls.

Similarly to the sea turtles, ChevronTexaco identifies a "peak seabird breeding period" when vehicle and machinery operation would be restricted on beaches. However, there is no definition in the ESE Review of what this period is. According to this Department's records, the peak nesting season on Barrow Island extends from August to October.

No mention is made of the impact of lights and flaring on seabirds. Gull populations have been a problem for gas facilities on the North-West shelf due to light trapping marine fauna beneath flares, resulting in an increase in available food. Increases in gull numbers increases predation upon other species (e.g. nestlings), as well as juvenile sea turtles. ChevronTexaco does not identify this as a potential problem, and it is uncertain as to how it would plan to deal with it.

The reference in the ESE Review to seabird nesting on constructed facilities (page 91) is of concern. Unfortunately, the situation often arises where seabird nests containing eggs or chicks (usually ospreys or sea eagles) that have nested on constructed facilities have to be destroyed during maintenance.

Recommendation

3.12 ChevronTexaco should clarify the "peak seabird breeding period" it refers to, and list its commitments to ensure that disturbance to breeding and migratory seabirds is minimised, should the proposal be approved.

3.13 Should the gas processing facility be constructed on Barrow Island, the Department would recommend that sufficient nest structures be placed nearby, and that any attempt by seabirds to nest on port or other constructed facilities be discouraged.

3.1.4 MARINE AND INTERTIDAL HABITATS

The ESE review identifies, at a relatively coarse scale, the existing marine benthic habitats located along the proposed pipeline corridors and areas adjacent to the development. However, to accurately assess the potential impacts to these habitats caused by the proposal, and to monitor disturbance upon existing habitats, it is necessary to develop more detailed habitat maps than those provided in the ESE Review.

Recommendation

3.14 Prior to any decision being made on this proposal ChevronTexaco should undertake more detailed mapping of the marine and intertidal benthic habitats along the proposed pipeline corridor and areas adjacent to the development. This will provide the Department with a more accurate indication of benthic habitats that may be potentially impacted by the proposal, and identify the possible impacts caused by the installation of the pipeline and the turbidity caused by the construction activities.

3.15 Should this proposal be approved, this Department would seek to have input to the specification of a detailed mapping program of the marine and intertidal habitats potentially impacted by the development. Input would also be sought into the design and implementation of any monitoring and research programs for marine habitats and marine species impacted by the proposal.

3.1.5 INCURSION OF MARINE PESTS

The risks associated with the incursion of marine pests to waters surrounding Barrow Island from the proposal are likely to be slightly higher on a regional scale, due to the overall movement patterns of vessels throughout the North West Shelf area. However, at a local scale marine pest incursions may have a more detrimental impact on the surrounding waters of Barrow Island. The greatest likelihood of introducing species to the surrounding waters is during the construction phase, when modules associated with the development are offloaded with subsequent ballast discharge within the intertidal zone. These movements will increase the risk of marine pest incursions through ballast water discharge or hull fouling and will require strict monitoring regimes in order to mitigate any risks. Flushing of the intertidal zone is limited, therefore increasing the potential impacts to the intertidal community.

During the operational phase, purpose-built LNG tanker movements are only likely to occur between the Barrow Island facility and one other port in temperate waters. This will reduce the likelihood of pests being introduced to the surrounding waters due to differences in water temperature and salinity levels.

The Australian Quarantine and Inspection Service (AQIS) guidelines are the most stringent guidelines internationally that address this issue. This Department would expect that, at a minimum, the AQIS guidelines be adhered to by ChevronTexaco for both the construction and operation phases of the development. We also have doubts about the proposal to establish a quarantine facility on the island (page 65) unless this is a subsidiary quarantine facility after major quarantine controls for all equipment and construction infrastructure on the mainland. There is a need for full quarantine and pre-treatment for weeds, pest animals and disease pathogens for all materials to be brought to the island.

Recommendations

3.16 A protocol for the monitoring of particular marine habitats and species at risk of marine pest incursions, together with contingency guidelines for the occurrence of any invasive event, should be developed by Chevron-Texaco in conjunction with this Department.

3.17 The AQIS guidelines should be strictly adhered to by ChevronTexaco for both the construction and operation phases of the development.

3.1.6 VESSEL OR PLANT DISCHARGES TO THE MARINE ENVIRONMENT

The risk of a major marine spill incident is probably low. However, ChevronTexaco should be certain in what its response would be to a major spill incident, considering that the east coast of Barrow comprises large areas of low energy, high productivity habitats like inter-tidal flats and mangroves. Increased ship traffic increases the chances of a spill incident, particularly given the long project life and the possibility of increased shipping traffic in time.

Recommendation

3.18 This Department recommends that, before any decision is made to proceed with a project on Barrow Island, the proposal should be subject to a quantitative risk analysis regarding the potential for a marine spill.

3.2. TERRESTRIAL ENVIRONMENT

3.2.1 VEGETATION AND FLORA

Reliability of botanical data in the ESE Review

In the main text of the ESE Review, 250 species of plants are quoted as being on Barrow Island (page 101). However, Mattiske and Associates (1993) cite that the species richness is 'in the vicinity of 300', while Astron (2002) (Appendix F) cites 350 species. This discrepancy causes concern as to the credibility of the information presented in the ESE Review.

The reference to Astron (2002) (page 115) in relation to the regeneration of *Corchorus interstans* is somewhat perplexing, given that the cited Astron (2002) report in the reference list (Astron Environmental, *Methanol plant Withnell East Industrial Estate fauna report*, June 2002) is for the GTL Resources project on the Burrup Peninsula, not for Barrow Island. *Corchorus interstans* is not mentioned in this report by Astron, and that species has not ever been recorded on the Burrup Peninsula. We suspect the reference should be to the Astron flora and vegetation report reproduced in Appendix F in the ESE Review (Astron Environmental, *Preliminary Vegetation and Flora Survey of Proposed Gorgon Development Barrow Island*, October 2002), and not the report cited in the reference list.

Mapping of vegetation units

The ESE Review states, incorrectly, that the flora of Barrow Island is typical of the arid Pilbara region (page 101). We advise that the vegetation of Barrow Island is not typical of the Pilbara Bioregion; it is more closely aligned to the Exmouth-Cape Range area than mainland Pilbara, as noted by Astron Environmental (2002) in Appendix F. Vegetatively, Barrow Island conforms to the Carnarvon Bioregion rather than the Pilbara. Floristically, Barrow has more affinities to the Cape Range-Rough Range area than to areas in the Pilbara.

The reference in the ESE document to Beard (1980) is very dated. The scale of Beard's mapping, which was designed to identify structural vegetation types over the entire State, is far too broad a scale for project assessment purposes.

Botanically, Barrow Island has a flora and vegetation that is atypical of the islands on the North-west Shelf. This is undoubtedly due to the size of the island, its geological-geomorphic heterogeneity and mosaic of habitats. In general terms, Barrow Island has unique vegetation and flora that is not represented on any other island off the Pilbara coast.

The vegetation mapping undertaken by Mattiske and Associates (1993) was at a very broad scale (formation level) and is not appropriate for project assessment purposes. For instance, the data presented in Tables 6.2 and 6.3 (pages 114-115) of the ESE Review are redundant for use in a potential Environmental Impact Assessment (EIA) process, as the scale of the vegetation mapping on which it is based is not appropriate. Vegetation descriptions at the scale of association or community are necessary for an informed and credible impact assessment.

The difference between mapping scales is clearly apparent when the Mattiske mapping is compared to the contemporary vegetation mapping and descriptions undertaken by Astron Environmental (2002) (Appendix F). Astron identified 25 vegetation types in the same area where Mattiske identified only five.

No data are provided in the ESE Review on the distribution across the Island of the vegetation types identified by Astron. Similarly, no data on the proportional representation of these vegetation types in the development area are provided, as this work only covered part of the Island, including the project area. Such data are required for an adequate and informed assessment process. For example, there is no indication of how widespread vegetation community L7d is.

Discrepancies between the Mattiske and Astron reports in terms of vegetation and floristics clearly indicate that the former report is dated and inadequate for assessing the environmental constraints of locating the project at Barrow Island. Astron Environmental (2002) also came to the same conclusion and noted the considerable incongruence between the mapped vegetation communities as per the Mattiske report and their actual distribution and boundaries on the ground.

A review of the vegetation mapping and GIS analysis by Mattiske and Associates (1993) was also undertaken by this Department (Attachment C), and similar flaws were found in the Mattiske report. This has ramifications for the potential EIA process and the credibility that can be placed on information provided by ChevronTexaco in relation to potential impacts. For example, the accuracy of the data presented in Tables 6.2 and 6.3 must be treated with extreme reservation, as must statements about proportional representation outside the project area and cumulative impacts on vegetation types.

In addition, no quantitative analysis or detailed description of the floristic communities present has been undertaken on Barrow Island, let alone in the project area. It is fundamental that such an analysis be completed in order to assist in quantifying the vegetation types on the island and to facilitate an informed assessment of impacts, especially in relation to the representation of community types and the distribution of species on the island.

Recommendation

3.19 The detailed community scale vegetation description and mapping undertaken by Astron (2002) needs to be completed for the whole island. This will allow for valid comparisons to be made with respect to the representativeness of the flora and vegetation types across the Island and determine the likely impacts that this project will have on these botanical values.

3.20 While the ESE Review attempts to examine the impact of the Gorgon development on the different vegetation types at the Town Point site (Table 6-3), it would be useful to include the areas of those vegetation units that have been disturbed on other parts of the island as a result of ChevronTexaco's petroleum operations (i.e. present a total view of the disturbance of the affected vegetation units). This is particularly relevant in regard to the area from which gravel has been mined.

3.2.2 TERRESTRIAL FAUNA

Barrow Island populations

In order to evaluate the possible consequences of the proposed Gorgon development on Barrow Island, an understanding of species, subspecies and populations restricted to Barrow Island is necessary. Island populations tend to undergo genetic change after island separation. In general, small populations tend to lose genetic diversity. For example, the population of *Petrogale lateralis* (black-footed rock-wallaby) on Barrow Island has extremely low levels of genetic variation (Eldridge *et al.* 1998). Selection pressure may also lead to changes in isolated populations, and it can therefore be expected that many of Barrow Island's animal populations differ in some way from their mainland conspecifics.

Some populations on Barrow Island have been described as subspecies based on morphological differences and population reproductive isolation (e.g. the Barrow Island euro, *Macropus robustus isabellinus*, and the Barrow Island white-winged fairy-wren, *Malurus leucopterus leucopterus*.) There has been limited genetic research to investigate the extent to which Barrow Island populations that show morphological or other variations compared to mainland populations actually represent change at the subspecies level, or whether some other designation is more appropriate.

One recent example where detailed genetic work has been undertaken is the white-winged fairy-wren (*Malurus leucopterus*). Driskell et al (2002) showed that the Barrow Island black-and-white birds were genetically different from the adjacent mainland blue-and-white birds and that the two populations were genetically isolated. The level of difference between the island and mainland birds reported by Driskell et al (2002) is smaller than that usually found between subspecies, however, it is clearly an 'evolutionary significant unit' (see below).

Results on one species cannot be extrapolated to other Barrow Islands species, and more genetics research is needed, paralleling additional morphometric data collection.

It is noted that in the ESE Review, Appendix G, Bamford Consulting Ecologists use the term 'race' when discussing named Barrow Island subspecies. Modern concepts of biodiversity conservation involve the conservation of ecosystem, species and genetic diversity. It is considered that, regardless of arguments about exact taxonomic status, Barrow Island populations should be considered to be 'evolutionary significant units' (ESU) (Moritz, 1994), or 'conservation units' (Coates, 2000) requiring conservation.

Appendix 2 (Table 1) lists taxa and/or ESU that have received the attention of taxonomists or geneticists that are endemic or nearly so to Barrow Island. The Table is very incomplete, as many populations of animals on Barrow, having been genetically isolated for at least the same period of time as entities that have been the subject of taxonomic and genetic research, have not been closely examined. The list of subterranean animals may be incomplete (more than 20 species of troglobites and stygobites are known from the island with additional species having been discovered during the surveys carried out for the ESE) and may not be accurate in terms of which species are restricted to Barrow Island, as the major review paper on this subject is in press.

Most taxonomic research is based on phenotypic differences. However, several studies have demonstrated that major genetic differences, including divergence at the species level, may exist without any obvious morphological variation. Thus, Barrow Island may harbour more endemic taxa and/or ESU than currently documented.

Of the vertebrate animals on Barrow Island, some occur elsewhere and some do not. Appendix 2 (Table 2) also shows the distribution and potential for translocation of some of the taxa/ESU listed in Table 1. Some species of troglobitic and stygobitic invertebrates not listed in Table 2 are, on the basis of current evidence, endemic to Barrow Island.

Suggestions have been made that Barrow Island endemics could be established elsewhere, thus reducing the risk of their extinction. Establishing Barrow Island endemics on other islands is not a straightforward procedure, as even if technically possible, introductions may lead to local environmental change, and even local extinctions. Most islands off the Pilbara coast are nature reserves and approval would not normally be given for introductions (as opposed to reintroductions) to island nature reserves. An exception is the Montebello Islands, where the existing environmental degradation makes them more appropriate to introductions of highly threatened animals; a procedure sometimes referred to as 'marooning'. However, apart from Hermite Island, where restoration of the original fauna is proposed, other islands are small and do not have similar vegetation to Barrow Island. Additionally, the translocation of some Barrow Island endemics would not be possible.

Dirk Hartog Island in Shark Bay has been suggested as a place where Barrow Island endemics could be relocated. There are several reasons why this should not proceed:

1. Dirk Hartog Island has suffered about 12 mammal extinctions and one bird extinction due to the presence of feral cats (Burbidge, 2001). Feral cats have yet to be eradicated from an island as large as Dirk Hartog.

2. Should feral cats be eradicated, the nature conservation aim should be to restore the island's original fauna, not to introduce species that never occurred there. Dirk Hartog's fauna is related to the south-west of Western Australia, not the Pilbara.

3. Dirk Hartog Island has very different vegetation from Barrow Island, and Shark Bay is in an area of mainly winter rainfall; thus there would be an expectation that some Barrow Island animals would not establish there.

In summary, Barrow Island is unique and its ecosystems can not be replicated elsewhere. The Island harbours taxa known from nowhere else and most sedentary species will show genetic differences compared with mainland conspecifics, making them ESUs. Introducing these endemic populations to other, smaller islands, even if possible, is not consistent with nature conservation practice and objectives.

Should the Gorgon gas facility be constructed on Barrow Island, the impacts on the terrestrial fauna on the island are likely to be significantly higher than those caused by the current petroleum operations on the island. A ten-fold increase in the island human population during construction, and a doubling during operations, will increase the likelihood of interactions with animals through road kills and recreational disturbance to nesting turtles and seabirds. An increased level of adverse impacts is unacceptable.

Much of the biological information contained in the ESE Review regarding terrestrial fauna was based on a report (Appendix G) by Bamford Consulting Ecologists. While the consultant's report provides a reasonable amount of information based on the literature on the terrestrial species, the ESE Review mostly focuses on threatened taxa. These taxa are important, but, in addition much of Barrow Island's conservation value is in the fact that it supports a wide range of terrestrial fauna species, many of which are endemic, and represents a uniquely relatively intact arid zone ecosystem.

Only approximately 10% of the now preferred Town Point site was surveyed for fauna by the consultants. More effort was put into the more northern Latitude Point site. It is doubtful that these efforts were sufficient to fully estimate the impact of the proposed development on Barrow Island's terrestrial conservation values. The statement in the ESE Review "*All of the fauna species recorded at the proposed development site have widespread distributions across Barrow Island...*" should not be made, given that it is based on a survey of the area that did not involve any actual trapping. For instance, only seven of the 43 species of reptile were recorded in the study area. Information on the smaller rodents and dasyurids and reptiles, particularly the endemic *Ctenotus pantherinus acripes*, is lacking.

Mammals

The ESE Review identifies the six species of mammal that are listed as threatened under State and Commonwealth legislation. It should also identify the spectacled hare-wallaby *Lagorchestes conspicillatus conspicillatus* as endemic to Barrow Island, as it does with the Barrow Island Golden Bandicoot, Barrow Island Euro and Barrow Island mouse. There is no mention in the ESE Review of the other native mammal species that occur on Barrow Island, some of which, such as *Planigale* species 1, *Pseudantechinus roryi* and *Zyzomys argurus* are only ever rarely trapped during regular mammal monitoring on the island (Morris *et al.* 2001, Morris *et al.* 2002). These species, while not listed as threatened under legislation, are important and should be recognised as such by ChevronTexaco.

References in the ESE Review to the abundance of mammals on Barrow Island are inaccurate, and unpublished reports are often referred to when published journal articles are available. The following points highlight inaccuracies in the ESE document on page 107:

- Short and Turner (1991) estimated that about 10,000 spectacled hare-wallabies and 1,800 euros inhabit the island, not the respective 9,000 and 1,500-1,800 quoted by ChevronTexaco.
- Short and Turner (1993) estimated that there are 3,400 boodies on Barrow Island, not 5,000 as stated by ChevronTexaco. The total boodie population, including those on Bernier and Dorre Islands, was estimated at 5,000.
- Short *et al* (1989) did not estimate that 50,000 – 120,000 bandicoots inhabit Barrow Island; their estimate was that about 9,000 inhabit the island.
- The estimate of rock-wallaby numbers on Barrow Island from the survey of Hall *et al* (1993) was 116-154. We are not aware of any other survey of rock-wallaby numbers on Barrow Island or of the source from which ChevronTexaco derived the figures in the ESE Review of 125-160. The

reference to Strahan (1995) in relation to black-flanked rock-wallabies abundance is also not accurate. The article on *Petrogale lateralis lateralis* in Strahan (1995) was written by Eldrige and Close and it does not refer to this species' habitat preferences on Barrow Island, or the estimated population size of 150 animals.

- Bamford Consulting Ecologists in Appendix G refer to Strahan (1995) when providing population estimates for various mammals on Barrow Island. No such estimates are provided in Strahan (1995).

Furthermore, the statement that "*terrestrial fauna in the areas subject to disturbance are abundant on Barrow Island and breed throughout the year*" (page 117) is not accurate. The potential impacts on rock-wallabies would probably be the greatest as they are the least abundant and are dependent on adequate day time refuges for survival. Contrary to what is stated in the ESE Review, mammal breeding does not occur throughout the year and is very dependent upon rainfall events. For example, in October 2001 after the driest year on record only 12% of female bandicoots were breeding (Morris *et al.* 2001). This contrasts with October 2000, when up to 50% of the female bandicoots were breeding (Burbidge *et al.* 2000).

These inaccuracies give rise to concern about the accuracy and reliability of the data provided by ChevronTexaco, and the potential to adequately predict and account for all potential impacts on populations of native mammals on the island.

Recommendations

3.21 ChevronTexaco should provide a reliable analysis of the conservation value of *all* of the terrestrial mammals inhabiting Barrow Island (not just threatened taxa), based on accurate and reliable data.

Mammal habitat

The ESE Review correctly recognises the importance of boodie warrens on the island, and the need to avoid disturbance to such areas. The proposed gas processing facility on Barrow Island is very close to at least three warrens and further work is required to determine the potential impact of the development on these.

It should be noted that the proposed pipeline route from Flacourt Bay to the gas plant traverses excellent rock-wallaby habitat and is near one of the rock-wallaby monitoring sites (Morris *et al.* 2001). The suggestion by Bamford Consulting Ecologists in Appendix G that "*a raised pipeline could ultimately be used for shelter by rock-wallabies*" is not accurate and is not supported by this Department. Rock-wallabies rely on the humidity as well as temperature benefits of small caves to maintain water balance (Bradshaw *et al.* 2001), and exposed pipelines are unlikely to provide this. Euros, however, may benefit from sheltering beneath exposed pipelines.

Recommendations

3.22 The proposed Gorgon gas processing facility on Barrow Island has the potential to impact adversely upon important fauna habitats. Should this proposal be approved on Barrow Island, the Department would expect that ChevronTexaco provide an accurate analysis of areas of fauna habitat in the subject area (including proposed pipeline easement and gas processing facility footprint), and commit to avoiding any disturbance to all sensitive areas of fauna habitat on the island.

3.23 Boodie warrens warrant particular attention at the development site. It is likely that warrens near the development will be impacted either by animals moving away, or by increased mortality during the construction phase (road kills etc). ChevronTexaco needs to do further work to determine the potential impact of the development on/near these habitats.

Reptiles and Amphibians

Only seven of the 43 reptile species were recorded during the survey by Bamford Consulting Ecologists. It should be noted that smaller reptiles are unlikely to be as mobile as many of the mammal species, and would be impacted by any vegetation clearing. No trapping at the proposed

development site was undertaken to detect the presence of one of the endemic taxa of reptiles, *Ctenotus pantherinus acripes*. Furthermore, there is no mention of the significance of the Barrow Island population of the perentie, *Varanus giganteus*. It is the only island population of Australia's largest goanna and the species often patrols roads slowly searching for food during daylight hours, hence making it vulnerable to road kill.

Recommendations

3.24 It is clear from the data presented in the ESE Review that a further, more detailed survey of reptiles and amphibians in the proposed project area needs to be conducted in order to assess the abundance and diversity of reptiles in the area and to adequately identify potential impacts on reptile populations.

Native Molluscs

The survey of the land snail populations on Barrow Island by the Western Australian Museum found a species of cameanid that may be endemic to the island. Given that there is the potential for the introduction of land snails (and other invertebrates) due to this proposed development, the conservation status of this species should be further examined.

Recommendations

3.25 The distribution of the cameanid species thought to be endemic to Barrow Island should be further examined.

3.2.3 SUBTERRANEAN FAUNA

The claim that the subterranean fauna of Barrow Island is 'relatively well studied' is misleading. The Department notes that ChevronTexaco did not commission any specific research into the island's subterranean fauna until it was felt necessary to do so in relation to this project, even though the Western Australian Museum showed as early as 1991 that the island harboured a rich and endemic troglobitic and stygobitic fauna. The WA Museum's work has been survey and taxonomy oriented, and not directed towards monitoring the effects, if any, of the oilfield, nor has it been comprehensive. This is unfortunate, as if there is any threat to the stygofauna it is much more likely to come from the existing oilfield than the proposed Gorgon industrial development.

The recent subterranean faunal survey (Technical Appendix I) is very preliminary, with many specimens unidentified, and it sought primarily to show that there are no species restricted to the 300 ha project area. The recent survey found new taxa, including new genera and families, on the island and found listed threatened species in the proposed project area, noting that the project area is the only known location for one species. Further research is needed to clarify these issues.

The section in the ESE Review that addresses subterranean fauna (pages 110-111) does not recognise the fact that *Ramphotyphlops longissimus*, the world's only known troglobitic reptile, was discovered on Barrow Island, and no follow-up of this discovery has been undertaken by ChevronTexaco. Furthermore, the presentation of data in this section is highly selective. The section describing an apparent absence of caves (page 111) ignored the fact that troglobitic fauna are small, and that very small voids will provide suitable habitat. The absence of large voids (i.e. caves) does not eliminate the possibility that troglobites occur in the study area.

ChevronTexaco acknowledges that the sampling for terrestrial troglobitic fauna has not yet been completed. No timetable is mentioned in the ESE Review for the completion of this work, or to extend the sampling to confirm the presence of the restricted species in areas outside the project area. ChevronTexaco should commit to fully describing the troglobitic fauna of the Gorgon project area, and to place this within a local and regional context.

Appendix I provides the following significant additional information that is not presented in the ESE Review:

1. The report is explicit in stating that the survey was poor in spatial coverage.

2. A significant number of the sampling bores were contaminated with oil, and that these either contained no fauna or were not sampled.
3. The bores sampled had poor penetration into the aquifer (only a few metres).
4. There has been no assessment of troglobitic fauna in the project area (traps have been set, but no program is mentioned to recover the traps and report the results).
5. The identification of species is provisional, and further attention from specialists (in what is a highly skilled and specialist field) may reveal the occurrence of further species.
6. The report notes that a more comprehensive and detailed survey of troglobitic fauna is required to provide any certainty in this matter.

Recommendations

3.26 A comprehensive subterranean fauna survey, with a dedicated drilling program, is required. The program must incorporate the full suite of techniques required to conduct a thorough assessment, including genetic analyses to determine species identities. This program should be collaborative, and include the Western Australian Museum, this Department and specialists in tertiary institutions. Completion of this work is necessary for proper assessment of the proposal.

Potential impacts on subterranean fauna

Pages 120-121 of the ESE Review highlight the potential impacts caused by the proposed construction and operations on the subterranean fauna in the project area. The following are components of the potential impacts that require further investigation by ChevronTexaco, in order to ensure that, should the proposal proceed, adverse impacts to subterranean fauna are minimised:

- CONTAMINANTS IN SURFACE HYDROLOGY

  The ESE Review is unclear as to the extent to which the proposal will have an impact upon surface hydrology. From Figure 6.6 (page 108), it appears that the facility footprint will intersect at least two drainage lines. Appendix I states that the development will result in "*effective closure of surface drainage inputs over an area of approximately 300 ha*". The extent to which modification to surface drainage might occur and the likely impacts on stygofauna require clarification.

- CONSTRUCTION

  The ESE Review deals with the potential impacts on troglobitic fauna of excavation during the construction process. ChevronTexaco acknowledges that there is a potential for subterranean fauna to be directly impacted during construction, however, it is unclear what degree of impact blasting will have on subterranean environments and fauna.

- CONTAMINATION

  ChevronTexaco has a very limited program of dealing with both oil leakage from decayed or inadequately maintained infrastructure (the tank farm). Much of this infrastructure is substandard and polluting the environment as a result. The past practice of disposing oiled water into natural cave systems has resulted in considerable oil pollution of shallow underground waters. It is possible that many species of fauna have now disappeared due to the oilfield operations on Barrow Island. For the ESE Review to claim that threatened species "*readily acclimatised to oilfield operations...*" is not true.

  The ESE Review states that areas that process or store liquid hydrocarbons will have impermeable hardstand, closed drainage systems and bunded areas. Hardstand areas (even concrete in the long term) are not impermeable to hydrocarbons.

  It is questionable as to how Chevron Texaco will distinguish between the contamination already present at the project site, and contamination caused by the Gorgon gas development, should it occur in the future. This Department expects that ChevronTexaco should assume responsibility for the clean-up and monitoring of the contamination that has already occurred due to its current operations, and that potentially may occur (if the Gorgon proposal is approved on Barrow Island) from tank farm leakage.

- GROUNDWATER UTILISATION
  ChevronTexaco utilises groundwater on Barrow Island. It is understood that available fresh groundwater is very limited and sits as a narrow band on top of saline groundwater. At least some of the stygofauna depend on this narrow lens of freshwater, however, no studies on the impact of groundwater extraction are available (and there is no licensing control by the Water and Rivers Commission).

Recommendations

3.27 ChevronTexaco has failed in the ESE Review to provide an adequate analysis of the potential impacts of its operation on subterranean fauna at Barrow Island. Given the above concerns, this Department recommends that ChevronTexaco provide information on the following:

- Whether 'first flush' water will be collected and separated from following water.
- How the water will be treated, so as to isolate it from water entering the local groundwater; and where the sink will be for this water.
- The potential consequences of failure or inability to isolate this water from the aquifer, given that rainfall is irregular and that significant build-ups of contaminants may accumulate between heavy rainfall events, which may be more than 12 months apart.
- The levels of contaminants that may enter the system, and what the consequences would be for local stygofauna.
- Whether ChevronTexaco will ensure that the hardstands remain impermeable for the duration of the project life.
- Whether hydrocarbon storage will be above ground, so that leaks will be immediately apparent and fixable.
- How ChevronTexaco plans to monitor the impacts of the extraction of fresh groundwater on stygofauna on the island.

3.2.4 FUTURE OF THE NATURE RESERVE

While legally the nature reserve has continued to exist in parallel with the oil production lease, the reality is that ChevronTexaco controls access to the island and manages it. Input by the Conservation Commission and the Department of Conservation and Land Management has been limited to occasional visits and irregular interaction with company staff. Recommendations for changes in management relating to nature conservation issues are not necessarily accepted by the company.

The argument has been put that ChevronTexaco (and before it WAPET) has managed the island from a conservation viewpoint better than any State Government department could. While this argument probably did apply in the 1960s when the oilfield was discovered and developed, it no longer applies today, when there is a comparatively well-resourced nature conservation agency with a strong group of scientists and a nearby regional office. Furthermore, the claim that has been made that Barrow Island has maintained its biodiversity values only because of the company's management does not stand up to scrutiny when there are other very valuable islands (e.g. Bernier and Dorre) that have maintained their values in the absence of such a presence.

Currently, the public of Western Australia can expect that Barrow Island will be returned to its full nature reserve status (and meet IUCN Protected Area Management Category 1a) once the oilfield is depleted in 15-20 years. Should the industrial development proceed, ChevronTexaco will be present on the island for a very long additional time. How long does not seem to be stated in the ESE Review; while it mentions 30 years as the life of the Gorgon gas project, there is clearly a greater supply of gas available. It is noted that when the oilfield was developed in the 1960s, its stated life expectancy was 20 years. Given the above, the approval of the gas plant on Barrow Island seems likely to prevent a full return of the island to its 'pure' nature reserve status.

3.2.5 OTHER COMMENTS

The practice of not supplying a hard copy of the full ESE document (including appendices), particularly the maps, made proper assessment more difficult.

The quality of some of the maps reproduced in the appendices in PDF format is very poor, making it extremely difficult for the reader to assess the information provided. At least one full hard copy of the ESE Review, including appendices and maps, for each agency office and in public libraries would have greatly assisted in the provision of comments on the Review.

4. CURRENT ENVIRONMENTAL PERFORMANCE ON BARROW ISLAND

ChevronTexaco consistently points to its 'industry benchmark' standards and 'conservation best practice' in its justification of this proposal. Whilst ChevronTexaco has had significant success to date in regard to quarantine management and control in the event of a quarantine breach, there are aspects of its environmental management performance that fall short of industry best practice and require scrutiny.

4.1 EXISTING LAND CLEARANCE

The figures presented in Table 6.1 in the ESE Review (page 100) on disturbed areas are misleading. The table highlights the total area of land that has been cleared on Barrow Island, however, a much larger proportion of the island has been significantly disturbed. It is acknowledged by ChevronTexaco that rehabilitated areas are not included in the disturbance statistics. If this is the case, it is uncertain in the ESE Review as to when a disturbed area becomes a rehabilitated area and what a 'rehabilitated area' actually means.

The reason for this uncertainty is because there are no quantifiable data available on disturbance rehabilitation for Barrow Island, and ChevronTexaco appears to have no information or knowledge on the resilience of the flora and vegetation on the island to anthropomorphic disturbance. This is acknowledged on page 113 of the ESE Review where it is stated that "*there remains some uncertainty as to whether the existing communities could be returned to the existing pre-disturbance state*". This statement seems to suggest that rehabilitation is a difficult proposition on Barrow Island. If this is the case then it is unclear as to why ChevronTexaco has not included all historical areas in the figures on disturbance. The disturbance figures should include all areas disturbed since the commencement of activities on Barrow Island.

The figures for areas disturbed by particular activities in table 6.1 are also questionable. For example, the area of disturbance on Barrow Island associated with the road network, which is more than 1,000 km in total length, is stated as being 284 ha. This implies an average road width of just 2.8 m, which is clearly not accurate. A more realistic figure for the average width of the roads on Barrow Island would be 5 m, which gives a disturbance area closer to 500 ha. (This 5 m value is conservative as it does not take into account the effects of dust and hydrological impacts promoted through water run-off and drainage shadow effects). Similarly, there are over 600 well heads and injection bores on Barrow Island, which ChevronTexaco states cover an area of only 60 square meters each. In reality, the majority of these cover at least 30 m x 30 m each of disturbed soils.

While the data on disturbance (as defined by ChevronTexaco) are provided for areas of cleared vegetation, no data are provided on the areas impacted and thus disturbed by seismic activities. In most cases, particularly from programs undertaken decades ago, all surface vegetation was removed to carry out seismic operations, which was clearly a significant disturbance event. Similarly, no data have been provided on the area of vegetation disturbed due to production and salt water flow-line failures. Previous Annual Environmental Reports by WAPET and ChevronTexaco (i.e. WAPET,

1988; Chevron, 2000) for operations on Barrow Island have reported figures for such disturbed areas and other contaminated sites, yet these figures do not appear in the disturbance statistics of the ESE.

The area of gravel pits on the island is also misleading as the proponent states that it currently stands at 5 ha for the whole island. While this may be the case for active pits, basically all creekline habitats and alluvial flats within the production field and over a majority of the island have been mined for gravel at some stage, as indicated by maps provided in previous Annual Environmental Reports produced by WAPET. It would be a useful exercise to determine the extent of pits (extinct and active) on Barrow Island and relate these data with Geographic Information Systems technology to original vegetation types. This exercise would most likely identify a habitat severely impacted by existing operations, and perhaps a vegetation community under threat as most of the preferred habitat has been removed. This Department does not accept the proposition that rehabilitated creekline habitats support the same vegetation and floristic communities pre- and post-gravel pit mining. The post-mining environment (soil type, depth to calcareous hardpan) would be significantly different and even hostile for many plants present in the pre-mined state. Trudgen (1989) apparently raised the same concerns although this cannot be confirmed, given that the report has not been released.

Recommendations

4.1 This Department recommends that ChevronTexaco provide historical data to show the total area of land cleared on Barrow Island for the duration of petroleum operations on the island. These data should adequately account for the area cleared for roads, gravel pits, seismic operations, well-heads and injection bores.

4.2 An investigation should be conducted by ChevronTexaco to determine the spatial distribution of cleared areas on Barrow Island (historically) in accordance with vegetation type, in order to estimate the impacts of clearing on the conservation value of creekline habitats and alluvial flats on the island.

Report by Trudgen (1989)

The ESE cites a report by Trudgen (Trudgen, M. (1989) *A report on the progress of the regeneration of vegetation on areas disturbed during oil production on Barrow Island*, report prepared for West Australian Petroleum Pty Ltd.). WAPET has previously failed to provide this document despite several requests from this Department for it to be made available, and this Department has not seen or read the Trudgen (1989) report.

It is, nevertheless understood by the Department that the Trudgen (1989) document is very critical of WAPET's management of gravel pits and their minimalistic attempts at rehabilitation. Apparently, the report discusses the implication of selectively mining all the creeklines and alluvial habitats on Barrow Island for gravel, which are coincidently the areas of highest floristic diversity. Mattiske (1993) substantiates Trudgen's proposition that creeklines and alluvial habitats are floristically rich habitats by recognising that such habitats are very important for the distribution of some species on the island.

Obviously this issue has significant implications for the extant distribution and persistence of many plant species on the Island. Trudgen (1989) apparently suggests that in excess of 30 species may have become extinct on the island, based on the lack of modern botanical collections (despite considerable survey effort in recent times), and the realisation that most of the species in question are creekline/alluvial flat specialists. Apparently, during his survey, Trudgen discovered an *Eremophila* species on the island, which was growing in an area destined to become a borrow pit. There is, however, no record of an *Eremophila* on Barrow Island in contemporary flora lists, and Mattiske (1993) did not cite one. There are also suggestions that a few species recorded by Trudgen may be introductions to the Island, although they are native species to the Pilbara.

The above is based on what Departmental officers have been advised is in the report, as this Department has not seen or read it. The lack of openness in this matter is of real concern to this Department. Now that this document has been cited in the ESE Review, ChevronTexaco must make it publicly available.

Recommendation

4.3 This Department requests that ChevronTexaco make available the document by Trudgen (1989).

4.4 It should be a requirement that all studies and reports relating to the Barrow Island environment be made public available.

4.2 CURRENT REHABILITATION PERFORMANCE

The ESE Review identifies that 657 ha or 2.79% of the land area at Barrow Island has been cleared for petroleum operations, with approximately 410 ha (1.74%) of that cleared area having undergone rehabilitation (Table 6.1, page 100). The requirement for cleared land for the Gorgon project on Barrow Island is for no more than a total of 300 hectares, which represents 1.3% of the land area. This ultimately increases the level of habitat disturbance to 5.83% of the island.

Although ChevronTexaco has developed rehabilitation practices for its petroleum operations on Barrow Island, until very recently it has not undertaken any research to quantify and monitor rehabilitation performance in relation to appropriate benchmark targets. Without such performance data, the capacity for ChevronTexaco to rehabilitate land to best practice standards is not demonstrated. While such performance practices have been commonly adopted in this industry for several decades, ChevronTexaco only commenced in 2002 to develop a program to establish benchmarks and develop completion criteria for its rehabilitation operations.

Consequently, the performance standard of ChevronTexaco's rehabilitation and the potential for cleared areas to be restored to baseline functionality is unknown, and there is no information available to measure its rehabilitation performance against industry best-practice benchmarks. This is of concern, given that ChevronTexaco proposes to clear a further 300 ha of land at Barrow Island, which will cause disturbance to vegetation in surrounding areas.

Recommendation

4.5 Before any proposal be approved for ChevronTexaco to clear additional land at Barrow Island, it must demonstrate its capability to meet 'best-practice' standards for rehabilitation by developing a program to establish benchmarks and develop and meet completion criteria for its current rehabilitation operations on the Island. Furthermore, a similar rehabilitation program should be developed in preparation for the decommissioning of the proposed gas processing plant, in the event of the proposal being approved on Barrow Island.

4.3 ENVIRONMENTAL MANAGEMENT

During its petroleum operations, ChevronTexaco has, in this Department's view, provided minimal environmental staffing levels for Barrow Island. It is our understanding that a single qualified environmental officer is responsible for Barrow and Thevenard Islands operations, as well as the overall coordination and planning of environmental management on the island, including the supervision of environmental contractors for the corporate group. This, in the Department's view, does not provide an adequate level of management and supervision on the ground at Barrow Island and indicates insufficient commitment to resourcing for adequate environmental management on Barrow Island.

Furthermore, when the oil production lease was last renewed, this Department attempted to get modern nature conservation conditions added to the lease. This was opposed by the proponent, and the then Department of Minerals and Energy renewed the lease with the same conditions that were applied in the 1960s. These are of little value in terms of protecting biodiversity conservation values on the island.

5. QUARANTINE

Depending on the species concerned, invasive species have the potential to have a much more extreme impact on biodiversity on Barrow Island than the destruction of 300 ha of native vegetation for the gas processing facility. Barrow Island is one of the largest land masses worldwide not to have any exotic mammals established on it, which gives it enormous value for fauna conservation in particular. While ChevronTexaco does have a relatively good record in quarantine procedures at the level of operations to date, there have been several incursions of exotic animals and plants over the past 30-40 years on Barrow Island. The proposed establishment of the gas processing facility on Barrow Island will very substantially increase the risk of establishment of invasive species due to the following:

- Large quantities of construction materials must be brought to the island from other locations, resulting in a greater risk. Material coming from overseas sites will present a higher risk compared to materials loaded on the adjacent mainland, where quarantine procedures have been established for some time.
- A tanker loading jetty will be required. Jetties increase the risk of invasive species establishing from ships and other vessels moored alongside. The current tanker loading area is some kilometres offshore and has no above sea connection to the island.
- A new 'materials offloading facility' will be required. This is necessary to accommodate much larger vessels than the barges and small boats currently landing on the island and will increase the risk of invasive species establishing on Barrow Island.
- There will be a substantial workforce on the island during construction, which may last for several years; the risk on introductions will increase proportionately with the number of visits. There will also be an increased workforce on the island after construction finishes.

Most modern (i.e. since 1600) extinctions world-wide have been on islands. These extinctions include mammals (e.g. Alcover *et al.* 1998), birds (e.g. Atkinson, 1985), reptiles and species from many groups of invertebrates. Well-known examples include the Mauritian Islands, the Hawaiian Islands and New Zealand. Analyses of mammal extinctions on the Australian continental islands show a strong correlation with the introduction of predators (Burbidge *et al.* 1997, Burbidge and Manly, 2002). World-wide, bird extinctions on islands are strongly correlated with the introduction of exotic species, especially predators such as rats.

The identification of potential invasive species in the ESE Review is poor and does not attempt to properly discuss or quantify the risks associated with the Gorgon development, although it does state that "*it is difficult to predict which species could survive if introduced to Barrow Island*" (page 132). A much better attempt should have been made in the ESE Review to quantify the risks of the establishment and possible consequences of invasive species on Barrow Island. The ESE Review simply states that the company will develop a list of possible invasive species at a later date. However, the Department believes that there are several scenarios where the establishment of invasive species would have irreversible consequences (e.g. black rats and tramp ants).

Furthermore, there is no discussion in the ESE Review of the possibility of introduction of disease organisms that might threaten the indigenous flora and fauna on the island. There is limited information on exotic diseases of native fauna in Australia, however, there are data on some (e.g. *Toxoplasma gondii*, spread via cats and mice but with a very wide host specificity; and various *Salmonella*), and anecdotal reports exist concerning massive die-offs, attributed to disease, of native mammals in the past on mainland Western Australia.

In summary, there can be no guarantee that invasive species will not establish on Barrow Island, should the gas processing facility proceed, and there can be no guarantee that some species could be eradicated once established. The establishment of some invasive species could be expected to result in species extinctions.

5.1 WEED MANAGEMENT

Previous so-called 'best practice' environmental hygiene and quarantine procedures by ChevronTexaco have not eliminated weeds on Barrow Island. The statement in the ESE Review that "*Barrow Island's ecosystem remains essentially unaffected by invasive species despite 35 years of oilfield operations...*" is inaccurate and misleading. Kapok (*Aerva japonica*) is still present, albeit in isolated occurrences, and buffel grass (*Cenchrus ciliaris*) abounds in areas of high disturbance and visitation. ChevronTexaco's current system of weed management and quarantine has also failed to eliminate the establishment of three other environmental weed species on the island: sow thistle (*Sonchus oleraceus*), spiked malvastrum (*Malvastrum americanun*) and black berry nightshade (*Solanum nigram*). Furthermore, there remains an infestation of kapok and buffel grass on Middle Island (within the ChevronTexaco petroleum permit), as a consequence of WAPET's exploration activities.

ChevronTexaco claims that these weed populations have been restricted in their distribution, however they still remain present. Given Chevron Texaco's inability or unwillingness to eradicate these weeds, the potential remains for them to spread. This Department is concerned that these populations cannot be contained in the future if the significant increase in activity expected as a result of the Gorgon Development is permitted to proceed. ChevronTexaco's current weed management and quarantine procedures need improvement if these species still continue to persist after many years.

The potential for the further spread of buffel grass on Barrow Island would be significantly increased, should the Gorgon proposal be approved, simply as a consequence of the greater area of ground disturbance, the large construction workforce and the requirement for materials (particularly soil and associated fills) to be imported from the mainland. Indirect workforce impacts also have the potential to pose a significant weed invasion problem. Apart from the increased chance of accidental introductions of weeds and animals to Barrow Island, there is an increased chance of invasive species being moved around Barrow Island.

Habitats on Barrow Island are susceptible to invasion by buffel grass, as is evident from its preponderance on most offshore islands and near coastal sandy and calcareous habitats throughout the Gascoyne and Pilbara Regions. Buffel grass has the potential to completely alter the vegetation structure and composition of all sandy habitats on Barrow Island, probably resulting in a monoculture of buffel grass (through direct competition and allelopathy). This process is apparent on Boodie Island, and on many other islands in the area (e.g. the Montebello group, Serrurier, Passage Islands, and the Dampier Archipelago).

Other potential weeds that also pose a risk and that may be introduced to the island as a result of the project are birdwood grass (*Cenchrus setigera*) and Caribbean stylo (*Stylosanthes hamata*). Birdwood grass is common throughout the Pilbara and is easily spread by humans. Caribbean stylo is a small pea that was introduced to tropical Australia for pasture improvement purposes, and has now become widespread throughout the tropics and coastal Pilbara areas. Unfortunately, this species is common on the Burrup Peninsula, especially in disturbed areas including road verges. It is possibly spread by vehicles and machinery (in tyre treads) and may be introduced to Barrow via the King Bay supply base. This species prefers disturbed areas and calcareous substrates.

There are also concerns about the potential for new plants, alien to Barrow Island but native to the Pilbara, to be introduced as a result of the proposed Gorgon development. This has been the case on Thevenard Island, where the 'alien' plants in question (native Pilbara mainland plants not previously recorded on Thevenard) were introduced to the island in fill from the mainland for construction purposes. In all known instances, the detection of the alien plants was not made by operational personnel on the island, but by third-party visiting consultants.

Recommendations

5.1 Should the proposal proceed on Barrow Island, ChevronTexaco will need to significantly improve its performance with regard to weed management and quarantine procedures on the

island (see section below on 'Quarantine Management'). ChevronTexaco should commit to eradicating the existing invasions of kapok and buffel grass within its existing petroleum permit area, before any further development occurs on Barrow Island.

5.2 INVASIVE ANIMALS

The increased possibility of invasive animals arriving and establishing on Barrow Island has the most potential to reduce or destroy the terrestrial conservation values of Barrow Island. There is no mention by ChevronTexaco in the ESE Review of the specific invasive species that would be of concern, should the proposal be approved. A quantitative risk analysis of the likelihood of this occurring on the island needs to be undertaken as part of the approvals process.

There have been no surveys of Barrow Island for the invasion of ants. 'Tramp' ants (i.e. crazy ants, fire ants) have caused significant environmental impacts where they have been introduced to islands and mainland areas (e.g. impacts on Christmas Island). As a large amount of equipment will be sourced from overseas for the Gorgon development, there is a real threat that invasive invertebrate species that are difficult to detect could be introduced to Barrow Island and become established.

Despite ChevronTexaco's record to date with quarantine management in relation to invasive fauna, there have been house mouse and black rat introductions to Barrow Island in the past. Departmental officers visiting the island have, in the past, located black rats present on South End. At that time, ChevronTexaco had no program in place to monitor for rats, despite knowing that this highly invasive and water-competent species was present on Middle Island in large numbers.

Known incursions of house mice have occurred on Barrow Island in association with ChevronTexaco activities, showing that quarantine procedures to date have not been 100% effective. There have been at least two instances in recent years that demonstrate this; one where mice arrived at the island in a transportable building brought from Thevenard Island, and one where mice were transported to the island in an old car body brought from the mainland for fire training. Both of these introductions escaped quarantine procedures at the point of origin. While all mice incursions to Barrow Island have either been eradicated or did not establish, at least two eradication operations that the Department is aware of have resulted in the death of numerous native mammals.

A further cause of concern is ChevronTexaco's quarantine procedures in the use of barges that stop at Thevenard Island (which is heavily infested by the house mouse), to transport material to Barrow Island. There are no clearly reported strict quarantine procedures to prevent mice from Thevenard Island moving onto these vessels (i.e. there is apparently no isolation and fumigation of bulk products such as mooring ropes prior to loading). Despite the vigilance of transport staff and operators currently on Barrow Island, quarantine breaches in respect of mice from Thevenard reaching Barrow Island will occur. When plaguing (a regular occurrence), mice will invade anything that touches on Thevenard Island. Our experience of removing mice from Varanus Island, for example, indicates that once established on Barrow, they may well be impossible to eradicate.

Past experience combined with a lack of definitive statements by ChevronTexaco as to exactly what it proposes to do for quarantine management in terms of long term invasive animal issues do not inspire confidence for the future. It is not sufficient to rely on past results and to provide a range of measures to be considered for the future and a process for their consideration. ChevronTexaco need to definitively state what their procedures are proposed to be and what independent verification there will be that they are being undertaken and are effective. There is a basis for significant concern that ChevronTexaco are not geared to immediately detect, identify and eradicate all possible known invasion threats. This is particularly the case in terms of ants and other invertebrates, but also for weeds and even mice and rats.

Recommendations

5.2 This Department recommends that ChevronTexaco undertake a quantitative risk analysis of the likelihood of the introduction of invasive animals to Barrow Island as part of the approvals

process for the proposed Gorgon gas development. It should be noted that it is the Department's view that any introduction of non-native animals to the island is not acceptable. Quarantine procedures should be adopted that will ensure that there is a very low risk of any invasion of any exotic species to the island (see further discussion under 'Quarantine Management').

5.3 Chevron Texaco needs to establish an adequate early detection, identification and control program for the invasives that risk analyses identify as having some risk of entry to the island.

5.3 QUARANTINE MANAGEMENT

By its own admission, the current quarantine management program implemented by ChevronTexaco based on its current petroleum operations is heavily dependent on the ownership of, and participation in, the quarantine program by all current employees. This involvement of staff is the direct result of strong motivational forces borne out of a sense of ownership of, and responsibility for, the unique environment of Barrow Island, held by long-term employees working on the island. An itinerant work force of 2,000 expected during the Gorgon gas development can not be expected to be similarly motivated, regardless of their level of training. If the success of quarantine management of the Gorgon gas development will, as stated in the Gorgon ESE document, "*...rely on the continued education, awareness, motivation and vigilance of personnel...*" (page 127), then the proposed quarantine program is flawed. Given that successful quarantine is viewed by all as being a fundamental essential factor for the protection of Barrow Island's conservation values, reliance only on an already flawed program is an unacceptable risk.

The environmental quarantine procedures proposed in Chapter 7 and Appendix J of the proposed Gorgon gas development ESE Review are an expansion of those currently in place for ChevronTexaco's oil operations on Barrow Island. This raises significant concern to this Department, as the current system, as outlined above, is less resilient than required. Furthermore, the current system was developed for relatively low-level routine operations, not major construction projects. It has not been developed to deal with massive imports of fill and construction materials, or with major modules from overseas. There is no mention by ChevronTexaco of how major quarantine issues such as this are intended to be addressed.

One additional quarantine procedure canvassed in the ESE Review is fencing on the island. Fencing is unlikely to be effective, partly because the site is on a coastline subject to large tides as well as cyclonic winds, and partly because some species (e.g. ants) could not be prevented from spreading by fencing.

It is the Department's view that while ChevronTexaco has achieved a generally good outcome to date in quarantine procedures at its current level of operations, quarantine can never be 100% effective and the proposed Gorgon development will increase the risk of establishment of invasive species significantly due to the number and size of the proposed landings on the island.

Risk Management

The ESE document refers extensively to risk minimisation with regard to quarantine management, but it does not present any clear identification of that risk. Without an adequate risk assessment for the Gorgon gas development, there is no clear scientific rationale for any aspects of the quarantine procedures proposed by ChevronTexaco. The level of risk cannot be assessed, and the reduction of risks from any management framework cannot be quantified.

The Australian Quarantine Review Committee (AQRC), in its report on the review of Australia's quarantine policies (AQRC, 1996), identified risk assessment as being fundamental in the establishment of quarantine policy and action in Australia. Biosecurity Australia, the Science and Policy Division of the Australian Quarantine and Inspection Service, provide a structured and transparent methodology for analysing quarantine risk that sets the standard for Australian quarantine risk analysis (Biosecurity Australia, 2001).

For the Gorgon development proposal, a quarantine risk assessment process is essential to make an informed decision about the risks associated with the use of Barrow Island for locating the gas processing facility. A quantitative quarantine assessment is the only approach that could adequately take into consideration the significantly increased volume of vectors entering Barrow Island.

In comparison, it would not be possible to assign numeric manipulations to qualitative or descriptive assessments. A qualitative assessment of this proposal could only be viewed as a guide to determining quarantine risk. However, in the absence of sufficient or specific information being provided by the proponent in the Gorgon ESE review, it is only possible at the present moment to undertake a qualitative risk analysis in order to provide a guide to the potential quarantine risks posed by this development. This Department has undertaken such a qualitative quarantine risk analysis of the proposal presented in the Gorgon ESE Review, using the methodology recommended and outlined by Biosecurity Australia (2001). This is attached for ChevronTexaco's consideration in Appendix 3 of this submission.

Qualitative Risk Assessment

The qualitative assessments undertaken by this Department (Tables 2 to 4 in Appendix 3) conclude that the quarantine risk posed by the Gorgon gas proposal represents an extreme risk in relation to the introduction, establishment and impact of invasive weeds, and a high risk with relation to both invertebrate pests vertebrate pests. This level of quarantine risk under current management proposals is unacceptable.

The Department is concerned at the poor level of consideration that ChevronTexaco has given to the issues of quarantine associated with this project. Before the proposal can be given serious consideration, the proponent should be required to revisit the issue of quarantine, undertake a thorough quarantine risk analysis, and make significant changes to its proposal to ensure that quarantine risk is brought to an acceptable level.

Quarantine area on Barrow Island

ChevronTexaco proposes to establish a quarantine area on Barrow Island (section 5, page 65), with all materials and large modules coming directly to this facility from overseas. However, this is not detailed further in section 7 of the ESE Review: *Quarantine Management*.

This Department is strongly opposed to the operation of a quarantine area on Barrow Island for the quarantine management of cargo and/or construction modules arriving directly from overseas. Quarantine management procedures must ensure all cargo and equipment is "clean" before arrival on Barrow Island. This may require the establishment of a quarantine area on the mainland to allow for the inspection and necessary treatment of materials before on-shipment to Barrow. If 'clean' imports to the island cannot be guaranteed by ChevronTexaco, Barrow Island should not be considered as a site for locating this project. The establishment of a secondary island quarantine facility with full security and secondary inspection and of materials transferred from the primary quarantine site, is however, supported.

Any modules or cargo arriving at Barrow Island directly from overseas ports are subject to the provisions of the Commonwealth *Quarantine Act 1908* and its associated regulations. Any such cargo would require the involvement and approvals by the Australian Quarantine and Inspection Service. This factor is not mentioned in the ESE Review.

This Department would reiterate that quarantine management would not be such a significant issue if an alternative site was chosen for the gas facility.

Recommendations

5.4 Prior to Cabinet providing any 'in principle' approval for using Barrow Island for locating the Gorgon gas processing facility, a comprehensive quantitative Quarantine Risk Assessment needs to be completed by ChevronTexaco. The assessment should be conducted in a manner that allows for early consultation with this Department, the CSIRO, the Australian Quarantine and Inspection

Service, the Western Australian Quarantine Inspection Service, and other stakeholders. The assessment should be based on scientific methodology and the analysis must be transparent and subject to peer review and public scrutiny.

5.5 If the Gorgon gas development does proceed on Barrow Island, the mere expansion of the current quarantine procedures on the island to deal with the proposed gas operations would not adequate. A separate and distinct quarantine management plan must be developed in consultation with stakeholders and expert bodies. The plan must be based on the outcomes of a quantitative risk assessment, and be subject to the approval of the Minister for the Environment and Heritage. The plan must also be subject to periodic external review and auditing.

5.6 Any Quarantine Plan should involve an independent team of dedicated staff that audits and monitors the quarantine procedures for all aspects of proposed operations on Barrow Island, and that is empowered to stop any operation when the risk of a quarantine breach is high. The team should be highly trained in all aspects of quarantine management. Its actions must be independent, transparent and consultative.

6. FIRE MANAGEMENT

Reference is made in the ESE Review to the suppressed natural fire regime (page 113), although this matter is not addressed in detail. Historical accounts, and the fact that Barrow Island has not been occupied by Aboriginal people, suggest that Barrow Island was probably burnt infrequently but extensively when it did burn.

There has been an active suppression policy and a 'no burn policy' on Barrow Island for the last 40 years. The last large fire was in 1961 when about 90% of the island was burned. If the Gorgon proposal proceeds, it will be proposed that this regime be extended for another 50 years at least.

It is this Department's view that the suppression of a natural fire regime in this highly-managed and disturbed island ecosystem will have serious consequences for the conservation of flora diversity and ecosystems on the island. Fire is a recognised regenerating process in spinifex communities. Removing fire for too long leads to the loss of many species of flora, which are dependent upon fire for germination and regeneration of seed beds. This Department has the expertise in fire management to implement a fire regime safely and effectively, outside of the oilfield. An appropriate monitoring or research program would determine the effects of small scale burning on both the fauna and flora of the area.

This Department questions how ChevronTexaco plans to address fire management and suppression issues around the Gorgon gas development on Barrow Island. It is not clear if ChevronTexaco has given consideration to the risks and impacts of carbon cinders escaping from flare towers and igniting adjacent vegetation. On the Burrup Peninsula for example, such carbon cinder escapes have caused a number of fires in surrounding areas over the years. On Barrow Island, such escapes and subsequent spinifex fires would obviously present a problem, not only for the adjacent oilfield, but also for biodiversity conservation, particularly if fire management and suppression issues had not previously been addressed.

Given this, the proposed Gorgon development has the potential to adversely affect Barrow Island ecosystems, through the increased frequency of fire in the vicinity of the flares, and the excessive periods between fire occurrence elsewhere if the total suppression and 'no-burn' management is continued on the island for the life of the project.

Recommendations

6.1 This Department recommends that, should the Gorgon gas development proceed on Barrow Island (therefore resulting in an increase in longevity of industrial operations on the island), ChevronTexaco agree to planning and undertaking a fire management regime on Barrow Island, which would be managed and carried out by this Department

7. MANAGEMENT OF GREENHOUSE GASES

The Project proposes two options for managing greenhouse gas emissions. Both options involve energy efficiency measures to reduce operational greenhouse emissions; one option also would inject "supercritical" carbon dioxide into a deep saline aquifer below Barrow Island.

The Department views climate change as one of the most significant threats to the sustainability or even survival of Western Australia's highly diverse biological systems. The Department therefore supports efforts to reduce greenhouse gas emissions.

The Department recognises that in many circumstances natural gas can reduce local and global greenhouse gas emissions where it is used to replace other fossil fuels such as oil and coal. The Department therefore supports the development and use, locally and overseas, of Western Australia's natural gas resources, especially where the carbon dioxide within the natural gas stream is separated and sequestered in some way, where organic carbon sequestration offsets are established and maintained or where other emission offsets are generated through national mechanisms or through international market mechanisms such as Clean Development Mechanism or Joint Initiative.

The proposed geological sequestration of carbon dioxide which has been stripped from the natural gas stream is an innovative option to reduce this project's contribution to climate change. Geological sequestration of carbon dioxide in deep saline formations, as a means of reducing greenhouse gas emissions, remains a highly experimental activity. This Department understands that this occurs only in one location off the coast of Norway. In several other locations, various gases are injected in depleted natural gas or oil formations either to enhance natural gas or oil recovery or for temporary (seasonal) storage. The importance of this sequestration option has been recognised by government and industry through the support for a Cooperative Research Centre for CO_2, which will commence in July 2003. However, even this recognition demonstrates the evolutionary nature of science and engineering underlying geological sequestration.

The Department expects that geological sequestration could become a well-proven technology through geological testing and research, modelling and experiments with monitoring, evaluation and improvement. However, geological sequestration is far from being a well-proven technology at this time.

It could be argued that it is opportune to undertake a major experiment in geological sequestration through the willingness of the Gorgon partners to sequester carbon dioxide geologically in conjunction with this project. Given a choice between a project that releases large quantities of greenhouse gases and a project that at least seeks to sequester these gases even through the use of an experimental technology, the Department would support the latter option.

However, Barrow Island is a nature reserve of very high value. The ESE Review does not provide information in relation to risk, accordingly this may not be an appropriate location for an experiment whose failure could release large quantities of lethal gas (carbon dioxide). The Department understands that other potential sequestration sites exist within the locality of the Gorgon gas field.

The ESE Review has identified Barrow Island as the best source for CO_2 injection. The veracity of this analysis is not clear and more detail is required in order to definitively make the case for this site above the other possibilities under consideration through the GEODISC consortium, as outlined in section 2.2. of this submission.

An alternative that is more proven scientifically and that has clear international recognition is developing emission offsets through organic carbon sinks such as revegetation. Moreover, properly designed, implemented and managed organic carbon sinks can deliver a range of associated regional economic, social and environmental benefits. This option would contribute considerably to a positive "triple bottom line" account for the Gorgon partners.

The Department has considerable expertise in designing, implementing and managing revegetation, and in determining the amount of carbon sequestered and any associated regional and natural resources management benefits. The Department urges the Gorgon partners to consider organic carbon sinks as an alternative (or contingency) to geological carbon sequestration and is prepared to work with the Gorgon partners to investigate options and evaluate alternatives.

Recommendations

7.1 The Department urges ChevronTexaco to further consider organic carbon sequestration to offset the greenhouse gas emissions from the project.

7.2 The experimental proposal to sequester carbon geologically in saline aquifers is supported in principle on the basis that it is viewed as an experiment, undertaken with appropriate monitoring and located in a place at which failure will not generate unacceptable hazards. There are clear impacts associated with pipelines across Barrow Island for such injection proposals and it should not be accepted without detailed critical analysis that Barrow Island is the best site from an environmental perspective.

8. NET CONSERVATION BENEFITS

It needs to be recognised that, if the project proceeds on Barrow Island, then it is the nature conservation values of the island that are put at risk. It has therefore been established that if the project is to proceed, nature conservation needs to also benefit through consideration and application of the concept of Net Conservation Benefits.

Cabinet has specifically requested that Net Conservation Benefits (NCB's) be addressed with respect to the consideration of Barrow Island as a potential site for the Gorgon gas development project. The issue of NCB's is therefore considered a primary determinant of the acceptability of the project. While the term NCB has not been unambiguously defined by Cabinet, it clearly implies that, as a result of a decision to proceed with a project, the conservation outcomes will exceed the net loss of, and risks to, those conservation values. A NCB is difficult to measure, but should be premised on the achievement of tangible long-term benefits to conservation that, to the greatest possible extent, replace and exceed the values lost or put at risk as a result of the development.

The notion of NCB's has developed in recent years as a natural progression from the concept of environmental offsets and mining compensation. In essence, environmental offsets have been determined in various jurisdictions across Australia and around the world to be a means for reimbursing the environment for the impacts arising from a development, where it is determined that those impacts are environmentally acceptable. In Western Australia environmental or conservation offsets have become standard features of proposals considered under the *Environmental Protection Act 1986*, as well as in some planning (e.g. subdivision) processes.

It is widely accepted practice that in negotiating for access to sensitive environments and high biodiversity conservation value sites, developers must be prepared to agree to offsets that will minimise if not eliminate the net loss of environmental or biodiversity conservation values from the development. Examples of developing trends for environmental protection, conservation or 'green' offsets can be found in the literature, including positions from the New South Wales EPA (Green offsets – development without additional environmental impact, 2002)

In consideration of highly significant development proposals, environmental protection offsets have often been agreed that involve land exchanges for conservation, provision of additional resources to conservation studies or programs, or statutory protection of lands with a high nature conservation value. Such offsets are additional to requirements for best practice environmental management associated with minimisation of the environmental impacts of a development (such as minimising disturbance, rehabilitation of disturbed areas, sensitive siting of infrastructure etc.). These higher order offsets are often invoked in situations where developments are proposed to occur on

conservation reserves, with an underlying presumption against any such disturbance in many instances.

In nature conservation terms the package of standard environmental protection offsets is now often considered in terms of:

- Minimisation and best practice rehabilitation of environmental damage;
- Recovery of additional conservation monitoring and management costs associated with disturbance of conservation lands; and
- Replacement of conservation values to be lost through the development (e.g. land exchanges etc.).

The proposal for NCB's takes the above requirements further, recognising that land exchanges and the like, in combination with the other categories of offsets above, do not necessarily provide a truly balanced outcome for biodiversity conservation where proposals relate to high value conservation assets.

Given Cabinet's decision to address NCB's in its consideration of the proposal on Barrow Island, this Department provides the following comments which address key issues on the scope and validity of proposed NCB and offset programs for the Gorgon development, the vehicle proposed for delivery of those programs (a foundation) and a better means to determine the quantum value of those programs.

This Department has had a firm position for some time that should the Gorgon development proceed on Barrow Island, a NCB package would need to be adopted that would adequately 'compensate' for the loss of biodiversity values and also the risked losses to biodiversity in an area that is one of the world's most important nature conservation reserves.

The Department prepared a NCB discussion paper in March 2002 for the proposed Gorgon gas development, which was supported by the Conservation Commission and noted by the Minister for the Environment and Heritage as the basis for developing applicatioin of the concept to the Gorgon proposal (Attachment D). Subsequent advice was provided to ChevronTexaco by both the Department and the Conservation Commission (Attachments E and F) during the preparation stages of the ESE document, identifying a need for ChevronTexaco to develop an adequate and acceptable NCB package that would adequately offset the risks and impacts associated with the Gorgon development. It is significant that in the final ESE document, ChevronTexaco chose not to incorporate much of the advice of the Department and the Commission with regards to NCB's in the package proposed in the ESE Review.

NCB's should not be confused with environmental protection offset measures, which result from a detailed environmental assessment process in the form of environmental conditions. Furthermore, NCB's should not be confused with the recovery of costs to this Department resulting from the requirement to manage and regulate the presence of any industrial complex on the island, or from commercial lease fees that reflect the utility of the island's industrial use. These latter issues are discussed separately.

There are ongoing developments in refining the basis for determining NCB's. It is the Department's position that to deliver true NCB's a development must meet all of the standard environmental offset expectations and, in addition, provide a outcomes that, on any analysis, can be considered to provide a nature conservation return that more than compensates for the nature conservation losses resulting from, or at risk from, the proposed development.

NCB's should, in our view replicate or relate closely to the values at risk or to be lost on Barrow Island should the development proceed. It would make little sense for the NCB's to entertain ideas like trees in the wheatbelt, or a community biodiversity information centre in Perth. The values protected should relate directly to Barrow Island and its regional setting. The Department has therefore been pursuing the idea that, given the world icon values of Barrow island for mammal

conservation and island ecological services as a 'pest animal free' haven, a major 'world icon' project on a similar island or group of islands nearby should be a key part of any NCB package.

The current NCB proposal of ChevronTexaco does not meet the above proposed requirements.

Should the Government decide to support the development of the Gorgon gas processing facility on Barrow Island, this Department proposes that the NCB programs be improved significantly in order for the impacts and associated risks of the development to be adequately accounted for. A major issue in relation to this is the question of establishing either a quantum or an outcome for the NCB's.

8.1 QUANTUM VALUE OF NET CONSERVATION BENEFITS

Traditionally, allocating or determining quantums for conservation values has been very difficult, with the lack of effective market mechanisms. In recent years valuation models have developed from those involving community surveys or estimations into models for calculating the costs associated with the loss of the 'ecosystem services' of natural ecosystems or by calculating how much it would cost to reconstruct such ecosystems. Interestingly the two approaches have produced similar results in recent papers.

The Prime Minister's Science Engineering and Innovation Council (PMSEIC) received a paper entitled "Sustaining our Natural Ecosystems and Biodiversity" at its eighth meeting on 31 May 2002. The authors of this paper (Dr Steve Morton CSIRO, Mr Greg Bourne BP Australia, Mr Paul Cristofani National Farmers Federation, Professor Peter Cullen CRC for Freshwater Ecology, Professor Hugh Possingham University of Queensland and Dr Mike Young CSIRO), proposed that it costs society between 10 and 100 times more to rehabilitate damaged ecological communities than to conserve functioning communities. In a paper published in Science magazine on August 9 2002 entitled "Economic reasons for conserving wild nature", the authors (Balmford *et al.*) discussed their research which indicated that the return on investments made to protect ecosystem services in wild landscapes was around 100:1. This figure was derived after investigations into the loss of ecosystem services arising from major developments around the world that degraded natural ecosystems and reduced their ability to function with a full range of their services.

It is the Department's position that it is not possible to accurately quantify NCB's when the values that are being put at risk on Barrow Island are unique and irreplaceable. It will clearly be difficult to establish a net benefit value if there is damage (e.g. from invasive species) and subsequently species are lost.

If this proposal proceeds it will damage the unique conservation values of Barrow Island. It may be argued that the genetic resources and ecological processes on the island should still persist, but this can not be guaranteed. This proposal carries real risks to the sustainability of the conservation resource, including risks of extinction of species. There is no economic (market) value directly applicable to a conservation resource that is unique, fragile and that has values to biodiversity conservation of the highest order.

There have been discussions as to how the quantum of a NBC package could be calculated and whether this is in any way linked to the financial scale of a development. It is our view that the financial capacity of a development to contribute NCB's is not a natural component of considerations in relation to NCB values and that these should, in most circumstances, be based on estimations of the conservation losses or risked, should the development proceed. There is, however, the factor that in considering NCB's for a unique and immensely valuable conservation asset such as Barrow Island, it is only a major high profile project that would warrant any consideration at all. Thus, it can be argued that recognition of the extremely high conservation values of Barrow Island and the resultant quantum of any NCB's to be considered has already been established by Government in its requirements for a detailed and exhaustive process of consideration in order to assess only 'in principle' support for a processing plant on Barrow Island.

The level of funding proposed in the ESE for its NCB package is very low in terms of the overall investment proposed for the Gorgon proposal on Barrow Island and also in terms of any estimate of the conservation values of the reserve that would be at risk from such a development. The proposed $10 million is less than 0.1% of the development cost. It is also of paramount importance to recognise that any industrial complex on Barrow Island will remain in place for well beyond the twenty-year timeframe considered in the ESE, given the known and prospective gas resources in the area. Any NCB formula needs to reflect the potential longevity of the development of the gas resource.

While this Department is happy to support the concepts taken up by ChevronTexaco that the NCB features should be major outcomes and be linked to the conservation values of Barrow Island, inadequate commitments are given in the ESE Review on the precise conservation outcomes that could be achieved by the proposed expenditure. Without this there is no clear NCB of having the development on Barrow Island.

Based on current inflation rates, the capital value of the proposed $10 million in the ESE Review will halve in 20 years to about $5 million, and the revenue from the interest will also be halved (while the strategic and economic value of the site for the Gorgon project will have escalated significantly). Towards the end of the current predicted project life the capacity of any Foundation to effect sustainable conservation outcomes would be almost non-existent.

If an economic value was to be ascribed to the Barrow site, several benchmarks may apply. It is appropriate to benchmark this proposal against others operating in ecosystems on which the community places a high value. Examples of offsets or compensation arrangements in place or proposed elsewhere include Alcoa's Bauxite mining operations in State forest in the Darling Range, which provides in excess of $2 million per annum in compensation. A total of $2.8 million has been put forward in a proposed compensation package by Cable Sands in seeking access to a small mineral sands resource in the Ludlow Tuart forest; an operation which has an approximate mining life of only 4 years (Cable Sands, 2002). In comparison, the offer by the proponent of $10 million in special NCB offsets for the Gorgon Environment Foundation, in conjunction with proposals to meet ongoing management costs through lease fees, is very small and is not considered equitable.

Taking into account the work undertaken for the PMSEIC and by Balmford et al, it would be possible to assign an ecosystem services value to Barrow Island and to calculate the loss of that value or the cost of rehabilitating that value should the island be developed and those ecosystem services be compromised. This work has not been undertaken to date, but it seems likely that the total ecosystem services value of Barrow Island on a world scale, based on the costs of removal of all pollution, re-establishment of all habitats, removal of all exotics and re-establishment of all native species would possibly be around $1 billion. In this regard a special NCB value of $10 million proposed for the Gorgon Environment Foundation is small.

8.2 NET CONSERVATION BENEFIT - STRUCTURE AND SCOPE

The concept of the proposed 'Gorgon Environment Foundation' is not supported by this Department, as it is likely that future outcomes of the Foundation will remain subject to the whim of the Foundation, which is controlled by the proponent. There is a real risk that public relations benefits could unduly influence support from the Foundation to the detriment of conservation priorities. There is a further risk that any Foundation, especially if comprising a wide range of represented interests, may attempt to meet the aspirations of too diverse a range of stakeholders and hence dissipate the benefit. This would mitigate strongly against the desire to establish and maintain a real world class icon project, in keeping with the biodiversity conservation values of Barrow Island.

As currently proposed in the ESE Review (section 9.3.2, page 180), there are no solid commitments with guaranteed outcomes with regard to the establishment of the Foundation (i.e. there are no guarantees of commitment to an icon project).

Any outcome must be able to be clearly identifiable and recognisable by the broader community in the long term (i.e. one hundred years) as a major environmental outcome of Gorgon's presence on the island (noting that there is a likelihood that the Gorgon project or some development of it may still be operating on the island). This should also be ChevronTexaco's vision. In our view, the offset proposal as structured in the ESE Review is unlikely to deliver upon this vision.

It is arguable that the Foundation as structured with its proposed wide ranging representation and benefit options would largely constitute a powerful community relations and image marketing exercise at a nominal cost. Additionally as the range of NCB's options as proposed is very broad there remains a real likelihood that proposals with only tenuous links to Barrow Island values would receive support.

The concept of entering partnerships to leverage benefit is acceptable in principle, but should not be used to excuse or reduce the requirement for the proponent to provide sustainable offsets (as the discussion on page 181 of the ESE appears to imply).

Recommendations

8.1 In order for real long-term sustainable conservation outcomes to be delivered as a result of any Gorgon gas development project based on Barrow Island, a combined system of best practice performance, environmental conditions and offsets and NCB outcome projects should be developed. These should involve the following:

(i) Best practice environmental performance for all aspects of management on Barrow Island in terms of minimising undesirable impacts to conservation values through:
   - o New standards of quarantine control, monitoring, incursion response;
   - o Best practice environmental performance in siting developments, including pipelines etc., and in all stages of construction, operation and maintenance;
   - o Elimination of threats to native species by eradication of weeds, elimination of light source and marine pollution risks to turtle nesting and other terrestrial and marine species; and,
   - o Full cost recovery for a new Department of Conservation and Land Management permanent conservation management presence on the island and in surrounding waters, including net conservation value compensation payments through an independently calculated conservation lease fee for the entire lease area (see section 9, below);

(ii) Direct and full net present value compensation for the lost conservation land and water taken up by, and diminished in conservation value by, infrastructure, roads, gravel pits, oil facilities, loading platforms etc.;

(iii) A major 'icon' conservation project that will produce a biodiversity conservation outcome of permanent conservation significance and is directly relevant to the biodiversity conservation values of Barrow Island that will be lost or at risk of being lost from the proposed development; and

(iv) Other significant conservation outcome projects (possibly through a Gorgon Environmental Foundation (with a suggested budget in the order of c. $2 million per year, linked to CPI) voluntarily put forward by ChevronTexaco in addition to the above for NCB outcomes.

8.2 The entire offsets, commitments and NCB package and the mechanisms for their delivery should be made as legally binding conditions under the Environmental Protection Act, as the most appropriate way to ensure long term commitments by the proponent are met.

9. RENTAL AND MANAGEMENT COST RECOVERY

The ESE Review includes a commitment to enter a "*formal Conservation Agreement with CALM*", which would "*...provide a mechanism for adequate resources of CALM activities on the island, and provide an ongoing vehicle to undertake research on the island*" (page 122). This commitment is vague and therefore of limited value. It is not clear as to what extent such an agreement would address the Department's management requirements or what practical level of support would be forthcoming. It is not acceptable to leave such a significant issue open to later negotiations.

Two main elements to biodiversity conservation can be identified for this project:

1. Protection: Essential measures to protect the Barrow Island marine and terrestrial environment during construction, operation and decommissioning (i.e. baseline research, monitoring, auditing, quarantine management etc.), which are not NCB's.
2. NCB: True NCB's that offset the biodiversity disbenefits by enhancing biodiversity outcomes on Barrow Island or elsewhere. This has been addressed above.

Specific environmental protection measures would become conditions as a result of a subsequent Environmental Protection Act environmental assessment. However, a major component of the protection element must be addressed as part of the ESE process. Specifically, it must be ensured that there are adequate resources to enable the managing agency (DCLM) to carry out regulatory audits and protection functions that provide the highest level of regulatory scrutiny in order to protect the high conservation value assets of the island, without a diminution of existing funding for current conservation programs. The Gorgon proposal, if approved, will present elevated risks to critical conservation values of Barrow Island and there is a need for regular scrutiny by an independent body. Such high-level audit functions should not be carried out by the proponent. Self-regulation or appropriation of the task from Government is not acceptable in this case.

The funding of management costs can also potentially provide a platform to deliver NCB's if the capacity is properly structured and resourced. An adequate Departmental management presence and operational capability on Barrow Island could, for example, underpin NCB projects on the Montebello Islands.

In the event of project approval, there is broad support for legislation to allow the Executive Director of DCLM to issue a form of lease over the nature reserve, and for the lease fee to be hypothecated to DCLM management costs. Approaches to the tenure issue currently under investigation include an Agreement Act or a specific 'Barrow Island Act'. Such legislation would need to support the Department having the capacity to issue leases similar to leases under the *Petroleum Pipelines Act 1969* for Varanus and Thevenard Islands.

Precedent for Charges

Two options for setting an appropriate lease fee are discussed below and a recommendation provided:

1. The principle of linking the fee level to management costs for petroleum bases on island nature reserves has adequate precedent in the Pilbara (e.g. Thevenard, Varanus and Airlie Islands). Furthermore, the conditions of the various petroleum pipeline leases include the provision by the operators for transport of staff to and from the islands plus food and accommodation at no cost to the Department. Lease fees are indexed to the Consumer Price Index.

2. It is noted that Barrow and Thevenard Islands have a similar overall magnitude of constraints (Figure 4.3, page 46), and that the critical constraint is the $500 million additional cost to establish the facility on Thevenard Island. Based on the proponent's case, a site on Barrow will either make the project viable in the immediate future or potentially save ChevronTexaco $500 million at some point in time. The economic value to the proponent could then be weighed up in terms of having or not having a project at this time, or saving several hundred million dollars at some future point in time.

Elsewhere (e.g. US Forest Service), market rents are applied. Typically, the annual lease fee would be 6-8% of the appraised market value, adjusted annually for inflation, for the life of the project. It is apparent from the ESE that the 'fair market value' that ChevronTexaco places on Barrow is $500 million: the cost differential identified between Barrow and Thevenard, which has been identified as otherwise suitable. This would indicate a market value (lease fee) between $3 million per year (i.e. 6% of $500 million) and $4 million if the lease fee was 8%.

Management Costs

If the principle of applying a lease fee as adopted for existing bases is applied (see no. 1 above), the following would outline the basis for establishing the annual rate on Barrow Island.

There is a need for a continual management presence on Barrow to support terrestrial and marine regulatory roles. The greatest need for continual scrutiny is during the construction process. Seven staff for the construction period should cover four staff rotating on and off Barrow Island in a regulatory role, two staff covering quarantine and other issues on the mainland, plus one staff to cover leave. This may be able to be reduced after construction. Two staff on the island working eight-hour days on a two-week rotation should be adequate.

There are high costs in supporting staff in this situation. Costs include transport, vehicles, helicopter support, a seagoing vessel, office and other accommodation. It is considered appropriate to require ChevronTexaco to provide transport, accommodation and victuals as part of a lease agreement. In particular, purpose-built office accommodation as part of a lease condition would be essential. Specifications on this will need to be agreed.

A seagoing vessel would be required. This would involve a substantial capital cost plus operational and maintenance costs. Estimates have been based on an annual lease basis for a ten-metre vessel.

Preliminary costs have been calculated and are described in Appendix 4.

Recommendations

9.1 It is recommended that the lease fee be linked to Departmental management costs in keeping with the precedent for other similar Petroleum Pipeline Act leases on Pilbara island nature reserves.

9.2 In order to assure adequate resources are available to DCLM for the protection of the environmental assets, it is recommended that, should Cabinet decide to provide 'in principle' support for this proposal, it endorse the principle of establishing a lease, structured on the costs to the Department to supervise this project and taking into account the conservation values lost and under threat. This fee should be independently established and revisited regularly as valuations and costs change. This requirement would amount to in the order of $2.2 million per year during construction and perhaps $1.3 million per year afterwards. It would also be appropriate to incorporate this requirement into any Agreement Act.

10. RELATIONSHIP OF PROJECT TO DRAFT STATE SUSTAINABILITY STRATEGY

The State Government has identified that the separate analysis of environmental, economic and social impacts of major development proposals is no longer appropriate, with the integrated assessment of these components now considered best practice. Both the *Review of the Project Development Approvals System* (the 'Keating Review', 2002) and *Focus on the Future: The Western Australian State Sustainability Strategy* (Government of Western Australia, 2002) have referred to the need for government to formulate sustainability objectives, assessment criteria and regulatory roles in terms of assessing the sustainability of major projects. The latter of these reports has acknowledged that

government sometimes has to make difficult decisions, involving significant trade-offs between social, economic and environmental factors. Assessment of sustainability is intended to work through these issues in a transparent way and find integrated solutions where trade-offs are non existent or minimal.

The (draft) *State Sustainability Strategy* has recognised that the Gorgon gas development project will be the first Western Australian project that attempts to integrate environmental, social and economic considerations into a formal assessment process. Assessment of the resultant Environment, Social and Economic (ESE) report has intrinsic difficulties given the lack of accepted sustainability criteria. Both of the documents referred to above provide a proposed framework of assessment only.

The (draft) *State Sustainability Strategy* provides a sustainability framework that consists of seven foundation principles and six visions for Western Australia's sustainability. These are intended to reflect the core values of sustainability. The foundation principles listed in the strategy are: long-term economic health; equity and human rights; biodiversity and ecological integrity; settlement efficacy and quality of life; community, regions 'sense of place' and heritage; net benefit from development; and common good from planning.

It is widely recognised that the biodiversity of Western Australia is globally significant. The Department considers Barrow Island to be one of the most important and iconic examples of this biodiversity. The conservation of this natural asset is a prerequisite for sustainability. This sustainability principle has been addressed in the ESE Review via Gorgon Sustainability Principle 3 – Biodiversity and Ecological Integrity Protection. Page 268 of the ESE Review outlines ChevronTexaco's commitment that "*The Gorgon gas development will not disrupt ecological structure and function, nor will it result in a loss of biological diversity on Barrow Island*". The Department finds it difficult to accept this statement as provided due to the high level of activity at Barrow Island that will occur as a result of the project proceeding, particularly during the construction phase. The ESE Review does not provide enough information on how this commitment would be achieved; the quarantine management plan is briefly referred to, however the level of detail is not adequate to allow this Department to make an informed recommendation in regards to the viability of the commitment.

As discussed earlier in this submission, given the inadequacies in both structure and scale of the current NCB package offered by the proponent, and the paucity of information made available through the ESE Review on economic and social gains to the State, it would appear to this Department that the proponent has not proved the net benefits to be gained by the State, given the very high value of the asset at risk.

The sustainability vision for Western Australia as stated on page 30 of the (draft) *State Sustainability Strategy* refers to a management and planning process for natural resources that is transparent and visionary. It would appear that the current ESE has not fully realised either of these objectives, given the apparent reluctance of the proponent to provide further information and clarification to government agencies during the ESE comment period.

Proposed sustainability assessment criteria discussed on page 118 of the *Review of the Project Development Approvals System* include:

- are the resources or features to be affected rare, scarce or unique;
- are the effects of the project (either environment or socio-economic) permanent or irreversible; and
- are existing environmental quality standards likely to be compromised?

In applying these criteria to the proposed project, the Department considers Barrow Island to be a unique resource that represents biodiversity values no longer found on the mainland due to the impact of invasive species. The proponent has inadequately acknowledged this value. The terrestrial mammal habitat and proposed marine reserves surrounding Barrow Island are of immeasurable value

in terms of biodiversity conservation in Western Australia. Given the high level of activity on Barrow Island that would result from project construction and operation and the likely timeframe of the project, it is the view of the Department that it would be extremely difficult to satisfactorily manage the impacts of any pest animal or weed species introductions that may occur. It is the view of this Department that the risk of permanent and irreversible effects to the island environment occurring outweigh the benefit of the project proceeding on Barrow Island and that the compromise to environmental quality standards as the project is currently proposed is unacceptable.

The ESE Review acknowledges on page 258 that there is currently no widely accepted approach to monitoring and assessing performance against sustainability criteria. ChevronTexaco has made no attempt in the ESE Review to document how the company will assess their performance against their ten sustainability criteria as outlined on pages 261 to 269. The sustainability criteria become less meaningful if no feasible method of monitoring and assessment of performance against criteria is determined.

Page 259 of the ESE states that "*the Gorgon gas development sustainability principles and criteria also incorporate the key interests and concerns of stakeholders that were raised during the consultation process.*" Given that the Department is the primary stakeholder if the project proceeds on Barrow Island, the Department does not accept that the sustainability principles have addressed all concerns of stakeholders, as raised in this submission.

The sustainability chapter of the ESE Review states on page 257 that "*Development of the Gorgon gas field offers substantial economic and social benefits at national, state and regional levels. However its remoteness and the need to construct a gas processing facility on Barrow Island present commercial, technical and environmental challenges.*" The Department questions the validity of this statement, as the ESE Review does not provide adequate information for government to assess the economic and social benefits to Western Australia, nor does the ESE justify the 'need' for the project to proceed on Barrow Island. The Department questions whether the ESE Review overall has adequately addressed the issue of sustainability, which according to the *State Sustainability Strategy* minimises conservation loss and social impact while providing economic benefit. Given the inadequacies of the NCB package as it currently stands, and the lack of information on biodiversity values and quarantine procedures if the project was to proceed on Barrow Island, the project is currently not considered to meet sustainability principles.

The Department notes that in its policies for the election in 2001, the Labor Party policy included a commitment to "prohibit mineral and petroleum exploration and mining in national parks and nature reserves". This reinforces the significance of the NCB requirement.

Recommendations

10.1 The Department of Conservation and Land Management does not agree with the statements that "*the development will deliver social and economic benefits to the region, Western Australia and Australia without compromising in any manner the nature conservation values of the Island. Indeed, the Gorgon Venture would provide net conservation benefits to Western Australia.*" There is no substance to the claim that Net Conservation Benefits would necessarily accrue, based on the information provided in the ESE document. The Department therefore recommends that the Gorgon joint venture partners recommence discussion and information exchange with government on project siting; economic and social impact on a regional and state level; biodiversity values and quarantine procedures; and Net Conservation Benefits. Greater transparency and access to information is essential for government to make an informed decision that integrates all three factors of sustainability.

10.2 The Department recommends that ChevronTexaco develop a detailed set of assessment criteria that would allow for accurate monitoring and measurement of how the company would perform against the ten sustainability criteria outlined in the ESE. Until this sustainability assessment capacity has been demonstrated, the sustainability principles as outlined in the ESE are viewed as having limited value.

10.3 The Department recommends that ChevronTexaco complete a Quantitative Risk Assessment of the risk of invasive species introduction over the life of the project and the timeframe of likely presence by ChevronTexaco on Barrow Island. The Department is unable to fully assess the impacts of the project until the risk to conservation values posed by the increased level of activity on Barrow Island is quantified.

Department of Conservation and Land Management
25 March 2003

11. REFERENCES

Alcover, J.A., Sans, A. and Palmer, M. (1998). The extent of extinctions of mammals on islands. *Journal of Biogeography*, **25**, 913-918.

AQRC (1996). *Australian Quarantine: A Shared Responsibility*. Report of the Australian Quarantine Review Committee.

Astron Environmental (2002). Methanol plant Withnell East Industrial Estate fauna report. June 2002.

Astron Environmental (2002). Preliminary Vegetation and Flora Survey of proposed Gorgon Development Barrow Island. October 2002

Atkinson, I.A.E. (1985). The spread of commensal species of *Rattus* to oceanic islands and their effects on island avifauna. *Conservation of island birds. International Council for Bird Preservation Technical Publication No. 3.* (ed. by P.J. Moors), pp. 35-81. International Council for Bird Preservation, London.

Beard, J.S. (1980). A new phytogeographic map of Western Australia. *Research Notes Western Australian Herbarium* **3**: 37-58.

Biosecurity Australia (2001). *Guidelines for Import Risk Analysis September 2001*. Agriculture, Fisheries and Forestry, Commonwealth of Australia.

Bradshaw, S.D., Morris, K.D., and Bradshaw, F. J. (2001). Water and electrolyte homeostasis and kidney function of desert-dwelling marsupial wallabies in Western Australia. *Journal of Comparative Physiology* **171** : 23-32.

Burbidge, Andrew (2001). Our largest island. *Landscope* **17**(2), 16-22.

Burbidge, A.A. and Manly, B.F.J. (2002). Mammal extinctions on Australian islands: causes and conservation implications. *Journal of Biogeography* **29**, 465-474.

Burbidge, A.A, Morris, K.D. and Drew, M. (2000). Mammal monitoring, Barrow Island Nature Reserve October 2000. Unpublished Report to ChevronTexaco and Department of Conservation and Land Management.

Burbidge, A.A., Williams, M.R. and Abbott, I. (1997). Mammals of Australian islands: factors influencing species richness. *Journal of Biogeography* **24**, 703-715.

Cable Sands Pty Ltd (2002). Ludlow Titanium Minerals Mine Environmental Review and Management Program. January 2002.

Chevron (2000). Barrow Island Annual Environmental Report 2000. Chevron Australia Pty Ltd, Perth.

Driskell, A.C., Pruett-Jones, S., Tarvin, K.A. and Hagevik, S. (2002). Evolutionary relationships among blue- and black-plumaged populations of the white-winged fairy-wren (*Malurus leucopterus*). *Australian Journal of Zoology* **50**, 581-595.

Eldridge, M.B., King, J.M., Loupisa, A.K.L., Spencer, P.B., Taylor, A., Pope, L.C. and Hall, G.P. (1998). Unprecedented levels of genetic variation and inbreeding depression in an island population of the black-footed rock-wallaby. *Conservation Biology* **13**, 531-541.

Government of Western Australia (2002). *Focus on the future: The Western Australian State Sustainability Strategy*. Consultation Draft. Department of the Premier and Cabinet, Perth.

Hall, G., Onus, M. and Kinnear, J. (1993). A survey of Barrow Island for the Black-flanked rock-wallaby (*Petrogale lateralis lateralis*). Unpublished report to the Department of Conservation and Land Management.

Higgins Wood and Associates (1995). *Pilbara/Gascoyne Islands Ecotourism Management Strategy*. Report for the Pilbara Development Commission.

IUCN (1994). Guidelines for protected area management categories. IUCN, Gland.
Latz, P. (1995). *Bushfires and bushtucker: Aboriginal plant use in central Australia*. IAD Press Alice Springs.

Limpus, C. (2002). *Western Australian Marine Turtle Review*. A study commissioned by Western Australian Department of Conservation and Land Management. October 2002.

Long, P., Kruger, J., and Long, V. (2002). *The Maitland Heavy Industrial Estate: Assessment and Comparison with the Burrup Peninsula Industrial Estate*. Report for the Shire of Roebourne

Manning, J., Toussaint, L., and Upton, H. (2002). Gamma Radiation Levels at the Montebello Islands June 2001. *Radiation Protection in Australasia* **19** (1): 49-58.

Mattiske and Associates. (1993). State of knowledge on vegetation, Barrow Island. Report prepared for West Australian Petroleum Pty Ltd, Perth.

Morris, K.D., Burbidge, A.A., Drew, M., and Kregor, G. (2001). Mammal monitoring, Barrow Island Nature Reserve October 2001. Unpublished Report to ChevronTexaco and Department of Conservation and Land Management.

Morris, K.D., Burbidge, A.A., Drew, M., and Kregor, G. (2002). Mammal monitoring, Barrow Island Nature Reserve October 2002. Unpublished Report to ChevronTexaco and Department of Conservation and Land Management.

Prince, R.I.T., Lawler, I.R. and Marsh, H.D. (2001). The distribution and abundance of dugongs and other megafauna in Western Australian coastal waters extending seaward to the 20 metre isobath between North West Cape and the De Grey River mouth, Western Australia. Final Unpublished Report to the Marine Species Protection Program, Environment Australia, Canberra.

Salmon, M., Witherington, B.E., and Elvidge, C.D. (2000). Artificial lighting and the recovery of sea turtles. In: Pilcher, N. and Ismail, G. (Eds). *Sea turtles of the Indo-Pacific: Research Management and Conservation*: 25-34. ASEAN Academic Press, London.

Short, J and Turner, B. (1991). Distribution and abundance of spectacled hare-wallabies and euros on Barrow Island, Western Australia. *Wildlife Research* **18**:421-429.

Short, J and Turner, B. (1993). Distribution and abundance of the burrowing bettong (Marsupialia: Macropodidae). *Wildlife Research* **20**:525 - 534.

Short, J, Turner, B, and Majors, C. (1989). The distribution, relative abundance and habitat preference of rare macropods and bandicoots on Barrow, Boodie, Bernier and Dorre Islands. Unpublished report to the National Kangaroo Monitoring Unit, Australian National Parks and Wildlife Service, Canberra.

Strahan, R. (1995). *The Australian Museum complete book of Australian Mammals*. Reed Books, Chatswood, NSW.

Trudgen, M. (1989). A report on the progress of the regeneration of vegetation on areas disturbed during oil production on Barrow Island. Report prepared for West Australian Petroleum Pty Ltd.

WAPET (1988). Barrow Island Oilfield Environmental Review 1963 – 1988. West Australian Petroleum Pty Ltd, Perth.

APPENDIX 1

SUMMARY OF RECOMMENDATIONS

1. INTRODUCTION

1.1 Should the Government decide to give 'in principle' support to the proposal to site the development on Barrow Island, a full range of firm requirements relating to management actions and best practice environmental performance should be made as unambiguous conditions on any future access.

2. EVALUATION OF ALTERNATIVE SITES

2.1 ChevronTexaco should undertake a further full and detailed analysis of all alternative locations for the proposed gas processing facilities. Analysis should consider qualitative *and* quantitative environmental constraints of each location, and provide adequate and reliable data (qualitative and quantitative) on the costs and benefits of developing the facility at each site.

2.2 ChevronTexaco should provide a detailed cost estimate for developing the Gorgon gas processing facility on each alternative site. Costs should include all components of construction and operation.

2.3 Cost estimates in Table 4.3 should also include the particular costs that ChevronTexaco would be expected to cover at each site in quarantine management, rental and environmental management cost recovery, and in meeting net conservation benefit outcomes.

2.4 Alternative project proposals that do not involve export of a gas product direct from the raw product purification process should also be investigated, particularly the concept of initial stripping of CO_2 allowing pipeline transfer of cleaner gas to the mainland for further product processing.

2.5 Cape Preston should be evaluated in terms of its qualitative and quantitative environmental, economic and social constraints as a potential site to locate the Gorgon gas processing facility. The existing mineral tenements on the site do not consitute an acceptable reason for eliminating the site from consideration.

2.6 Reliable quantitative and qualitative data should be provided by ChevronTexaco to validate its argument as to why Cape Preston, Maitland Estate and Thevenard Islands and the Montebello Islands would or would not be suitable sites. All cost estimates (construction, operation, net conservation benefits, site rental, environmental management cost recovery, quarantine management) should be compared between these sites.

2.7 ChevronTexaco should provide an analysis of 'other' alternatives, such as locating a small plant on the Montebello Islands, which strips the CO_2, dries the gas, and transports the resulting gas to the mainland for liquefaction; and locating part of the gas processing facility offshore, obviating the need for a tanker-loading jetty on Barrow Island.

ASSESSMENT OF CONSERVATION VALUES ON BARROW ISLAND

3.1 It was found that ChevronTexaco failed to provide reliable data regarding the actual conservation status of sea turtles in the Pilbara region, and in particular, species that utilise Barrow Island for nesting activities. Furthermore, the ESE Review largely underestimated that value of Barrow Island for sea turtle nesting activities. These omissions and errors need to be addressed in the response to the ESE comments.

3.2 While the ESE Review identified Flacourt Bay as a sea turtle nesting beach, it did not provide data on the nesting attempts at other suitable nesting beaches on Barrow Island. ChevronTexaco should provide these data in order to estimate the overall utilisation of the Island for sea turtle nesting activities.

3.3 This Department challenges the notion that disturbance to sea turtles during 'non-peak' periods is acceptable. We request that ChevronTexaco clarify the "peak" nesting periods it refers to.

3.4 The Department requires that no construction activities be undertaken on turtle nesting beaches at night during any period when turtles use the beach (adult or hatchling). In the event of approval for this project, an environmental specialist must be employed to oversee any operations during the breeding period (September to April inclusive), to ensure compliance with this requirement.

3.5 ChevronTexaco has not provided adequate information on how it will minimise the potential impacts to sea turtles during operations. While it commits to the strategies on page 94 of the ESE Review, further information should be provided on the following:

- how the proponent will shield the pilot flare, which will burn continuously;
- the height of the lights on the proposed plant and how ChevronTexaco plans to minimise light-fall from the plant;
- a commitment to the installation of fully shielded lights, time switches or motion detectors, low intensity lighting, lights installed at a low height, and physical barriers around lit areas; and
- the design of a lighting system that minimise all irradiance on the beach (i.e. will not reflect off large areas of plant back towards the beach and thus escape directional shielding).

3.6 It is expected that during operations, ChevronTexaco should meet its commitments on page 94 to minimise all potential impacts to sea turtles. Furthermore, regular audits by a dedicated environmental specialist (reporting to DCLM and DEWCP) would be expected, and regular inspections by Departmental personnel would be required in order to ensure compliance to these commitments.

3.7 Chevron Texaco should commit to undertake no night time operations on the jetty. Should it persist in requiring the jetty to be lit, ChevronTexaco should quantify the worst-case turtle hatchling kill for the jetty and meet any requirements for permits under the *Wildlife Conservation Act 1950* to take that number of turtles.

3.8 Inshore vessel movements and operations during the pre-nesting aggregation phase should be restricted at both the eastern and western nesting areas. Such activity would seriously disturb mating aggregations. Operations in inshore marine areas will need to be similarly supervised to ensure compliance with this requirement.

3.9 In order to prevent any impacts of flaring activities on turtle hatchlings, ChevronTexaco should commit to either eliminating the need to conduct flaring on Barrow Island, or fully shielding the flare.

3.10 Vehicle and machinery activity along all beaches should be restricted to areas only directly within the pipeline access easement.

3.11 If larger marine fauna such as whales and dugongs are detected in the vicinity of construction activities, shut-down operations should be employed where possible, in order to avoid the risk of any direct impacts to the species.

3.12 ChevronTexaco should clarify the "peak seabird breeding period" it refers to, and list its commitments to ensure that disturbance to breeding and migratory seabirds is minimised, should the proposal be approved.

3.13 Should the gas processing facility be constructed on Barrow Island, the Department would recommend that sufficient nest structures be placed nearby, and that any attempt by seabirds to nest on port or other constructed facilities be discouraged.

3.14 Prior to any decision being made on this proposal ChevronTexaco should undertake more detailed mapping of the marine and intertidal benthic habitats along the proposed pipeline corridor and areas adjacent to the development. This will provide the Department with a more accurate indication of benthic habitats that may be potentially impacted by the proposal, and identify the possible impacts caused by the installation of the pipeline and the turbidity caused by the construction activities.

3.15 Should this proposal be approved, this Department would seek to have input to the specification of a detailed mapping program of the marine and intertidal habitats potentially impacted by the development. Input would also be sought into the design and implementation of any monitoring and research programs for marine habitats and marine species impacted by the proposal.

3.16 A protocol for the monitoring of particular marine habitats and species at risk of marine pest incursions, together with contingency guidelines for the occurrence of any invasive event, should be developed by Chevron-Texaco in conjunction with this Department.

3.17 The AQIS guidelines should be strictly adhered to by ChevronTexaco for both the construction and operation phases of the development.

3.18 This Department recommends that, before any decision is made to proceed with the project on Barrow Island, the proposal should be subject to a quantitative risk analysis regarding the potential for a marine spill.

3.19 The detailed community scale vegetation description and mapping undertaken by Astron (2002) needs to be completed for the whole island. This will allow for valid comparisons to be made with respect to the representativeness of the flora and vegetation types across the Island and determine the likely impacts that this project will have on these botanical values.

3.20 While the ESE Review attempts to examine the impact of the Gorgon development on the different vegetation types at the Town Point site (Table 6-3), it would be useful to include the areas of those vegetation units that have been disturbed on other parts of the island as a result of ChevronTexaco's petroleum operations (i.e. present a total view of the disturbance of the affected vegetation units). This is particularly relevant in regard to the area from which gravel has been mined.

3.21 ChevronTexaco should provide a reliable analysis of the conservation value of *all* of the terrestrial mammals inhabiting Barrow Island (not just threatened taxa), based on accurate and reliable data.

3.22 The proposed Gorgon gas processing facility on Barrow Island has the potential to impact adversely upon important fauna habitats. Should this proposal be approved on Barrow Island, the Department would expect that ChevronTexaco provide an accurate analysis of areas of fauna habitat in the subject area (including proposed pipeline easement and gas processing facility footprint), and commit to avoiding any disturbance to all sensitive areas of fauna habitat on the island.

3.23 Boodie warrens warrant particular attention at the development site. It is likely that warrens near the development will be impacted either by animals moving away, or by increased mortality during the construction phase (road kills etc). ChevronTexaco needs to do further work to determine the potential impact of the development on/near these habitats.

3.24 It is clear from the data presented in the ESE Review that a further, more detailed survey of reptiles and amphibians in the proposed project area needs to be conducted in order to assess the abundance and diversity of reptiles in the area and to adequately identify potential impacts on reptile populations.

3.25 The distribution of the cameanid species thought to be endemic to Barrow Island should be further examined.

3.26 A comprehensive subterranean fauna survey, with a dedicated drilling program, is required. The program must incorporate the full suite of techniques required to conduct a thorough assessment, including genetic analyses to determine species identities. This program should be collaborative, and include the Western Australian Museum, this Department and specialists in tertiary institutions. Completion of this work is necessary for proper assessment of the proposal.

3.27 ChevronTexaco has failed in the ESE Review to provide an adequate analysis of the potential impacts of its operation on subterranean fauna at Barrow Island. Given the above concerns, this Department recommends that ChevronTexaco provide information on the following:

- Whether 'first flush' water will be collected and separated from following water.
- How the water will be treated, so as to isolate it from water entering the local groundwater; and where the sink will be for this water.
- The potential consequences of failure or inability to isolate this water from the aquifer, given that rainfall is irregular and that significant build-ups of contaminants may accumulate between heavy rainfall events, which may be more than 12 months apart.
- The levels of contaminants that may enter the system, and what the consequences would be for local stygofauna.
- Whether ChevronTexaco will ensure that the hardstands remain impermeable for the duration of the project life.
- Whether hydrocarbon storage will be above ground, so that leaks will be immediately apparent and fixable.
- How ChevronTexaco plans to monitor the impacts of the extraction of fresh groundwater on stygofauna on the island.

CURRENT ENVIRONMENTAL PERFORMANCE ON BARROW ISLAND

4.1 This Department recommends that ChevronTexaco provide historical data to show the total area of land cleared on Barrow Island for the duration of petroleum operations on the island. These data should adequately account for the area cleared for roads, gravel pits, seismic operations, well-heads and injection bores.

4.2 An investigation should be conducted by ChevronTexaco to determine the spatial distribution of cleared areas on Barrow Island (historically) in accordance with vegetation type, in order to estimate the impacts of clearing on the conservation value of creekline habitats and alluvial flats on the island.

4.3 This Department requests that ChevronTexaco make available the document by Trudgen (1989).

4.4 It should be a requirement that all studies and reports relating to the Barrow Island environment be made public available.

4.5 Before any proposal be approved for ChevronTexaco to clear additional land at Barrow Island, it must demonstrate its capability to meet 'best-practice' standards for rehabilitation by developing a program to establish benchmarks and develop and meet completion criteria for its current rehabilitation operations on the Island. Furthermore, a similar rehabilitation program should be developed in preparation for the decommissioning of the proposed gas processing plant, in the event of the proposal being approved on Barrow Island.

QUARANTINE

5.1 Should the proposal proceed on Barrow Island, ChevronTexaco will need to significantly improve its performance with regard to weed management and quarantine procedures on the island (see section below on 'Quarantine Management'). ChevronTexaco should commit to eradicating the existing invasions of kapok and buffel grass within its existing petroleum permit area, before any further development occurs on Barrow Island.

5.2 This Department recommends that ChevronTexaco undertake a quantitative risk analysis of the likelihood of the introduction of invasive animals to Barrow Island as part of the approvals process for the proposed Gorgon gas development. It should be noted that it is the Department's view that any introduction of non-native animals to the island is not acceptable. Quarantine procedures should be adopted that will ensure that there is a very low risk of any invasion of any exotic species to the island (see further discussion under 'Quarantine Management').

5.3 Chevron Texaco needs to establish an adequate early detection, identification and control program for the invasives that risk analyses identify as having some risk of entry to the island.

5.4 Prior to Cabinet providing any 'in principle' approval for using Barrow Island for locating the Gorgon gas processing facility, a comprehensive quantitative Quarantine Risk Assessment needs to be completed by ChevronTexaco. The assessment should be conducted in a manner that allows for early consultation with this Department, the CSIRO, the Australian Quarantine and Inspection Service, the Western Australian Quarantine Inspection Service, and other stakeholders. The assessment should be based on scientific methodology and the analysis must be transparent and subject to peer review and public scrutiny.

5.5 If the Gorgon gas development does proceed on Barrow Island, the mere expansion of the current quarantine procedures on the island to deal with the proposed gas operations would not adequate. A separate and distinct quarantine management plan must be developed in consultation with stakeholders and expert bodies. The plan must be based on the outcomes of a quantitative risk assessment, and be subject to the approval of the Minister for the Environment and Heritage. The plan must also be subject to periodic external review and auditing.

5.6 Any Quarantine Plan should involve an independent team of dedicated staff that audits and monitors the quarantine procedures for all aspects of proposed operations on Barrow Island, and that is empowered to stop any operation when the risk of a quarantine breach is high. The team should be highly trained in all aspects of quarantine management. Its actions must be independent, transparent and consultative.

FIRE MANAGEMENT

6.1 This Department recommends that, should the Gorgon gas development proceed on Barrow Island (therefore resulting in an increase in longevity of industrial operations on the island), ChevronTexaco agree to planning and undertaking a fire management regime on Barrow Island, which would be managed and carried out by this Department.

MANAGEMENT OF GREENHOUSE GASES

7.1 The Department urges ChevronTexaco to further consider organic carbon sequestration to offset the greenhouse gas emissions from the project.

7.2 The experimental proposal to sequester carbon geologically in saline aquifers is supported in principle on the basis that it is viewed as an experiment, undertaken with appropriate monitoring and located in a place at which failure will not generate unacceptable hazards. There are clear impacts associated with pipelines across Barrow Island for such injection proposals and it should not be accepted without detailed critical analysis that Barrow Island is the best site from an environmental perspective.

NET CONSERVATION BENEFITS

8.1 In order for real long-term sustainable conservation outcomes to be delivered as a result of any Gorgon gas development project based on Barrow Island, a combined system of best practice performance, environmental conditions and offsets and NCB outcome projects should be developed. These should involve the following:

(i) Best practice environmental performance for all aspects of management on Barrow Island in terms of minimising undesirable impacts to conservation values through:
- New standards of quarantine control, monitoring, incursion response;
- Best practice environmental performance in siting developments, including pipelines etc., and in all stages of construction, operation and maintenance;
- Elimination of threats to native species by eradication of weeds, elimination of light source and marine pollution risks to turtle nesting and other terrestrial and marine species; and,
- Full cost recovery for a new Department of Conservation and Land Management permanent conservation management presence on the island and in surrounding waters, including net conservation value compensation payments through an independently calculated conservation lease fee for the entire lease area (see section 9, below);

(ii) Direct and full net present value compensation for the lost conservation land and water taken up by, and diminished in conservation value by, infrastructure, roads, gravel pits, oil facilities, loading platforms etc.;

(iii) A major 'icon' conservation project that will produce a biodiversity conservation outcome of permanent conservation significance and is directly relevant to the biodiversity conservation values of Barrow Island that will be lost or at risk of being lost from the proposed development; and

(iv) Other significant conservation outcome projects (possibly through a Gorgon Environmental Foundation (with a suggested budget in the order of c. $2 million per year, linked to CPI) voluntarily put forward by ChevronTexaco in addition to the above for NCB outcomes.

8.2 The entire offsets, commitments and NCB package and the mechanisms for their delivery should be made as legally binding conditions under the Environmental Protection Act, as the most appropriate way to ensure long term commitments by the proponent are met.

RENTAL AND MANAGEMENT COST RECOVERY

9.1 It is recommended that the lease fee be linked to Departmental management costs in keeping with the precedent for other similar Petroleum Pipeline Act leases on Pilbara island nature reserves.

9.3 In order to assure adequate resources are available to DCLM for the protection of the environmental assets, it is recommended that, should Cabinet decide to provide 'in principle' support for this proposal, it endorse the principle of establishing a lease, structured on the costs to the Department to supervise this project and taking into account the conservation values lost and under threat. This fee should be independently established and revistited regularly as valuations and costs change. This requirement would amount to in the order of $2.2 million per year during construction and perhaps $1.3 million per year afterwards. It would also be appropriate to incorporate this requirement into any Agreement Act.

RELATIONSHIP OF PROJECT TO DRAFT STATE SUSTAINABILITY STRATEGY

10.1 The Department of Conservation and Land Management does not agree with the statements that "*the development will deliver social and economic benefits to the region, Western Australia and Australia without compromising in any manner the nature conservation values of the Island. Indeed, the Gorgon Venture would provide net conservation benefits to Western Australia.*" There is no substance to the claim that Net Conservation Benefits would necessarily accrue, based on the information provided in the ESE document. The Department therefore recommends that the Gorgon joint venture partners recommence discussion and information exchange with government on project siting; economic and social impact on a regional and state level; biodiversity values and quarantine procedures; and Net Conservation Benefits. Greater transparency and access to information is essential for government to make an informed decision that integrates all three factors of sustainability.

10.2 The Department recommends that ChevronTexaco develop a detailed set of assessment criteria that would allow for accurate monitoring and measurement of how the company would perform against the ten sustainability criteria outlined in the ESE. Until this sustainability assessment capacity has been demonstrated, the sustainability principles as outlined in the ESE are viewed as having limited value.

10.3 The Department recommends that ChevronTexaco complete a Quantitative Risk Assessment of the risk of invasive species introduction over the life of the project and the timeframe of likely presence by ChevronTexaco on Barrow Island. The Department is unable to fully assess the impacts of the project until the risk to conservation values posed by the increased level of activity on Barrow Island is quantified.

APPENDIX 2: ENDEMIC OR NEARLY ENDEMIC TAXA ON BARROW ISLAND

TABLE 2: SOME ENDEMIC OR NEARLY ENDEMIC TAXA AND/OR 'EVOLUTIONARY SIGNIFICANT UNITS' ON BARROW ISLAND

Mammals

Taxon/Evolutionary Significant Unit	Distribution	Taxonomy and genetics
Unnamed planigale, *Planigale* 'species 1'	Occurs on Pilbara mainland, isolated population on Barrow Island	No genetics research, isolated population
Tan antechinus, *Pseudantechinus roryi*	Occurs on Pilbara mainland and North West Cape peninsula, isolated population on Barrow Island	No genetics research, isolated population
Barrow Island golden bandicoot, *Isoodon auratus barrowensis*	Subspecies endemic to Barrow and Middle Islands (no genetics research comparing two populations)	Genetics research suggests that *Isoodon obesulus* group once widely distributed in southern Australia; Barrow Island animals probably the same taxon as mainland animals (note highly threatened on mainland)
Northern brushtail possum, *Trichosurus vulpecula arnhemensis*	Subspecies occurs across northern Australia, isolated population on Barrow Island	No subspecies described, no genetics research, isolated population
Barrow Island boodie, *Bettongia lesueur* Barrow Island subspecies	Endemic to Barrow Island, reintroduced to Boodie Island – may be a full species	Unpublished research by Dr Ken Aplin (formerly WA Museum) suggests that this taxon is an undescribed full species
Barrow Island spectacled hare-wallaby, *Lagorchestes conspicillatus conspicillatus*	Subspecies endemic to Barrow Island, ? same subspecies extinct on Montebello Islands	No genetics research
Black-flanked rock-wallaby, *Petrogale lateralis lateralis*	Scattered, remnant populations on mainland, also on Salisbury Island, extinct on Depuch Island, isolated population on Barrow Island	Barrow Island population highly inbred and genetically unique
Barrow Island euro, *Macropus robustus isabellinus*	Subspecies endemic to Barrow Island	Limited genetics research—unique Barrow population
Barrow Island mouse, *Pseudomys nanus ferculinus*	Subspecies endemic to Barrow Island	No genetics research

Birds

Barrow Island black-and-white fairy-wren, *Malurus leucopterus leucopterus*	Endemic to Barrow Island, possibly occurred in the Montebellos; if it did it is extinct there	Detailed genetics research shows 0.60% difference in mtDNA between Barrow Island and mainland WA populations.
Spinifexbird, *Eremiornis carteri*	Common on Barrow Island, widespread in arid, northern mainland Australia	No genetics research, isolated population

Reptiles

Ctenotus pantherinus acripes	Endemic to Barrow Island	No genetics research
Ramphotyphlops longissimus	Endemic to Barrow Island	No genetics research

Fish

Blind gudgeon, *Milyeringa veritas*	Barrow Island and North West Cape peninsula	No genetics research, isolated population

Invertebrates

Barrow Island millipede, *Speleostrophus nesiotes*	Endemic to Barrow Island	No genetics research, species very distinct
Scorpion: new genus: family placing uncertain	Endemic to Barrow Island	No genetics research, distinct at genus level, possibly at family level
Barrow Island draculoides, *Draculoides bramstokeri*	Barrow Island and North West Cape peninsula	No genetics research, isolated population
Nocticola sp.	Endemic to Barrow Island	
Barrow Island bogidomma amphipod, *Bogidomma australis*	Endemic to Barrow Island	
Barrow Island liagoceradocus amphipod, *Liagoceradocus subthalassicus*	Endemic to Barrow Island	
Nedsia fragilis	Endemic to Barrow Island	Genetics research of amphipods underway (ESE Technical Appendix I)
Nedsia humphreysi	Endemic to Barrow Island	Genetics research of amphipods underway (ESE Technical Appendix I)
Nedsia hurlberti	Endemic to Barrow Island	Genetics research of amphipods underway (ESE Technical Appendix I)
Nedsia macrosculptilis	Endemic to Barrow Island	Genetics research of amphipods underway (ESE Technical Appendix I)
Nedsia sculptilis	Endemic to Barrow Island	Genetics research of amphipods underway (ESE Technical Appendix I)
Nedsia straskraba	Endemic to Barrow Island	Genetics research of amphipods underway (ESE Technical Appendix I)
Nedsia urifimbriata	Endemic to Barrow Island	Genetics research of amphipods underway (ESE Technical Appendix I)
Nedsia chevronia	Endemic to Barrow Island	Genetics research of amphipods underway (ESE Technical Appendix I)
Oniscidea (Isopoda) sp. nov.	Endemic to Barrow Island	No genetics research
Oniscidea (Isopoda) sp. indet.	Endemic to Barrow Island	No genetics research
Haptolana pholeta	Endemic to Barrow Island	No genetics research
Stygiocaris stylifera	Barrow Island and North West Cape peninsula	No genetics research, isolated population
Qistrachia barrowensis	Also on nearby islands	No genetics research

Notes: 1. Technical Appendix I suggests that additional endemic stygofauna, including oligochaetes, ostracods and copepods, exist on Barrow Island.
2. Recent DCLM data suggests some of the stygofaunal taxa may occur on the mainland.

TABLE 2: DISTRIBUTION OF SOME BARROW ISLAND VERTEBRATE ENDEMIC OR NEARLY ENDEMIC TAXA AND/OR ESU, WITH NOTES ON POTENTIAL FOR TRANSLOCATION

Mammals	
Unnamed planigale	Population limited to Barrow Island, translocation not considered; no obvious site
Tan antechinus	Population limited to Barrow Island, translocation not considered; no obvious site
Barrow Island golden bandicoot	Also occurs on Middle Island, proposed for reintroduction to Hermite Island, subject to confirmation that rat eradication has been successful.
Northern brushtail possum	Population limited to Barrow Island, translocation not considered; no obvious site
Barrow Island boodie	Occurred on Barrow and Boodie Islands; ? same taxon became extinct on Boodie Island, reintroduced there in 1993
Barrow Island spectacled hare-wallaby	Taxon restricted to Barrow Island, proposed for reintroduction to Hermite Island (Montebellos), subject to confirmation that rat eradication has been successful
Black-footed rock-wallaby	Population limited to Barrow Island, translocation not considered; no obvious site
Barrow Island euro	Taxon limited to Barrow Island, translocation not considered; no obvious site
Barrow Island mouse	Taxon limited to Barrow Island, translocation not considered; no obvious site
Birds	
Barrow Island black-and-white fairy-wren	Restricted to Barrow Island (similar birds possibly of same genotype may have occurred in the Montebellos), proposed for introduction to Hermite Island, subject to confirmation that rat eradication has been successful
Reptiles	
Ctenotus pantherinus acripes	Restricted to Barrow Island, translocation not considered
Ramphotyphlops longissimus	Restricted to Barrow Island, very little known about this species
Fish	
Blind gudgeon	Also occurs on North West Cape peninsula, translocation probably not possible

APPENDIX 3

QUALITATIVE RISK ASSESSMENT

The following Qualitative Risk Assessment is based on the methodology recommended and outlined by Biosecurity Australia (2001), in order to provide a guide to the potential quarantine risks posed by the proposed Gorgon gas development on Barrow Island.

Qualitative Risk Assessment

To overcome the difficulties of volume and time, probabilities have been considered over the life of the project and for the forecast volumes (i.e. transport of vectors to and within Barrow Island) outlined in the document. Qualitative risk assessments have been undertaken for generic quarantine risks that have similar characteristics and management actions for invasive weeds, vertebrate pests, and invertebrate pests.

In these assessments, probabilities of a breach and exposure are expressed out of six descriptors; high, moderate, low, very low, extremely low and negligible, with moderate being described as an even probability of the event occurring. In assessing the likelihood of entry and the establishment of a weed or pest on the island, the lower qualitative weighting (descriptor) between the breach probability and the exposure assessment has been taken.

The consequence is expressed as a descriptor of the likely impact, given the identified exposure and rational presented. The consequence is identified as negligible, very low, low, moderate, high or extreme. The headings in the resulting assessment tables may be defined as follows.

- *Breach Probability* – This refers to the probability that a breach of the proposed quarantine system will occur during the life of the project and given the extent or volume of traffic to and activities on the island.
- *Exposure assessment* – This considers the probability that any breach will result in the establishment of the pest weed or vermin on the island and takes into consideration the control and monitoring measures outlined in the Gorgon ESE document and environmental conditions that may restrict a populations development.
- *Consequence Assessment* – This is the description of the potential impact of a given exposure (above) and an estimation of the likelihood that each will occur.

In determining the estimated risk, the identified possibility of entry and exposure (the lower of the breach probability or exposure descriptors) and the identified consequence or impact of that exposure for each generic group was applied to the risk estimation matrix (Table 1) to identify the estimated level of risk.

Table 1: Risk Estimation Matrix (taken from Biosecurity Australia, 2002, "*Guidelines For Import Risk Analysis, September 2001*").

Possibility of Entry and Exposure							
	High Likelihood	Negligible Risk	Very Low Risk	Low Risk	Moderate Risk	High Risk	Extreme Risk
	Moderate	Negligible Risk	Very Low Risk	Low Risk	Moderate Risk	High Risk	Extreme Risk
	Low	Negligible Risk	Negligible Risk	Very Low Risk	Low Risk	Moderate Risk	High Risk
	Very Low	Negligible Risk	Negligible Risk	Negligible Risk	Very Low Risk	Low Risk	Moderate Risk
	Extremely low	Negligible Risk	Negligible Risk	Negligible Risk	Negligible Risk	Very Low Risk	Low Risk
	Negligible Likelihood	Negligible Risk	Negligible Risk	Negligible Risk	Negligible Risk	Negligible Risk	Very Low Risk
		Negligible Impact	Very Low	Low	Moderate	High	Extreme Impact

Consequence of Entry and Exposure

The band of cells shown white representing a very low risk is an acceptable level of risk.

TABLE 2

QUALITATIVE QUARANTINE RISK ASSESSMENT

Invasive Weeds Arriving on Barrow Island

Hazard Identification	**11.** Risk Assessment		
	Breach Probability	**Exposure Assessment**	**Consequence Assessment**
The introduction of invasive weed seeds to Barrow Island on machinery employees in cargo and land fill. The spread of invasive species already introduced and established on the island in disturbed areas surrounding infrastructure.	• Quarantine breaches have repeatedly occurred under the current system. • The quarantine procedures outlined depend heavily on the participation of employees and contractors faced with competing motivational forces of time financial and safety constraints. • Seeds may be introduced in personal baggage, on shoes and passengers, dramatically increasing the number and frequency of vectors arriving at the island. • The proponent has not presented management procedures to adequately address the threat of arrival of weed seeds on people and their baggage. • The proponent has not presented adequate management procedures to address the threat of weed seeds in land fill brought to the island. • Significantly increased volume of traffic and quantity of cargo resulting in increased management difficulties and the potential for human error.	• Identification of weed species requires expert personnel. • Population expansion and spread is often rapid particularly in good seasons. • Control and or containment of species with long seed dormancy periods is very difficult. • Some species may be restricted in their development by the availability of water, however many have spread extensively on the mainland under similar conditions and have proven impossible to control. • ChevronTexaco have been unable to eradicate four species already introduced to the island. • It is unlikely given the increased level of activity associated with the Gorgon Gas project that populations already on the island can be contained at their current locations.	• Grasses Particularly *Cenchrus* Species have the potential to out compete Triodia , creating extensive monoculturs and drastically impacting on the ecosystem as a whole. • A breakdown of the floral structure will have devastating effects on the fauna of the island. • The domination and destruction of island ecotypes by weeds specifically, Buffel grass and Kapok has been demonstrated on many Northwest Islands. • Impact on native flora from control measures. • Financial and operational cost of control is considered to be prohibitive in the management and reduction of impact. • Management and control of impacts cannot be guaranteed beyond the life of the project, particularly as ChevronTexaco have demonstrated that some species cannot be eradicated from the island.
Probability / Impact	**12. High**	**13. High**	**14. Extreme**

TABLE . Qualitative Quarantine Risk Assessment
Invertebrate Pests Arriving on Barrow Island

Hazard Identification	**15.** Risk Assessment		
	Breach Probability	**Exposure Assessment**	**Consequence Assessment**
Introduction of invertebrates in cargo, soil fill material, on vermin , and amongst personal baggage.	• Quarantine breaches have occurred under the current system. • The quarantine procedures outlined depend heavily on the participation of employees and contractors faced with competing motivational forces of time financial and safety constraints. • While cargo in containers may be fumigated, invertebrates can be very difficult to detect in Cargo and on Machinery. • Invertebrate pests may be introduced in personal baggage dramatically increasing the number and frequency of vectors arriving at the island. • The proponent has not presented management procedures to adequately address the threat of arrival of invertebrates or their eggs or lava on people and their baggage. • The proponent has not presented adequate management procedures to address the threat of arrival of invertebrates, their eggs or lava in land fill. • Significantly increased volume of traffic and quantity of cargo resulting in increased management difficulties and the possibility of human error.	• Breaches of quarantine are difficult to detect until a population is at a size that is difficult to control. • Identification of invertebrate pests requires expertly trained personnel. • The monitoring procedures outlined depend heavily on the participation of employees relatively unskilled in this area . • Population expansion and spread is often rapid particularly in good seasons. • Some invertebrates may persist only around development. • Control measures are costly and difficult and are often unlikely to eradicate the pest. • The proponent proposes inspections on only an "opportunistic" basis	• Invertebrates provide an added vector for the transfer of zoonotic disease to and around the island with potentially catastrophic consequences. • Direct impacts on flora is undefined but considered to be extensive with some invertebrate species. • Impact on native fauna from control measures, through direct and secondary poisoning. • Financial and operational cost of control considered to be prohibitive in the management and reduction of impact. • Management and control of impacts cannot be guaranteed beyond the life of the project.
Probability / Impact	**16.** High	**17.** Moderate	**18.** High

TABLE 4 QUALITATIVE QUARANTINE RISK ASSESSMENT

Vertebrate Pests Arriving on Barrow Island

Hazard Identification	**19.** Risk Assessment		
	Breach Probability	**Exposure Assessment**	**Consequence Assessment**
Introduction of (*Rattus rattus*), Mice (*Mus musculus*)And other vertebrate pests to the island	• Quarantine breaches have repeatedly occurred under the current system. • Level of containment at barge Landing sites inadequately described and therefore considered ineffectual in maintaining a secure quarantine environment over the life of the project. • The quarantine procedures outlined depend heavily on the participation of employees and contractors faced with competing motivational forces of time financial and safety constraints. • Bait stations in containers left open over night can not be guaranteed to be effective in destroying any vermin within the container over a short period. • Significantly increased volume of traffic and quantity of cargo resulting in increased management difficulties and the possibility of human error.	• Increased activity, the number of personnel living on the island and increased infrastructure will all make the control and containment of any outbreak more difficult. • Mice introduced to Thevenard Island have spread throughout the island. Rats have persisted on many islands in the North West despite control measures, demonstrating the colonising capabilities of these rodents. • ChevronTexaco have been unable to control mice on Thevenard Island. • Barrow Island is likely to present similar if not greater difficulties in controlling introduced rodents, as recognised control measures would impact heavily on native fauna and therefore could not be used.	• Vermin compete heavily with threatened native fauna for resources, impacting heavily on small mammal and reptile populations. • Vermin provide an added vector for the transfer of zoonotic diseases and pests to and around the island. • Rats and Mice impact directly on native fauna through predation of young and eggs, resulting I a significant impact to reptile bird and small mammal populations. • Direct impact on Flora is undefined but considered to be extensive, particularly through consumption of seed. • Impact on native fauna from control measures, through direct and secondary poisoning. • Financial and operational cost of control considered to be prohibitive in the management and reduction of impact. • Management and control of impacts cannot be guaranteed beyond the life of the project. • Rats will spread to other neighbouring islands previously cleared of rats, threatening their seabird colonies.
Probability / Impact	**20. Moderate**	**21. High**	**22. High**

Appendix 4: Estimation of Management Costs - Barrow Island

COSTS DURING CONSTRUCTION

	Vehicles	FTE	Hrs	Rate	Sub Total	45% Corp O/H	Total	COMMENT
Salaries (L6) inc overheads		7		$ 100,000	$ 700,000	$ 315,000	$ 1,015,000	Notional 25% loading for 2 week on 2 week off. 8 hr Shifts. (manning levels - 2 Barrow, 1 mainland)
Other Staff Costs		7		$ 30,000	$ 210,000	$ 94,500	$ 304,500	District Allownce, housing, ARL airfares, aircon subsidy, camping allowance
Plant (4WD)	3			$ 15,000	$ 45,000	$ 20,250	$ 65,250	
Operating Budget					$ 300,000	$ 135,000	$ 435,000	
Helicopter support			100	$ 1,500	$ 150,000	$ 67,500	$ 217,500	
Office and Lab Barrow								Provided as part of lease agreement
Office Accom Karratha								Included in Corp Overheads
Operational support provided by CT. E.g. Accom, victualling, flights, fuel, transport of equipment								
						Net total	$ 2,037,250	
						Vessel*	$ 150,000	
						Total	**$ 2,187,250**	

COSTS POST CONSTRUCTION

	Vehicles	FTE	Hrs	Rate	Sub Total	45% Corp O/H	Total	COMMENT
Salaries		3		$ 80,000	$ 240,000	$ 108,000	$ 348,000	
Other Staff Costs		3		$ 30,000	$ 90,000	$ 40,500	$ 130,500	District Allownce, housing, ARL airfares, aircon subsidy, camping allowance
Plant (4WD)	2			$ 15,000	$ 30,000	$ 13,500	$ 43,500	
Operating budget					$ 300,000	$ 135,000	$ 435,000	
Helicopter support			100	$ 1,500	$ 150,000	$ 67,500	$ 217,500	
Operational support provided by CT								
						Net Total	$ 1,174,500	
						Vessel*	$ 150,000	
						Total	**$ 1,324,500**	

* Costs for Seagoing Vessel (10 metre Class 2 B Survey) Capital Cost. $0.5M

Jal Lease	$100,000 (Estimate only)
Annual Maint and running cost (150 hrs)	$50,000 (Estimate only)
Total	**$ 150,000**