Melanie-1 Petroleum Exploration Well, Cape Range Peninsula

Sun Resources NL

Report and recommendations
of the Environmental Protection Authority

Environmental Protection Authority
Perth, Western Australia
Bulletin 865
September 1997

ISBN. 0 7309 8050 2

ISSN. 1030 - 0120

Summary

This report is to provide the advice and recommendations of the Environmental Protection Authority (EPA) to the Minister for the Environment, on the proposal to drill the land-based Melanie-1 petroleum exploration well near the tip of Cape Range Peninsula. The report is based on the environmental factors relevant to the proposal.

The proponent, Sun Resources NL, proposes to drill and evaluate the well for a gas and oil target. Drilling is proposed to a depth of 1420 m, and the first 60 to 120 m is expected to be through cavernous limestone. The proposal does not include any future plans to develop a gas or oil field.

Relevant Environmental Factors

In the EPA's opinion, the following are the environmental factors relevant to the proposal:

(a) Subterranean fauna;

(b) Vegetation communities;

(c) Groundwater quality;

(d) Hydrocarbons;

(e) Drilling fluids; and

(f) Visual amenity.

Conditions

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

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

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

The EPA recommends that the following conditions, which are set out in formal detail in Appendix 4, be imposed if the proposal by Sun Resources NL to drill the Melanie-1 petroleum exploration well on the Cape Range Peninsula is approved for implementation:

(a) the proponent shall fulfil the commitments set out in the Summary of Commitments statement as an attachment to the recommended conditions in Appendix 4;

(b) in order to manage the relevant environmental factors and EPA objectives contained in this bulletin, and subsequent environmental conditions and procedures authorised by the Minister for the Environment, the proponent shall be required to prepare, prior to implementation of the proposal, environmental management system documentation with components such as those adopted in Australian Standards AS/NZS ISO 14 000 series;

(c) prior to commencement of construction for the drilling operations, the proponent shall prepare and implement an Environmental Management Plan, to the requirements of the Environmental Protection Authority on advice of the Department of Environmental Protection and the Department of Minerals and Energy.

This Plan shall address, but not be limited to the following:

1. Management of disturbance to soil and terrain;
2. Management of disturbance to vegetation;
3. Control of spillage of waste or materials;
4. Control of toxic materials in the subsurface environment;
5. Increasing knowledge of subterranean fauna;
6. Decommissioning and rehabilitation; and
7. Environmental performance audit.

The proponent shall make this Environmental Management Plan publicly available prior to commencement of construction for the drilling operations, and throughout the drilling process and decommissioning phase;

(d) prior to commencement of drilling, the proponent shall prepare a written prescription for contractor work practices covering pre-drilling, drilling and decommissioning, to ensure that work practices are carried out at the level of international best practice, to the requirements of the Environmental Protection Authority on advice of the Department of Environmental Protection and the Department of Minerals and Energy. The proponent shall ensure that pre-drilling, drilling and decommissioning operations comply with this prescription; and

(e) the proponent shall submit periodic Performance and Compliance Reports, in accordance with an audit programme prepared by the Department of Environmental Protection in consultation with the proponent.

Conclusions

The EPA has concluded that the proposal by Sun Resources NL to drill the Melanie-1 petroleum exploration well on Cape Range Peninsula can be managed in a manner such that the proposal does not impose an unacceptable impact on the environment, provided that the conditions recommended in Section 4, and set out in formal detail in Appendix 4, are imposed.

The EPA has provided additional advice on the need for an integrated approach to planning and environmental performance on the Cape Range Peninsula.

Recommendations

The EPA recommends that:

1. The Minister considers the report on the relevant environmental factors of Subterranean fauna (3.1), Vegetation communities (3.2), Groundwater quality (3.3), Hydrocarbons (3.4), Drilling fluids (3.5) and Visual amenity (3.6);

2. The Minister notes that the EPA has concluded that the proposal can be managed to meet the EPA's objectives, and thus not impose an unacceptable impact on the environment, provided there is a satisfactory implementation by the proponent of the recommended conditions set out in Section 4;

3. The Minister imposes the conditions recommended in Section 4 and set out in formal detail in Appendix 4 of this report;

4. Noting that there has been a number of previous planning and scientific studies which have recommended extension of the Cape Range National Park, the Government give priority to consideration of the proposals in the various reports to extend the Cape Range National Park and to consider other extensions which may be relevant in light of additional information particularly covering the coastal plains and foothills;

5. The Minister notes the EPA's views on the need for an integrated approach between planning and environment for the Cape Range Peninsula presented in Section 5 of the report, and takes appropriate action to address the EPA's proposals;

6. The Minister notes that the EPA is progressing the preparation of an environmental policy on development within the Exmouth-Cape Range area to assist in the management of the area and the assessment of development proposals.

Contents

Page

Summary ..... **i**

1. Introduction **1**

2. The proposal **2**

3. Relevant environmental factors **4**

3.1 Subterranean fauna 4

3.2 Vegetation communities 7

3.3 Groundwater quality 8

3.4 Hydrocarbons 11

3.5 Drilling fluids 15

3.6 Visual amenity 16

4. Conditions **18**

5. Other advice **19**

5.1 Integrated approach between planning and environment of the Cape Range Peninsula 19

5.2 Proposed environmental policy 21

6. Conclusions **21**

7. Recommendations **21**

Table

1. Proposal characteristics 3
2. Anzecc water quality guidelines and proposed concentrations of additives used for drilling the melanie-1 well 15
3. Summary of relevant environmental factors, environmental objectives, proponent's commitments and epa's opinion 22

Appendix

1. Figures
2. List of submitters
3. References
4. Recommended Environmental Conditions and Proponent Commitments

1. Introduction

This report is to provide the advice and recommendations of the Environmental Protection Authority (EPA) to the Minister for the Environment on the environmental factors relevant to the proposal by Sun Resources NL to drill the Melanie-1 petroleum exploration well near the tip of Cape Range Peninsula.

The proposal to drill the Melanie-1 petroleum exploration well was first referred to the EPA in June 1996. The EPA considered the potential environmental impacts of the proposal and set the level of assessment at Informal Review with Public Advice. It was considered that the project could be managed adequately under conditions to be imposed by the Department of Minerals and Energy.

Appeals were lodged against the informal level of assessment on the grounds of proximity to Cape Range National Park and Ningaloo Marine Park, and potential impacts on subterranean fauna.

On 8 February 1997, under Section 43 of the Environmental Protection Act, the Minister directed the EPA to conduct a formal assessment of the proposal at Consultative Environmental Review (CER) level.

The Melanie-1 exploration well proposal described in the CER report (W G Martinick & Assoc, 1997), hereafter referred to as the CER, was available for public review for four weeks between 19 May 1997 and 16 June 1997.

Seven submissions were received by the Department of Environmental Protection (DEP). The major issues raised in submissions were:

- impacts on subterranean fauna and karst system;
- potential contamination of groundwater;
- potential for fuel and oil spillages; and
- lack of planning for development in the region.

In compiling this report, the EPA has considered:

(a) information provided in the CER;

(b) issues raised by the public and government agencies in their submissions on the CER;

(c) the proponent's response to submissions; and

(d) information provided by the DEP as well as other expert agencies.

The report discusses the environmental factors that the EPA considers are relevant to the proposal, and sets out the conditions and procedures which should be applied if it is to be implemented. The report also provides recommendations.

Appendix 1 provides maps relating to the proposal. A list of people and organisations that made submissions is included in Appendix 2, published information is listed in Appendix 3 and Recommended Environmental Conditions and Proponent Commitments are included as Appendix 4.

The DEP's summary of submissions and the proponent's response to those submissions has been published separately and are available in conjunction with this report.

2. The proposal

Sun Resources NL propose to drill and evaluate a land-based exploration well, Melanie-1, on Cape Range Peninsula for a gas and oil target. The proposal does not include any future plans to develop a gas or oil field. Drilling proposal characteristics are summarised in Table 1 below.

The proposed Melanie-1 exploration well is located near the north western tip of Cape Range Peninsula, inland of the Yardie Creek Road and behind the line of hills which form the continuation of Cape Range. The project site, which covers an area of approximately 0.8 hectares, is approximately 1.3 km to the south of the Ningaloo Marine Park and 18 km to the northeast of Cape Range National Park. The grid co-ordinates for the project area are 21°48'S and 114°6'E.

A location map is shown in Appendix 1:Figure 1. Topographical contours shown on Figure 1 illustrate that the project area is situated 20 - 40 m above sea level on relatively flat land. The land gently slopes down to 20 m above sea level at an estimated distance of 200 m from the project site, then gradually slopes down to the coast.

Drilling of the Melanie-1 exploration well will intersect a series of geological formations before reaching the target zone which is located in Cretaceous formation and may contain hydrocarbons. A schematic diagram of the well, showing these formations, is illustrated in Appendix 1:Figure 2. The drilling target is estimated to have the potential to contain between 12 and 74 billion cubic feet of gas or 10 to 60 million barrels of oil, and possibly a combination of both.

In addition to the petroleum exploration well, the proposal also includes the drilling of a water supply bore. This bore will be located approximately 40 m away from the proposed exploration well within the project area described above, and will be drilled to a depth of approximately 80 m. The drilling operation will require approximately 1100 litres of water per minute. Depending on the type of formations encountered during drilling, this water will either be totally recycled within the drilling circuit, or will largely be lost into cavernous formations.

Establishment of the drilling site will include the construction of several level pads for various infrastructure, establishing a cellar, which is an excavated area surrounding the hole which is to be drilled, a polyethylene-lined sump to contain all drilling cuttings and mud, and a flare pit to flare hydrocarbons in the event of testing the formation.

Drilling will be to a depth of approximately 1420 metres. The proposal is to drill the section above the water table with an air hammer, which will not require drilling lubricants or water. Once drilled, this section will be reamed to a diameter of 311 mm and cased. From then onwards, it is estimated that a further 220 - 230 m of Trealla limestone will be drilled with the aid of water and drilling fluids consisting of bentonite, lime and caustic soda. Immediately after this section has been drilled it will be fully cased and cemented. After casing this section, the well will be drilled to a depth of approximately 1420 m with a diameter of 216 mm. A water-based potassium chloride polymer will be used to facilitate drilling in these lower sections.

In the event of a gas and/or oil discovery, the well will be production tested prior to appraisal of the field for possible production. In the event that hydrocarbons are found in potentially commercial volumes, the well will be fully cased and suspended.

After drilling, the site will be decommissioned and rehabilitated, with all infrastructure removed and any disturbed vegetation or terrain rehabilitated. Drilling is expected to be completed within three weeks, and the entire operations expected to last for a maximum of six weeks.

A detailed description of the proposed project is provided in Section 5 of the Melanie-1 exploration well, Cape Range Peninsula CER report (W G Martinick & Assoc Pty Ltd, 1997).

Table 1. Proposal characteristics

Aspect	Characteristic
Target resource	12-74 billion cubic feet of natural gas and/or 10-60 million barrels of oil.
Depth Exploration well Water bore	 1420 m. 80 m.
Drilling materials: Upper section (Trealla limestone approx 250m) Lower section (from approx 250m to 1420m)	 Water with some bentonite and minor amounts of lime and caustic soda. Water-based potassium chloride polymer and bentonite.
Well casing	Through the Trealla limestone formation, estimated to a depth of 250m.
Project area	0.8 ha.
Access track	5 m wide, 50 m long ≈ 0.01 ha.
Flare pit	Used to flare hydrocarbons in the event of testing the formation. 6 m x 3 m and 2 m deep with a fire wall on three sides.
Sump	Polyethylene-lined sump to contain drilling cuttings and mud. Approx 20 m x 15 m and 2.5 m deep.
Bunded area	Diesel fuel storage area to be bunded in accordance with the requirements of DME and Dangerous Goods Legislation.
Vegetation disturbance	Confined to 0.8 ha project area. Vegetation disturbance minimised by cropping and flattening vegetation rather than clearing.
Products generated	Oil and/or gas, formation water (max $5m^3$) and drill cuttings (max $6m^3$).
Water requirement	Approx 1100 litres per minute.
Period of project	Approx 6 weeks.
Rehabilitation and decommissioning	All materials and infrastructure removed. Any removed topsoil respread and any disturbed vegetation rehabilitated. Exploration well plugged and marked to requirements of DME. Water bore capped as described by WA Museum to allow sampling of subterranean fauna.

3. Relevant environmental factors

Having considered the public and government agency submissions (Appendix 2) and appropriate references (Appendix 3), in the EPA's opinion the following are the environmental factors relevant to the proposal:

(a)	Subterranean fauna;	(Section 3.1)
(b)	Vegetation communities;	(Section 3.2)
(c)	Groundwater quality;	(Section 3.3)
(d)	Hydrocarbons;	(Section 3.4)
(e)	Drilling fluids; and	(Section 3.5)
(f)	Visual amenity.	(Section 3.6)

Detail of the environmental factors and their assessment is contained in the discussion below.

3.1 Subterranean fauna

Description

Diversity and significance of subterranean fauna of the Cape Range Peninsula

The Cape Range Peninsula is considered to contain one of the world's most diverse subterranean faunas despite limited and incomplete sampling relative to other internationally significant karst provinces.

The richness of the fauna reflects the diverse geomorphology of the province, supporting a rich terrestrial (troglobitic) and aquatic (stygofauna) subterranean fauna.

Troglobites and stygofauna are animals fully adapted to living in caves and are totally dependent on these environments for survival. Humphreys (1993a) states that troglobitic fauna not only occur in caves but also, probably mainly, inhabit interstitial and fissure habitats in the rock.

The fauna is ancient and highly adapted to subterranean life. The troglobitic fauna shows evidence of having its origins as fauna from the litter of an ancient rainforest floor (Humphreys, 1993b). The origins of the stygofauna is believed (Humphreys, 1993c) to stem from the time the area was part of the Tethys Sea, formed by the disintegration of the former supercontinent Pangea. The closest relatives of the fauna are now found in the Caribbean and Canary Islands, showing evidence of the effects of continental drift.

The fauna has no close relationship to other faunas on the Southern Hemisphere and is entirely endemic to the Cape Range Peninsula and partly Barrow Island. The fauna contains the only southern hemisphere representatives of entire classes, orders, families and genera of crustaceans (ANCA, 1996).

State of knowledge of subterranean fauna on the Cape Range Peninsula

A good summary of current knowledge of subterranean fauna of the Cape Range is Humphreys (1993). The information on the subterranean fauna of the Cape Range is based mostly on sampling of caves and existing drill holes. The sampling is not extensive.

Currently some 55 species (33 terrestrial and 22 aquatic) have been identified from the area (EPA, 1997). The number of species is expected to increase substantially as more sampling is undertaken.

There are five stygofauna (aquatic) species and four troglobitic (terrestrial) species declared as Specially Protected (Threatened) fauna pursuant to the *Wildlife Conservation Act 1950.* Protected fauna, including those which are Specially Protected (Threatened), cannot be taken without authorisation.

The aquatic subterranean species of the coastal plains are likely to be more widely distributed than the terrestrial species because of the high degree of interconnectedness of the cavernous coastal plain limestone. The degree of connection between the eastern and western coastal plains is likely to be limited, and there is evidence of genetic differences (EPA, 1997).

The sampling to date indicates that the deep gorges of the northern part of the range that divide the cavernous Tulki Limestone, which normally lies between the Trealla Limestone and the Mandu Limestone, have isolated fauna populations, leading to speciation (EPA, 1997).

There have been several proposals to extend the Cape Range National Park, including the Cape Range National Park Management Plan (CALM, 1987), Legislative Council Select Committee Report (WA Parliament, 1995) and the Gascoyne Coast Regional Strategy (Ministry for Planning, 1996). In finalising proposals for extension of the Park consideration needs to be given to ensuring that subterranean fauna is likely to be well represented within the conservation reserve.

Potential impacts from the proposed mining on subterranean fauna

There has previously been limited sampling and identification of subterranean fauna from the area in the vicinity of the project area. This sampling was undertaken using seismic upholes drilled by Ampolex during seismic surveys in 1995 and left open for the WA Museum to sample and document subterranean fauna. Figure 3 (Appendix 1) illustrates the species of subterranean fauna that were sampled from seismic upholes in the vicinity of the project area. Sampling extended the known range of a number of aquatic and terrestrial species to the northern tip of Cape Range Peninsula.

Subterranean fauna is expected to exist in the cavernous formations of the geological profile, expected to occur to a depth of 60 to 120 m. The proposal has the potential to impact upon subterranean fauna through contamination of the subterranean environment by drilling fluids, drilling wastes and hydrocarbons. The proponent has made a commitment to use non-toxic drilling fluids during the drilling of this section and to fully case and pressure test this cavernous section prior to drilling the remaining section of the well. This will reduce the potential for seepage of drilling fluids, drilling wastes and any hydrocarbons into the cavernous formation, and therefore reduce the potential for contamination of the subterranean environment and for potential impacts on subterranean fauna.

The proponent has also made a commitment to sample water from the proposed water bore to collect any subterranean fauna brought to the surface. A commitment has also been made to case, seal and lock the water bore to the specifications of the WA Museum to allow future sampling of subterranean fauna.

In a submission received from the WA Museum, it is stated that cavernous formations are expected to exist to a depth of approximately 120 m, rather than 60 m as stated in the CER.

In its submission, the WA Museum also disputed the statement made by the proponent in the CER that no subterranean fauna was found in the seismic uphole closest to the proposed site of the exploration well (Figure 3, uphole 13), as it was not sampled for stygofauna.

Submissions received from conservation groups expressed concern regarding the likelihood of water and drilling waste being lost to caverns, and the impact this may have on subterranean fauna.

Assessment

Subterranean fauna exists throughout the karst landform system of the Cape Range Peninsula. Species diversity of subterranean fauna is considered by Humphreys and Adams (1993) to be variable within three regions of the Cape, referred to as northern, central and southern provinces (Appendix 1:Figure 4), and also between coastal and upland areas. Therefore, the area considered for assessment of this relevant environmental factor, subterranean fauna, is the karst landform of the northern coastal area of the Cape Range Peninsula

The EPA's environmental objective in regard to this factor is to maintain the abundance, species diversity and geographical distribution of subterranean fauna and to protect subterranean fauna consistent with the provisions of the *Wildlife Conservation Act 1950.*

Subterranean fauna potentially exists in the cavernous formations of the geological profile, expected to occur to a depth of 60 to 120 m. During drilling of the cavernous sections there is potential for impacts on the subterranean environment from contamination by drilling fluids and drilling wastes.

Drilling wastes, consisting of fine limestone particles, may result in a temporary increase in turbidity of the groundwater in close proximity to the well. This increase in turbidity will be temporary, and is not expected to have significant impacts on any stygofauna which may exist below the project area.

The proponent has made a commitment to use non-toxic drilling fluids during the drilling of this section (Section 3.5: Drilling fluids). Furthermore, the proponent will fully case and pressure test the cavernous section prior to drilling the remaining section of the well (Section 3.3: Groundwater quality). This will reduce the potential for seepage of drilling fluids, drilling wastes and any hydrocarbons into the cavernous formation, and therefore reduce the potential for contamination of the subterranean environment and for potential impacts on subterranean fauna. After drilling through this cavernous section, the lower formations are expected to be relatively impermeable, and seepage into the subsurface environment is considered unlikely.

Drilling may result in the loss of subterranean fauna habitat due to infilling of caverns by drilling cuttings and sealing cement which will be used to case and seal the upper section of the well. The proponent has estimated that a maximum of 6 m^3 may be infilled from drilling cuttings, and a maximum of 9 m^3 lost during casing and sealing of the well. On a regional basis, this 15 m^3 loss of cavernous space is considered to be insignificant.

The proponent has also committed to collect stygofauna from the water bore for identification, and, on advice from the WA Museum, will leave the water bore in a state that will allow for future sampling of subterranean fauna. This proposed sampling will contribute to the limited knowledge of the distribution and species diversity of subterranean fauna in the Cape Range region.

The proponent must comply with the requirements of the *Wildlife Conservation Act 1950,* relating to the taking of any protected fauna, including that which is declared as Specially Protected (Threatened). The proponent would need to establish appropriate mechanisms with the Department of Conservation and Land Management (CALM), which administers the Wildlife Conservation Act, to ensure that these requirements are met.

Having particular regard to:

(a) the commitment by the proponent to prepare and implement an Environmental Management Plan which will contain a number of management measures to reduce potential impacts on subterranean fauna, such as fully casing and pressure testing the exploration well through cavernous formations, collecting any subterranean fauna from the water bore for identification, and leaving the water bore in a state that will allow for future sampling of subterranean fauna;

(b) the proponent's statutory obligations to comply with the requirements of the *Wildlife Conservation Act 1950*;

(c) the insignificant area of the subterranean environment likely to be impacted upon by the proposal; and

(d) the need to increase knowledge on the abundance, diversity and geographical distribution of subterranean fauna of the Cape Range Peninsula and the opportunity for this project to contribute further knowledge on subterranean fauna and provide more certainty as part of a regional approach;

it is the EPA's opinion that the proposal can be managed to meet its objective for this factor provided that the proponent prepares and implements an Environmental Management Plan containing management measures to reduce potential impacts on subterranean fauna as outlined in the draft Environmental Management Plan included as Appendix J in the CER.

3.2 Vegetation communities

Description

A description of the existing vegetation communities on the project site is provided in the CER.

A list of flora recorded within the project area and the surrounding ridges is listed by the proponent in Section 4.7 of the CER.

The proposal will affect an area of vegetation communities belonging to the Stony Footslopes Landscape Unit, which consists predominantly of scattered Acacia shrubs over spinifex grass. No rare or priority listed species have been found in surveys of the project area and surrounds (W G Martinick & Assoc, 1997).

The proposed project will result in the disturbance of this vegetation community within the 0.8 hectare project area and along a 5 metre wide, 50 metre long access track. This track will follow an existing seismic line which was established in 1995.

Assessment

The vegetation of the project area is part of the 'Stony Footslopes Landscape Unit' which is a unit of the Learmonth Landsystem. The 'Stony Footslopes Landscape Unit' extends along the western and eastern edges of Cape Range, and lies between the coastal plain and the range on Cape Range Peninsula. Therefore, the area considered for assessment of this relevant factor, vegetation communities, is the 'Stony Footslopes Landscape Unit' of the Cape Range Peninsula.

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

The Learmonth Landsystem covers 285 km^2 and consists of a number of landscape units. The project area is part of the 'Stony Footslopes Landscape Unit', which comprises approximately

57 km^2 (20%) of the total Learmonth Landsystem. The proposed project will be restricted to an area of approximately 0.8 ha. This area represents less than 0.01% of the 'Stony Footslopes Landscape Unit'.

The EPA notes that the project area is located on vacant Crown land which was recommended for inclusion in the Cape Range National Park in the EPA recommended Conservation Reserves for WA series (Red Book series) of 1975 (EPA, 1975). To date, the area has not been included in the national park.

To minimise the disturbance to vegetation within the project area, the proponent has made a commitment to prepare and implement an Environmental Management Plan which will contain the following management measures:

- Vegetation clearing will be confined to a minimum and to within the project area;
- Where possible, vegetation will be flattened and pruned rather than cleared to minimise damage and enable rapid regrowth upon decommissioning;
- Management measures will be taken to prevent the introduction of weeds;
- Disturbed vegetation will be rehabilitated. Rehabilitation will be monitored and measured by comparing photos of the area, and will be carried out to the satisfaction of the DEP and CALM; and
- Should monitoring show rehabilitation of the area has not been successful, the proponent will liaise with the DEP and Department of Minerals and Energy (DME) to identify and implement alternative rehabilitation measures.

Having particular regard to:

(a) the fact that the size of the project area represents less than 0.01% of the 'Stony Footslopes Landscape Unit'; and

(b) the commitment by the proponent to prepare and implement an Environmental Management Plan which will contain a number of management measures to reduce potential impacts on vegetation communities, including rehabilitation of disturbed areas, as outlined above;

it is the EPA's opinion that the proposal can be managed to meet its objective for this factor provided that the proponent prepares and implements an Environmental Management Plan containing management measures to reduce potential impacts on vegetation communities as outlined in the draft Environmental Management Plan included as Appendix J in the CER.

3.3 Groundwater quality

Description

The groundwater profile under the project area remains largely unknown. However, from water bores drilled near the vicinity of the proposed project area, it is expected that brackish to saline groundwater is likely to be encountered beneath the project area at around 20 m, a depth approximately equal to the level of seawater. Regional data and samples taken from bores in the vicinity of the project area indicate that potable groundwater will not be encountered beneath the project area. Should groundwater exist, it will be confined to the Trealla limestone formation, which is expected to exist to an estimated depth of 250 m, with the first 60 to 120 m of this formation likely to be cavernous.

The proposal includes the drilling of a petroleum exploration well and the drilling of a water supply bore to supply an estimated 1100 litres of water per minute to be used for the exploration well drilling operations.

The water supply bore will be drilled to approximately 80 m to provide information on the limestone formations for the drilling of the Melanie-1 exploration well, although water is likely to be abstracted from a depth of approximately 30 metres below sea level. The water bore will be drilled with a percussion cable tool and it will be constructed with PVC. Drilling of the water bore will be facilitated with water which will be imported onto the site. On decommissioning, the water bore will be sealed and capped to the requirements of the WA Museum to allow for future sampling of subterranean fauna.

In an ideal situation of no water loss, all water used during drilling will be totally recycled within the drilling circuit. However, it is likely that there will be some water lost to the cavernous surrounds in the upper formation.

Drilling wastes, fluids and water will be brought to the surface and disposed of into a sump pond. The sump will consist of two or more sections to allow the precipitation of drilling mud and stone chips into one section and the decanting of water into another section. This water will then returned to the aquifer. The residual water will be tested for contaminants prior to being returned to the aquifer.

A submission received from the WA Museum expressed concern about the restoration of groundwater should hydrocarbon contamination occur, and suggested that the proponent make an additional commitment to restore the groundwater should it become contaminated by hydrocarbons. The proponent has made an additional commitment to recover as much hydrocarbon as is practically achievable to restore groundwater, in consultation with the DEP, should hydrocarbon contamination of groundwater occur.

The Water and Rivers Commission (WRC) advised in its submission that any residual water from the sump pond to be discharged down the shallow production bore should be essentially free of hydrocarbons. The proponent has made an additional commitment that any water discharged will have an analysed hydrocarbon content less than 1 mg/L TPH.

Other public submissions expressed concern about potential contamination of groundwater resulting in contamination of the marine environment.

Assessment

From drilling near the vicinity of the project area, it is thought that a highly permeable, cavernous aquifer exists beneath the project site. Therefore, the area considered for the assessment of this relevant environmental factor, groundwater quality, is the limestone aquifer beneath the project area and between the project area and the coast, and the nearshore marine environment.

The EPA's environmental objective in regard to this factor is to maintain or improve the quality of groundwater to ensure that existing and potential uses, including ecosystem maintenance are protected, consistent with the draft WA Guidelines for Fresh and Marine Waters (EPA, 1993) and the Australian Water Quality Guidelines for Fresh and Marine Waters (ANZECC, 1992).

The proposal may potentially result in the contamination of groundwater through the introduction of drilling wastes and additives used during the drilling process and through contamination by hydrocarbons.

Subsequent contamination of the marine environment through contaminated groundwater is unlikely considering the distance between the project area and the coast (1.3 km) and the fact

that it is unlikely that there is any extensive mixing of groundwater and marine water in the vicinity of the project area.

Tidally induced movements of the groundwater in the region indicate that the groundwater aquifer is connected to the marine environment. However, in response to public submissions, the proponent's has outlined that, in the extremely unlikely event that well casing failed and hydrocarbons were released into the subsurface environment, the small volumes of possible contamination, coupled with the distance of the site from the coast, would mean only negligible quantities of hydrocarbons would have the potential to reach the marine environment.

The potential for groundwater contamination to occur is restricted to the drilling through the cavernous formations which are expected to be encountered in the top 60 to 120 m. The potential for surface spillage and resultant seepage into the groundwater is minimal. Fuels will be stored in bunded areas and, should hydrocarbons be found, only small samples will be brought to the surface for testing. Any residual hydrocarbons will be flared in the flare pit. Therefore, in the unlikely event of a surface spill, the spill would be small and any impacts would be managed by the proponent's commitment to remove and dispose of any contaminated soil.

Drilling through the cavernous formation will result in loss of some, if not all, water and drilling fluids. During the drilling of this cavernous formation, the proponent has outlined that non-toxic drilling fluids consisting of water with some bentonite and minor amounts of lime and caustic soda will be used to assist drilling. At the concentrations used, these drilling additives will meet the water quality guidelines specified for marine waters and water used for livestock watering (ANZECC, 1992) (see Section 3.5: Drilling fluids). Drilling wastes, primarily consisting of fine limestone particles, may be dispersed from the drill hole through the cavernous formation, resulting in increased suspended solids in the groundwater in the immediate vicinity of the drill hole. The proponent has estimated that, based on expected geological formations beneath the project area, introduced drilling fluids and drilling wastes will have a potential radius of influence no greater than 26 metres, assuming a worst case scenario. Therefore, any impacts are expected to be localised (W G Martinick & Assoc, 1997).

The proponent has made a commitment that the cavernous section of the well will be cased and pressure tested to prevent the contamination of the cavernous section by any waste material produced whilst drilling into the non-cavernous formation below 250 m. Proposed casing of the well involves casing the well through the Trealla limestone formation (to an estimated depth of 250 m, of which the first 60 - 120 m are expected to be cavernous), and cementing down the inside of the well casing in order to cement the base of the casing. From the base upward, cement will fill the annular space between the casing and the wall of the well hole. During casing and sealing, loss of cement may result in infilling of cavernous formations. The proponent has estimated that a maximum volume of 9 m^3 of sealing cement may be lost to cavernous spaces encountered during drilling.

After the casing and sealing of the cavernous section is complete, a water-based potassium chloride polymer will be used to facilitate drilling. This potassium chloride polymer is non-toxic and biodegradable, and is widely used onshore and offshore in the Carnarvon Basin. It is expected that there will be no loss of water or drilling additives during the drilling through these lower sections.

The EPA notes that the proponent will be required to obtain a licence from the Water and Rivers Commission prior to abstracting water.

To minimise the potential contamination of groundwater beneath the project area, the proponent has made a commitment to prepare and implement an Environmental Management Plan which will contain the following management measures:

- The exploration well will be cased through cavernous formations (expected to exist in the first 60 to 120 m) where there is potential for seepage, thereby preventing a loss of drilling material and additives and to prevent the loss of pressure;
- The casing will be pressure tested according to the requirements of DME;
- Non-toxic drilling fluids will be used during the drilling of potentially cavernous formations between the surface and a depth of 250 m, prior to casing and sealing of the exploration well;
- Any waste water discharged back into the well or bore will be essentially free of petroleum hydrocarbons, with an analysed hydrocarbon content less than 1 mg/L TPH;
- Any spillages of oil or fuel will be contained and removed immediately and disposed of to a site appropriately licensed by the DEP for the disposal of such wastes; and
- Should any hydrocarbon contamination of groundwater beneath the project area inadvertently occur, the proponent, in consultation with the DEP, will take action to recover as much hydrocarbon as is practically achievable to restore groundwater quality.

Having particular regard to:

(a) the fact that additives at non-toxic concentrations will be used to facilitate the drilling process;

(b) the fact that, in the unlikely event that groundwater contamination occurs, there is unlikely to be significant impacts on the marine environment;

(c) the fact that the potential impacts on groundwater resulting from drilling wastes will be limited to localised and temporary increases in suspended solids;

(d) the commitment by the proponent to prepare and implement an Environmental Management Plan which will contain a number of management measures to reduce the potential for contamination of groundwater beneath the project area, as outlined above; and

(e) the fact that the proponent is required to obtain a licence to abstract water from WRC prior to abstracting water;

it is the EPA's opinion that the proposal can be managed to meet its objective for this factor, provided that the proponent prepares and implements an Environmental Management Plan containing management measures to reduce potential impacts on groundwater, as outlined in the draft Environmental Management Plan included as Appendix J in the CER.

3.4 Hydrocarbons

Description

There are no hydrocarbons present at the surface or directly beneath the project area. The current proposal to drill the Melanie-1 petroleum exploration well is to investigate the petroleum and gas resources which may exist under the project area. From a seismic survey carried out in 1995, the Melanie-1 drilling target is estimated to potentially contain a modest quantity of natural gas (between 12 and 74 billion cubic feet) or oil (10 to 60 barrels), and possibly a combination of both.

DME has a number of safety and environmental conditions relating to the drilling of all petroleum exploration wells. The proponent will comply with these conditions when drilling the proposed Melanie-1 petroleum exploration well.

Surface spillage

In the CER, the proponent states that the possibility of a large scale spillage of hydrocarbons at the surface of the project area is highly unlikely.

Potential for surface spillage of hydrocarbons is limited to accidental spillage of oil brought to the surface from the geological formation potentially containing hydrocarbons. In the event of a gas and/or oil discovery, small samples will be collected for analysis, and the balance will be flared on site.

Subsurface seepage

The potential for subsurface seepage of hydrocarbons is limited to seepage through the cavernous limestone formation expected in the first 60 to 120 m of the drilling. The remaining geological formations below the cavernous section are of comparatively low permeability and any seepage can only extend for very small distances and would be confined to the immediate vicinity of the well.

Concerns regarding the risk of hydrocarbon release into the terrestrial and subterranean environments were raised in public submissions. These submissions outlined that it was considered that the risks of blowouts and other accidents, including hydrocarbon loss to the aquifer, during and post drilling, must be quantified.

Concern was also raised in a submission regarding the disposal of oil contaminated soil, specifically the location of a disposal site for such contaminated soil, the environmental acceptability of such a disposal site, and the capacity of this site.

Assessment

Should a resource be discovered, hydrocarbons have the potential to contaminate both the surface of the land in close proximity to the well, and subsurface cavernous formations. The area of assessment for this relevant environmental factor, hydrocarbons, is therefore the land in close proximity to the well, and subsurface cavernous formations beneath the project area to an estimated depth of 60 to 120 m below sea level.

The EPA's environmental objective in regard to this factor is to ensure that hydrocarbons associated with the drilling process are contained so that they do not adversely affect the surrounding environment.

Through the cavernous formation expected in the first 60 to 120 m of drilling, the drilling circuit will be cased and pressure tested to prevent potential seepage of hydrocarbons. The method of casing the well is outlined in Section 3.3: Groundwater quality above. The well will be pressure tested prior to drilling the geological formation which may contain gas and/or oil, as required by the safety and environmental conditions of DME. Drilling will not proceed unless adequate pressure is maintained to demonstrate that there is no potential for subsurface seepage.

DME (1997) has calculated the risk of blow-outs and the potential for well casing failure.

Six oil well blow-outs have occurred Australia wide in the last 30 years, with no significant loss of hydrocarbons. No blow-outs have ever been reported in WA. The Melanie-1 well is not considered to be over pressured, further reducing the probability of a blow-out occurring. The risk of a blow-out is further reduced by the presence of a Blow-out Prevention system which will be fitted prior to drilling below the surface casing, as required by DME.

Furthermore, the main resource target for the Melanie-1 well is considered to be gas. If a blow-out did occur, produced water and gas would preferentially flow into the well pipe. The risk of an oil spill under these conditions would therefore be negligible.

The well will be cased through the first 250 m, of which the first 60 to 120 m is likely to be cavernous. The risk of this casing failing was calculated by DME (1997), which has estimated that the risk of loss of integrity of casing failure is 1×10^{-6}. The proponent has outlined that a number of management measures will be implemented to reduce secondary risk. Casing of the Melanie-1 well involves sealing the well by cementing down the inside of the well casing (see Section 3.3: Groundwater quality). This cement will provide an additional barrier to potential contaminants. Furthermore, the blow out prevention valves, mentioned above, will be located in succession in the top of the well in a manner designed to seal the well in the event of a blow out or kick, further reducing the potential for secondary risk.

The EPA considers that the risk associated with casing failure, and resultant contamination of the subterranean environment, is sufficiently low as to be acceptable.

In the event of an oil and/or gas discovery, small samples of material will be brought to the surface for analysis. Any excess oil and/or gas will be flared on-site to reduce the risk of spillages. In the event of an accidental surface spillage, all affected soil will be removed and disposed of according to the requirements of the Shire of Exmouth and to a site appropriately licensed by the DEP for the disposal of such wastes. Topographical contours shown on Figure 1 illustrate that the project area is situated 20 - 40 m above sea level on relatively flat land. The land gently slopes down to 20 m above sea level at an estimated distance of 200 m from the project site, then gradually slopes down to the coast. The relatively flat topography of the area and the distance from the coast (illustrated in Figure 1), combined with the small quantities of hydrocarbons which will be brought to the surface, reduces the potential for surface spillages resulting in run-off and contamination of the marine environment.

The EPA notes that DME has a number of safety and environmental conditions relating to the drilling of all petroleum exploration wells. These include:

- petroleum obtained from land covered by a petroleum title shall be properly confined in accordance with good oil field practice;
- surface casing shall be set at least 25 m into a competent formation and the minimum surface casing requirement is 20 m;
- drilling operations and operations to complete or test an exploration well are only permitted to commence after a satisfactory pressure test of all casing strings has been completed, to ascertain that there is no continuous pressure drop. The results must be recorded in the driller's log;
- surface and conductor casing strings are cemented with a volume of cement sufficient to fill the annular space between the casing string and the hole from the shoe of the casing to the surface;
- blow out preventers and related well control equipment shall be installed, operated, maintained and tested in accordance with practices recommended by DME;
- blow out preventer drills are conducted weekly for each drilling crew to ensure that all equipment is operating and that crews are properly trained to carry out emergency duties; and
- an emergency response manual will be prepared.

These conditions will be complied with or exceeded when drilling the proposed Melanie-1 petroleum exploration well. Any fuel associated with the proposal will be stored in accordance with the requirements of DME and Dangerous Goods Legislation.

Furthermore, the EPA notes that, if hydrocarbons are found in commercially viable volumes, the Melanie-1 well will be fully cased and suspended as required by DME. Further environmental impact assessment will then be required to decide whether approval will be given for commercial abstraction of these hydrocarbons.

To minimise the potential for surface spillage and subsurface seepage of hydrocarbons, the proponent has made a commitment to prepare and implement an Environmental Management Plan which will contain the following management measures:

- The exploration well will be cased through cavernous formations (expected to exist in the first 60 to 120 m) where there is potential for seepage, thereby preventing seepage of hydrocarbons into the subsurface environment;
- The casing will be pressure tested according to the requirements of DME;
- All production oil will be flared in the flare pit;
- Any spillages of oil or fuel will be contained and removed immediately and disposed of to a site appropriately licensed by the DEP for the disposal of such wastes;
- All fuel in the project area will be kept within a bunded area which meets with the requirements of DME; and
- Should hydrocarbon contamination of groundwater beneath the project area inadvertently occur, the proponent, in consultation with the DEP, will take action to recover as much hydrocarbon as is practically achievable to restore groundwater quality.

Having particular regard to:

(a) the commitment by the proponent to prepare and implement an Environmental Management Plan which will contain a number of management measures to reduce the potential for contamination of the subsurface environment in the vicinity of the project area, as outlined above;

(b) the fact that the proponent will comply with safety and environmental conditions relating to the drilling of petroleum exploration wells set by DME; and

(c) the fact that, if hydrocarbons are found in commercially viable volumes, the Melanie-1 well will be fully cased and suspended, and further environmental impact assessment will be carried out to decide whether approval will be given to commercially abstract these hydrocarbons;

it is the EPA's opinion that the proposal can be managed to meet its objective for this factor, provided that the proponent prepares and implements an Environmental Management Plan containing management measures to reduce the potential for surface spillage and subsurface seepage of hydrocarbons, as outlined in the draft Environmental Management Plan included as Appendix J in the CER.

3.5 Drilling fluids

Description

The exploration well will traverse a number of geological formations (Figure 2). The Trealla limestone formation is expected to exist to an estimated depth of 250 m, with the first 60 to 120 m of this formation likely to be cavernous. It is proposed that this cavernous section of the well will be cased and pressure tested to prevent the escape of any waste material produced whilst drilling into the non-cavernous formation below 250 m, as described in Section 3.3: Groundwater quality above.

The proponent has outlined that, during drilling through the cavernous limestone formation and prior to this section being cased, a mixture of water with some bentonite, lime and caustic soda will be used to assist drilling.

After the casing and sealing of the cavernous section is complete, a water-based potassium chloride polymer will be used to facilitate drilling.

Assessment

Drilling fluids have the potential to contaminate groundwater in the vicinity of the drilling. The area of assessment for this relevant environmental factor, drilling fluids, is therefore the limestone aquifer beneath the project area and between the project area and the coast.

The EPA's environmental objective in regard to this factor is to ensure that drilling fluids used during drilling do not adversely affect the surrounding environment.

Drilling fluids have the potential to contaminate the subsurface environment, specifically through contamination of groundwater under the project area. As outlined in Section 3.3: Groundwater quality above, potential for contamination of groundwater is restricted to the drilling through the cavernous formations expected to occur in the top 60 to 120 m of the geological profile. Drilling through this section will result in the loss of some, if not all, water and drilling fluids.

As outlined in the CER, the section of cavernous formations will be cased and pressure tested, as described in Section 3.3: Groundwater quality above.

During drilling through the cavernous limestone formation and prior to this section being cased and sealed, a mixture of water with some bentonite, lime and caustic soda will be used to assist drilling. The proponent has outlined that, at the concentrations proposed to be used, these additives are not toxic and are within the limits specified in ANZECC Water Quality Guidelines (ANZECC, 1992). ANZECC criteria and calculated concentrations of additives to be used in the drilling of the Melanie-1 well are summarised in Table 2 below.

Table 2: ANZECC Water Quality Guidelines and proposed concentrations of additives used for drilling the Melanie-1 well.

		WATER USE		
Proposed additive concentration	**ANZECC parameter**	**Aquatic waters**	**Raw drinking water**	**Water for livestock watering**
Lime ($CaCO_3$) ~ 83.33 mg/L	Calcium	No listing	500 mg/L (as $CaCO_3$)	1000 mg/L
Caustic soda (NaOH) ~ 9.2 mg/L	Sodium	No listing	300 mg/L	No listing

It is necessary to use bentonite, caustic soda and lime when drilling the cavernous section of the Melanie-1 well in order to maintain appropriate viscosity in the well and ensure drill cuttings are brought to the surface. If not brought to the surface, the cuttings could fall to the base of the well and potentially cause the loss of the well. Bentonite is a naturally occurring clay, and DME consider it is probably the least toxic of all drilling clays. Once brought to the surface, drilling fluids and drilling cuttings will be pumped into the sump. Once settled, drilling wastes will be excavated and removed from the project area.

After the casing and sealing of the cavernous section is complete, a water-based potassium chloride polymer will be used to facilitate drilling. This potassium chloride polymer is non-toxic and biodegradable, and is widely used onshore and offshore in the Carnarvon Basin. It is expected that there will be no water loss during the drilling through these relatively impermeable lower sections, and the potential for contamination is therefore considered to be minimal.

To minimise the potential for contamination of the surrounding environment by drilling fluids, the proponent has made a commitment to prepare and implement an Environmental Management Plan which will contain the following management measures:

- The exploration well will be cased through cavernous formations (expected to exist in the first 60 to 120 m) where there is potential for seepage, thereby preventing a loss of drilling material and additives and to prevent the loss of pressure;
- The casing will be pressure tested according to the requirements of DME;
- Non-toxic drilling fluids will be used during the drilling of potentially cavernous formations between the surface and a depth of 250 m, prior to casing and sealing of the exploration well; and
- A non-toxic and biodegradable water-based potassium chloride polymer will be used to facilitate drilling below the cavernous formation.

Having particular regard to:

(a) the fact that additives at non-toxic concentrations will be used to facilitate the drilling process; and

(b) the commitment by the proponent to prepare and implement an Environmental Management Plan which will contain a number of management measures to reduce the potential for drilling fluid contamination of the subsurface environment beneath the project area, as outlined above;

it is the EPA's opinion that the proposal can be managed to meet its objective for this factor, provided that the proponent prepares and implements an Environmental Management Plan containing management measures to reduce potential for contamination by drilling fluids, as outlined in the draft Environmental Management Plan included as Appendix J in the CER.

3.6 Visual amenity

Description

Cape Range Peninsula is a major tourist area. Two major parks, Cape Range National Park and the Ningaloo Marine Park, have been established on the Cape. The proximity of these parks in relation to the project area is illustrated in Figure 4. The project area is located in close proximity to these major tourist areas. Vlaming Head Lighthouse, a popular tourist lookout, is located approximately 0.7 km from the proposed project area. The project area is located approximately 1 km from Yardie Creek Road. Yardie Creek Road, which runs along the tip and down the western-side of the Cape Range Peninsula, is the primary road access to the western side of the Cape and to Ningaloo Marine Park.

The proponent has indicated that, although the actual height of the drilling rig will depend on the rig available at the time of drilling, the height of the mast on the drill rig is expected to be between 30 and 35 metres.

Assessment

The area considered for the assessment of this relevant environmental factor, visual amenity, is the estimated visible distance of 5 km.

The EPA's environmental objective in regard to this factor is to ensure that the visual amenity of the area adjacent to the project is not unduly affected by the proposal.

The 0.8 ha project area will be visible from the Vlaming Head Lighthouse and chalets near the lighthouse, however it will be shielded from Yardie Creek Road by rising terrain.

The proponent has indicated that the area required for the operations will be kept to a minimum, and will not exceed the proposed 0.8 ha project area. The proponent has also outlined that the proposed drilling will be completed within approximately six weeks, and that the area will be totally rehabilitated upon decommissioning. Therefore any impacts on the visual amenity of the area will be of a temporary nature.

The EPA also notes that the proponent intends to conduct drilling in the tourist off-season, in October/November, to reduce the potential for any visual impacts associated with the drilling project affecting the tourism industry. This timing will depend on when approvals are obtained and availability of a drilling rig.

To minimise the potential for impacts on the visual amenity of the area, the proponent has made a commitment to prepare and implement an Environmental Management Plan which will contain the following management measures:

- Vegetation clearing will be confined to a minimum and to only within the project area;
- Where possible vegetation will be pruned or flattened rather than removed to retain an intact rootsystem;
- Disturbed vegetation will be rehabilitated. Rehabilitation will be monitored and measured by comparing photos of the area, and will be carried out to the satisfaction of the DEP and CALM; and
- Should monitoring of rehabilitation show rehabilitation of the area has not been successful, the proponent will liaise with the DEP and DME to identify and implement alternative rehabilitation measures.

Having particular regard to:

(a) the fact the drilling operation will be completed over a 6 week period, and therefore any visual impacts associated with drilling will be temporary;

(b) the intention of the proponent to undertake drilling during the tourist off-season to reduce the potential for any visual impacts associated with the drilling project affecting the tourism industry; and

(c) the commitment by the proponent to prepare and implement an Environmental Management Plan which will contain a number of management measures to reduce the potential impacts on visual amenity, specifically relating to rehabilitation of the area on decommissioning, as outlined above.

it is the EPA's opinion that the proposal can be managed to meet its objective for this factor, provided that the proponent prepares and implements an Environmental Management Plan containing management measures to reduce the potential impacts on the visual amenity of the area through rehabilitation of the area on decommissioning, as outlined in the draft Environmental Management Plan included as Appendix J in the CER.

4. Conditions

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

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

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

The EPA recommends that the following conditions, which are set out in formal detail in Appendix 4, be imposed if the proposal by Sun Resources NL to drill the Melanie-1 petroleum exploration well on the Cape Range Peninsula is approved for implementation:

(a) the proponent shall fulfil the commitments set out in the Summary of Commitments statement as an attachment to the recommended conditions in Appendix 4;

(b) in order to manage the relevant environmental factors and EPA objectives contained in this bulletin, and subsequent environmental conditions and procedures authorised by the Minister for the Environment, the proponent shall be required to prepare, prior to implementation of the proposal, environmental management system documentation with components such as those adopted in Australian Standards AS/NZS ISO 14 000 series;

(c) prior to commencement of construction for the drilling operations, the proponent shall prepare and implement an Environmental Management Plan, to the requirements of the Environmental Protection Authority on advice of the Department of Environmental Protection and the Department of Minerals and Energy.

This Plan shall address, but not be limited to the following:

1. Management of disturbance to soil and terrain;
2. Management of disturbance to vegetation;
3. Control of spillage of waste or materials;
4. Control of toxic materials in the subsurface environment;
5. Increasing knowledge of subterranean fauna;
6. Decommissioning and rehabilitation; and
7. Environmental performance audit.

The proponent shall make this Environmental Management Plan publicly available prior to commencement of construction for the drilling operations, and throughout the drilling process and decommissioning phase;

(d) prior to commencement of drilling, the proponent shall prepare a written prescription for contractor work practices covering pre-drilling, drilling and decommissioning, to ensure that work practices are carried out at the level of international best practice, to the requirements of the Environmental Protection Authority on advice of the Department of Environmental Protection and the Department of Minerals and Energy. The proponent shall ensure that pre-drilling, drilling and decommissioning operations comply with this prescription; and

(e) the proponent shall submit periodic Performance and Compliance Reports, in accordance with an audit programme prepared by the Department of Environmental Protection in consultation with the proponent.

5. Other advice

5.1 Integrated approach between planning and environment of the Cape Range Peninsula

The Cape Range Peninsula is an area of significant environmental value, and its management requires an integrated approach. In this regard, the following reports and features of the area need to be taken into account:

(a) Gascoyne Coast Regional Strategy;

(b) Legislative Council's Select Committee's First Report on Cape Range National Park;

(c) Symposium on the Biogeography of Cape Range;

(d) draft report on Karst Management Considerations for the Cape Range Karst Province;

(e) Structure Plan for the Exmouth/Learmonth area being developed by the WA Planning Commission;

(f) Cape Range National Park, and proposals for its extension; and

(g) the array of activities either being undertaken or proposed in the multiple use areas, such as town, tourism, mining, oil and gas exploration, aquaculture and fishing.

An integrated management approach needs to be based on environmental and biogeographic regions, and include the waters adjacent to the Cape, especially the Ningaloo Reef. The important environmental factors of the area should be incorporated into the development of such integrated management strategies as a prime consideration.

One of the most important environmental factors of the Cape Range Peninsula is its karst landscape (small voids through to caves, ranging in size from millimetres to metres) formed primarily as a result of selective chemical dissolution of limestone by natural waters. These voids are the habitat for an array of very small, mostly invertebrate, subterranean animals which have an ancient set of taxonomic relationships. Subterranean fauna inhabit both the air voids in the ground above the water table (troglobitic fauna), and voids filled with water (stygofauna).

The voids within the limestone landscape of the area are thought to be randomly distributed. Therefore, it is not possible either through borehole drilling or geophysical mapping to understand the full extent or nature of the habitat. Also, it is not known whether the various subterranean fauna species are widely distributed or whether they are restricted to very small areas. Accordingly, there will be uncertainty associated with proposals which have the potential either to physically remove part of the landscapes (such as limestone quarrying, urban

development and harbour development) to affect the water balance (water extraction) or the water quality (urban development, hydrocarbon exploration and production).

Further research of subterranean fauna and the karst landscape will improve our understanding of these environmental factors, allowing for the development and implementation of improved management strategies for the area. Such research, however, is likely to take many years to significantly contribute to our understanding due to the random distribution of the voids and the small number of researchers available in this specialised area.

The foregoing has focussed on the karst landscape as an important element of the Cape Range Peninsula. However, this is just one of a number of important aspects which need to be considered in the long term management of the area, not only because of the current development proposals, but also because there are likely to be an array of proposals presented for consideration over time.

The EPA proposes that the Government takes action to:

(a) give high priority to the planning process for the area and ensure that this is integrated with the environmental considerations through a joint approach by the planning and environmental authorities;

(b) ensure that land use is defined in a timely manner;

(c) give priority to a consideration of the proposals in various reports to extend the Cape Range National Park and to consider other extensions which may be relevant in the light of additional information which may now be available;

(d) apply the principles and goals of the National Strategy for Biodiversity, which includes using the precautionary approach to prevent environmental degradation;

(e) continue to require projects and operators within the Cape Range area to develop and implement environmental management plans and systems which achieve the intent of Standards Australia ISO 14 000 series;

(f) encourage research and management to be undertaken in a manner which provides for continuous improvement of understanding of the important elements of the environment and continuous improvement in environmental management, and noting that where appropriate the industry and developers should contribute to the research;

(g) pursue the management of the Cape Range Peninsula as a whole-of-government approach, recognising the importance of the area and the need for an integrated approach to environmental management of the highest standard. This should include the development and implementation of consistent, integrated environmental management programmes by all land managers and developers across the peninsula. The Exmouth Coastal Strategy (Shire and CALM) provides a good example of integrated management, and these principles should be extended across the Peninsula; and

(h) establish a technical Environmental Management Group, comprising relevant government agencies and the Shire, to advise on, and facilitate:

- integration of environmental management for the peninsula;
- on-going research and investigation needs; and
- review of performance of individual environmental management programmes for the peninsula.

5.2 Proposed environmental policy

With increasing development in the Exmouth-Cape Range area, there is a need for improved environmental policy for the area, particularly in relation to karst landscape and subterranean fauna. In response to this the EPA intends to develop an environmental policy for the Exmouth-Cape Range area to assist the assessment of development proposals, and overall environmental management of the area.

6. Conclusions

The EPA has concluded that the proposal by Sun Resources NL to drill the Melanie-1 petroleum exploration well on Cape Range Peninsula can be managed in a manner such that the proposal does not impose an unacceptable impact on the environment, provided that the conditions recommended in Section 4, and set out in formal detail in Appendix 4, are imposed.

The EPA has provided additional advice on the need for an integrated approach to planning and environmental performance on the Cape Range Peninsula.

7. Recommendations

The EPA recommends that:

1. The Minister considers the report on the relevant environmental factors of Subterranean fauna (3.1), Vegetation communities (3.2), Groundwater quality (3.3), Hydrocarbons (3.4), Drilling fluids (3.5) and Visual amenity (3.6);
2. The Minister notes that the EPA has concluded that the proposal can be managed to meet the EPA's objectives, and thus not impose an unacceptable impact on the environment, provided there is a satisfactory implementation by the proponent of the recommended conditions set out in Section 4;
3. The Minister imposes the conditions recommended in Section 4 and set out in formal detail in Appendix 4 of this report;
4. Noting that there has been a number of previous planning and scientific studies which have recommended extension of the Cape Range National Park, the Government give priority to consideration of the proposals in the various reports to extend the Cape Range National Park and to consider other extensions which may be relevant in light of additional information particularly covering the coastal plains and foothills;
5. The Minister notes the EPA's views on the need for an integrated approach between planning and environment for the Cape Range Peninsula presented in Section 5 of the report, and takes appropriate action to address the EPA's proposals;
6. The Minister notes that the EPA is progressing the preparation of an environmental policy on development within the Exmouth-Cape Range area to assist in the management of the area and the assessment of development proposals.

Table 3. Summary of relevant environmental factors, environmental objectives, proponent's commitments and EPA's opinion

RELEVANT ENVIRONMENTAL FACTOR	ENVIRONMENTAL OBJECTIVE	PROPONENT'S COMMITMENT	EPA OPINION
Subterranean fauna	Maintain the abundance, species diversity and geographical distribution of subterranean fauna. Protect subterranean fauna consistent with the provisions of the Wildlife Conservation Act 1950.	The proponent will prepare and implement an Environmental Management Plan (EMP), containing the following management measures: • Exploration well fully cased through cavernous formations where there is potential for seepage, thereby preventing a loss of material or pressure; • Non-toxic drilling fluids used during drilling of Trealla limestone (to 250m), which is possibly cavernous to 120m, prior to casing and sealing of the well; • Prior to casing and sealing of the exploration well, only groundwater from an adjacent bore and a drilling mixture of water, bentonite, some lime and caustic soda will be used in the drilling circuit; • Any fauna brought to the surface from the water bore will be collected for identification; and • Water bore will be cased, sealed and locked for future sampling of subterranean fauna.	Potential impacts on subterranean fauna will be reduced through the use of non-toxic drilling fluids and fully casing the exploration well through cavernous formations where there is potential for seepage, thereby preventing a loss of material or pressure into subterranean fauna habitats. It is the EPA's opinion that the proposal can be managed to meet its objective for this factor, provided the proponent prepares and implements an EMP containing management measures to reduce potential impacts on subterranean fauna.
Vegetation communities	Maintain the abundance, species diversity, geographic distribution and productivity of vegetation communities.	The proponent will prepare and implement an EMP, containing the following management measures: • Vegetation clearing minimised and confined within the project area; • Where possible, vegetation will be flattened and pruned, not cleared; • Management measures taken to prevent introduction of weeds; • Disturbed areas rehabilitated to the satisfaction of the DEP; and • Rehabilitation monitored and measured by comparing photos of the area before and after drilling. Alternative rehabilitation measures to be implemented if necessary.	Project area confined to a 0.8 ha area. Vegetation disturbance in the project area to be minimised. Disturbed areas will be rehabilitated to the satisfaction of the DEP. It is the EPA's opinion that the proposal can be managed to meet its objective for this factor, provided the proponent prepares and implements an EMP containing management measures to reduce potential impacts on vegetation communities.
Groundwater quality	Maintain or improve the quality of groundwater to ensure existing and potential uses, including ecosystem maintenance are protected, consistent with the draft WA Guidelines for Fresh and Marine Waters (EPA, 1993) and ANZECC 1992 guidelines.	The proponent will prepare and implement an EMP, containing the following management measures: • Exploration well will be cased through cavernous formations where there is potential for seepage. The casing will be pressure tested; • Non-toxic drilling fluids, consisting of water, bentonite and small amounts of lime and caustic soda, will be used during the drilling of cavernous formations (to a depth of 250 m), prior to casing and sealing of the well; • Any wastewater discharged back into the well will have a hydrocarbon content <1 mg/L TPH; and • Should hydrocarbon contamination of groundwater occur, proponent to take action to restore groundwater quality.	The exploration well is to be cased through cavernous formations where there is the potential for seepage. Non-toxic drilling fluids are to be used during the drilling of this cavernous section, prior to casing. It is the EPA's opinion that the proposal can be managed to meet its objective for this factor, provided the proponent prepares and implements an EMP containing management measures to reduce potential impacts on groundwater quality.

RELEVANT ENVIRONMENTAL FACTOR	ENVIRONMENTAL OBJECTIVE	PROPONENT'S COMMITMENT	EPA OPINION
Hydrocarbons	Ensure that hydrocarbons associated with the drilling process are contained so that it does not adversely affect the surrounding environment	The proponent will prepare and implement an EMP, containing the following management measures: • Exploration well cased and pressure tested (to DME requirements) to prevent any subsurface and surface seepage of oil. • Any samples brought to the surface will be taken away to a laboratory or flared on site in the flare pit; • All surface samples will be fully contained; • Any spillages of oil, fuel or drilling fluids will be contained and removed immediately and disposed of according to the requirements of the Shire of Exmouth; and • should hydrocarbon contamination of groundwater occur, proponent to take action to restore groundwater quality.	Risk assessment undertaken by the Department of Minerals and Energy has estimated that the risk of loss of well casing integrity is 10^{-6}. Therefore the risk of contamination of the subsurface environment after casing is considered extremely unlikely. It is the EPA's opinion that the proposal can be managed to meet its objective for this factor, provided the proponent prepares and implements an EMP containing management measures to reduce the potential for surface spillage and subsurface seepage of hydrocarbons.
Drilling fluids	Ensure that drilling fluids used during drilling do not adversely affect the surrounding environment.	The proponent will prepare and implement an EMP, containing the following management measures: • The exploration well will be cased through cavernous formations where there is potential for seepage. The casing will be pressure tested; • Non-toxic drilling fluids, consisting of water, bentonite and some lime and caustic soda, used during the drilling of Trealla limestone (to a depth of 250 m), prior to casing and sealing of the well; • After casing, a potassium chloride polymer will be used; and • Any spillages of oil, fuel or drilling fluids will be contained, removed immediately and disposed of according to the requirements of the Shire of Exmouth	Non-toxic drilling fluids will be used through drilling of cavernous sections of the well. The well will be cased through cavernous formations where there is potential for seepage, thus preventing contamination by drilling fluids or drilling wastes. It is the EPA's opinion that the proposal can be managed to meet its objective for this factor, provided the proponent prepares and implements an EMP containing management measures to reduce potential for contamination by drilling fluids.
Visual amenity	Ensure that the visual amenity of the area adjacent to the project is not unduly affected by the proposal.	The proponent will prepare and implement an EMP which will contain rehabilitation measures to be implemented after decommissioning, reducing long term visual impacts	Drilling will be completed within approximately 6 weeks, and rehabilitation of the area will be carried out on decommissioning. Any visual impacts from the drilling rig will therefore be temporary. It is the EPA's opinion that the proposal can be managed to meet its objective for this factor, provided the proponent prepares and implements an EMP containing management measures to reduce potential impacts on visual amenity of the area through rehabilitation of the area on decommissioning.

Appendix 1

Figures

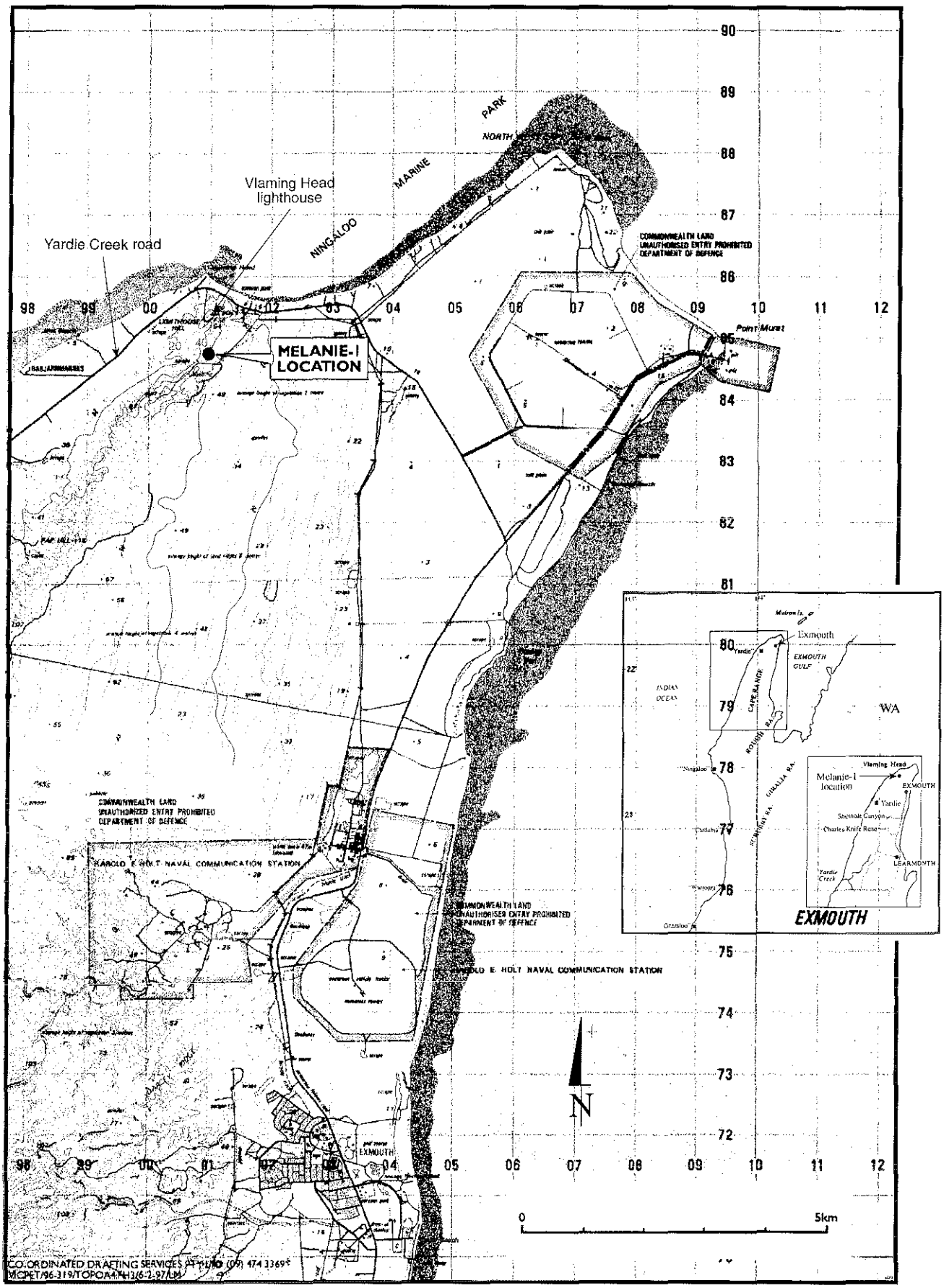

Figure 1. Location of proposed Melanie-1 well (After: Martinick & Associates, 1997).

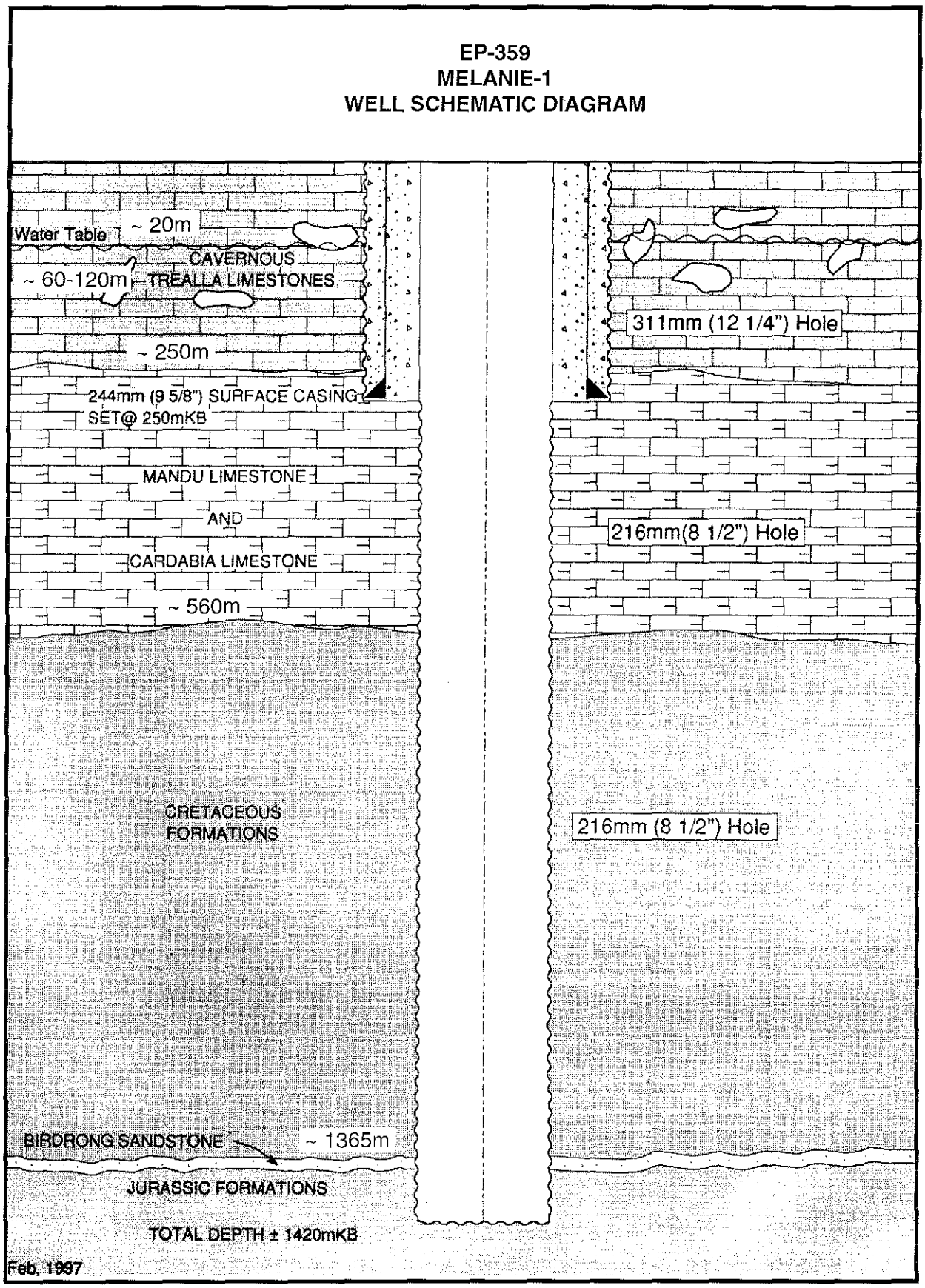

Figure 2. Melanie-1 well schematic diagram (After: Martinick & Associates, 1997).

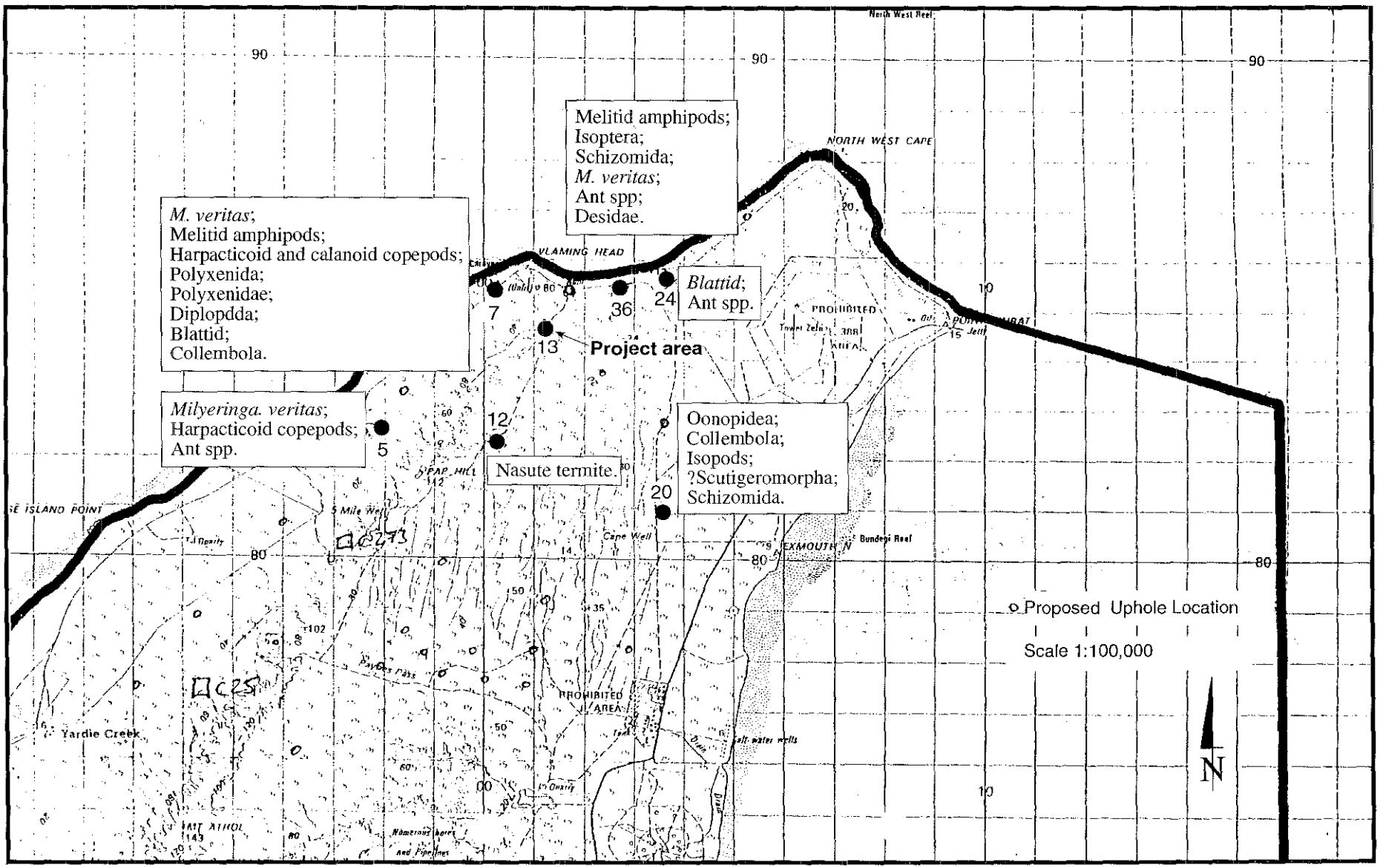

Figure 3. Subterranean fauna sampling in the vicinity of the project area.

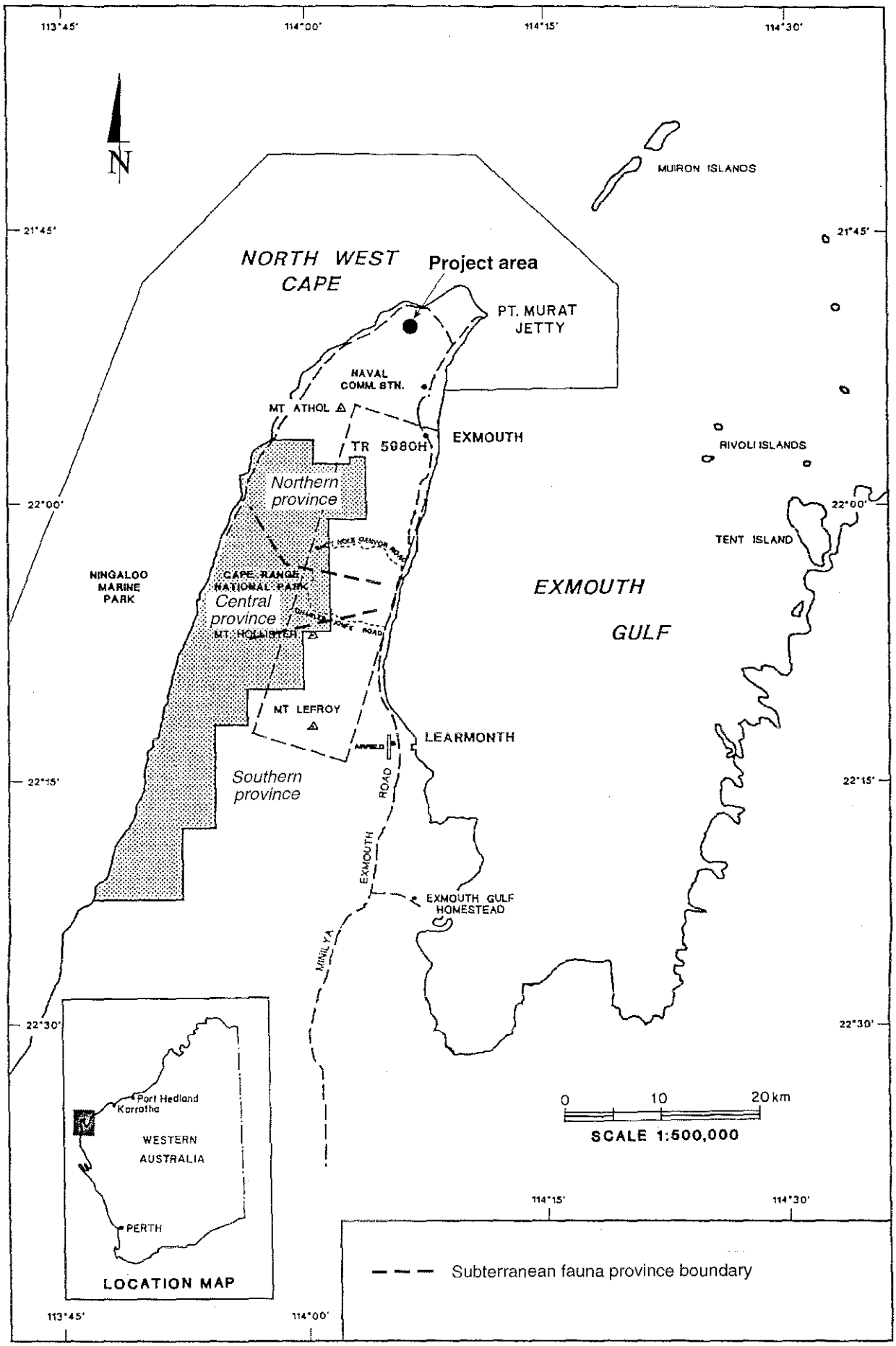

Figure 4. Location of Cape Range National Park and Ningaloo Marine Park in relation to project area (After: Halpern Glick Maunsell, 1995).

Appendix 2

List of submitters

State and local government agencies:

Department of Conservation and Land Management

Department of Land Administration

Shire of Exmouth

Western Australian Museum

Water and Rivers Commission

Organisations:

Conservation Council of Western Australia Inc

Ningaloo Action Group

Appendix 3

References

References

Australian and New Zealand Environment and Conservation Council, 1992. *Australian water quality guidelines for fresh and marine waters*, Australian and New Zealand Environment and Conservation Council.

Australian Nature Conservation Agency (1996). *A directory of important wetlands in Australia.* Second ed. ANCA, Canberra.

Department of Conservation and Land Management, 1987. *Parks of the Cape Range Peninsula, Part 1: Cape Range National Park Management Plan 1987 - 1997*, Department of Conservation and Land Management, Perth.

Department of Minerals and Energy, 1997. *Risk Assessment for the proposed Melanie-1 Petroleum Exploration Well*, unpub.

Environmental Protection Authority, 1993. Draft Western Australian Water Quality Guidelines for Fresh and Marine Waters, Bulletin 711, EPA, Perth, Western Australia.

Environmental Protection Authority, 1997. *Limestone mine, quicklime plant and use of existing port facility (Point Murat), Shire of Exmouth*, Report and recommendations of the Environmental Protection Authority, Bulletin 846, EPA, Perth, Western Australia.

Environmental Protection Authority, 1975. Conservation Reserves for Western Australia as recommended by the EPA, EPA, Perth, Western Australia.

Halpern Glick Maunsell, 1995. *Limestone Mine, Quicklime Plant and Shiploading Facility, Exmouth, WA*. Public Environmental Review, unpub.

Humphreys W F (ed) 1993. *The Biogeography of the Cape Range, Western Australia*, Western Australian Museum, Perth, Western Australia.

Humphreys W F 1993a. 'The significance of the subterranean fauna in biogeographical reconstruction: examples from Cape Range Peninsula, Western Australia', *The Biogeography of Cape Range, Western Australia*, Western Australian Museum, Perth, Western Australia. pp 165 - 192.

Humphreys W F 1993b. *Cave Fauna in semi-arid tropical Western Australia: a diverse relic wet-tropical litter fauna. Memoires de Biuospeologie* 20:105 - 110.

Humphreys W F 1993c. *Stygofauna in semi-arid tropical Western Australia: a Tethyan connection? Memoires de Biuospeologie* 20: 111 - 116.

Humphreys W F and Adams M 1993. 'Patterns of genetic diversity within selected subterranean fauna of the Cape Range peninsula, Western Australia: systematic and biogeographic implications', *The Biogeography of Cape Range, Western Australia*, Western Australian Museum, Perth, Western Australia. pp 145 - 164.

Ministry for Planning, 1996. *Gascoyne Coast Regional Strategy*, Western Australian Planning Commission, Western Australia.

Western Australia, Parliament, 1995. *First Report of the Legislative Council Select Committee on Cape Range National Park and Ningaloo Marine Park* (Hon Graham Edwards MLC, Chairman).

W G Martinick & Assoc, 1997. *Melanie-1 Exploration Well, Cape Range Peninsula - Consultative Environmental Review*, unpub.

Appendix 4

Recommended Environmental Conditions and Proponent's Commitments

Statement No.

September 1997

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

MELANIE-1 PETROLEUM EXPLORATION WELL, CAPE RANGE PENINSULA
SHIRE OF EXMOUTH (1085)

SUN RESOURCES NL

This proposal may be implemented subject to the following conditions:

1 Proponent Commitments

The proponent has made a number of environmental management commitments in order to protect the environment.

1-1 In implementing the proposal, the proponent shall fulfil the commitments made in the Consultative Environmental Review and in response to issues raised following public submissions and subsequently during the environmental assessment process conducted by the Environmental Protection Authority, provided that the commitments are not inconsistent with the conditions or procedures contained in this statement.

In the event of any inconsistency, the conditions and procedures shall prevail to the extent of the inconsistency.

The attached environmental management commitments form the basis for consideration by the Chief Executive Officer of the Department of Environmental Protection for auditing of this proposal in conjunction with the conditions and procedures contained in this statement.

The environmental management commitments of September 1997 are attached.

2 Implementation

Changes to the proposal which are not substantial may be carried out with the approval of the Minister for the Environment.

2-1 Subject to these conditions, the manner of detailed implementation of the proposal shall conform in substance with that set out in any designs, specifications, plans or other technical material submitted by the proponent to the Environmental Protection Authority with the proposal.

2-2 Where, in the course of the detailed implementation referred to in condition 2-1, the proponent seeks to change the designs, specifications, plans or other technical material submitted to the Environmental Protection Authority in any way that the Minister for the Environment determines, on the advice of the Environmental Protection Authority, is not substantial, those changes may be effected.

3 Proponent

These conditions legally apply to the nominated proponent.

3-1 No transfer of ownership, control or management of the project which would give rise to a need for the replacement of the proponent shall take place until the Minister for the Environment has advised the proponent that approval has been given for the nomination of a replacement proponent. Any request for the exercise of that power of the Minister shall be accompanied by a copy of this statement endorsed with an undertaking by the proposed replacement proponent to carry out the project in accordance with the conditions and procedures set out in the statement.

4 Environmental Management System

The proponent should exercise care and diligence in accordance with international best practice environmental management principles.

4-1 In order to manage the relevant environmental factors, to meet the environmental objectives in Environmental Protection Authority Bulletin 8xx, and to fulfil the requirements of the conditions and procedures in this statement, prior to construction, the proponent shall prepare environmental management system documentation with components such as those adopted in Australian Standards AS/NZS ISO 14000 series, to the requirements of the Environmental Protection Authority.

4-2 The proponent shall implement the environmental management system referred to in condition 4-1.

5 Environmental Management Plan

In order to plan for the Melanie-1 exploration well and to meet the Environmental Protection Authority's objectives, an Environmental Management Plan is required.

5-1 Prior to commencement of construction for the drilling operations, the proponent shall prepare an Environmental Management Plan, to the requirements of the Environmental Protection Authority on advice of the Department of Environmental Protection and the Department of Minerals and Energy.

This Plan shall address, but not be limited to the following:

1. Disturbance to soil and terrain;
2. Disturbance to vegetation;
3. Spillage of waste or materials;
4. Toxic materials in the subsurface environment;
5. Knowledge of subterranean fauna;
6. Decommissioning and rehabilitation; and
7. Performance audit.

5-2 The proponent shall implement the Environmental Management Plan required by condition 5-1.

5-3 The proponent shall make the Environmental Management Plan required by condition 5-1 publicly available prior to commencement of construction for the drilling operations, and throughout the drilling process and decommissioning phase.

6 Work Practices

6-1 Prior to commencement of drilling, the proponent shall prepare a written prescription for contractor work practices covering pre-drilling, drilling and decommissioning, to ensure that work practices are carried out at the level of international best practice, to the

requirements of the Environmental Protection Authority on advice of the Department of Environmental Protection and the Department of Minerals and Energy.

6-2 The proponent shall ensure that pre-drilling, drilling and decommissioning operations comply with the prescription referred to in condition 6-1.

7 Time Limit on Approval

The environmental approval for the substantial commencement of the proposal is limited.

7-1 If the proponent has not substantially commenced the project within five years of the date of this statement, then the approval to implement the proposal as granted in this statement shall lapse and be void. The Minister for the Environment shall determine any question as to whether the project has been substantially commenced.

Any application to extend the period of five years referred to in this condition shall be made before the expiration of that period to the Minister for the Environment.

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

8 Compliance Auditing

To help determine environmental performance and compliance with the conditions, periodic reports on the implementation of the proposal are required.

8-1 The proponent shall submit periodic Performance and Compliance Reports, in accordance with an audit programme prepared by the Department of Environmental Protection in consultation with the proponent.

Procedure

1 Unless otherwise specified, the Department of Environmental Protection is responsible for assessing compliance with the conditions contained in this statement and for issuing formal clearance of conditions.

2 Where compliance with any condition is in dispute, the matter will be determined by the Minister for the Environment.

Note

1 The Environmental Protection Authority reported on the proposal in Environmental Protection Authority Bulletin 8xx (August 1997).

Proponent's Environmental Management Commitments

September 1997

MELANIE-1 PETROLEUM EXPLORATION WELL,
CAPE RANGE PENINSULA
SHIRE OF EXMOUTH (1085)

SUN RESOURCES NL

SUMMARY OF COMMITMENTS

Environmental Management Plan

The proponent, Sun Resources NL, will prepare and implement an Environmental Management Plan (EMP) to manage potential environmental impacts resulting from the proposal. The EMP will be prepared to the requirements of the Department of Environmental Protection prior to the commencement of the project, and will be implemented throughout the operations to the satisfaction of the Department of Environmental Protection. The EMP will contain measures to address the following:

Disturbance to soil and terrain

1 The layout of the facilities within the project area will be undertaken on the basis of a site specific assessment, with consideration of terrain features.

2 Where possible, wooden or steel duckboards will be used as walkways between operational pads to minimise compaction.

3 Dust generation will be suppressed on a needs basis with applications of fresh water.

Disturbance to vegetation

4 Vegetation clearing will be confined to a minimum and to only within the project area. Where possible, vegetation will be pruned rather than removed to retain an intact root system.

5 Where possible, vegetation will be flattened rather than cleared.

6 The surface of essential operational pads will be spread with limestone gravel which will be removed on decommissioning.

7 Clumps of shrubs which are not to be damaged will be surrounded with flagging.

8 Appropriate care will be taken to prevent the introduction of weeds.

9 Photographs of the project area will be taken before and after the drilling operations from identical positions to provide a reference.

Spillage of waste or materials

10 All fluid and solid waste recovered from the drilling operation will be deposited in a plastic lined sump, which is surrounded by ringlock fencing.

11 Any spillages of oil, fuel or drilling fluids will be contained and removed immediately and disposed of at a site appropriately licenced by the Department of Environmental Protection for the disposal of such wastes.

12 All domestic rubbish and similar waste will be disposed of according to the requirements of the Shire of Exmouth.

13 All fuel in the project area will be kept within a bunded area which meets with the requirements of the Department of Minerals and Energy.

14 All drilling waste and water will be retained in a sump until the retained water has a total suspended solids content of 20 ppm or less. The water will then be released into the exploration well or the adjacent bore. Any waste water discharged back into the well or bore will be essentially free of petroleum hydrocarbons, with an analysed hydrocarbon content <1 mg/L TPH.

15 All production oil or gas will be flared in the flare pit.

Disturbance to fauna

16 A mesh fence will be placed around the sump to prevent animals from falling in and becoming trapped.

Toxic materials in the subsurface environment

17 Non-toxic drilling fluids will be used during the drilling of potentially cavernous formations between the surface and a depth of 250 meters, prior to casing and sealing of the exploration well.

18 Prior to casing and sealing of the initial 250 meters of the exploration well, only groundwater from an adjacent bore and a drilling mixture consisting of water, some bentonite and small amounts of lime and caustic soda will be used in the drilling circuit.

Seepage of harmful pollutants in the subsurface environment

19 The exploration well will be cased through cavernous formations where there is potential for seepage, thereby preventing a loss of material or pressure.

20 The casing will be pressure tested according to the requirements of the Department of Minerals and Energy.

Groundwater contamination

21 Should hydrocarbon contamination of groundwater beneath the project area inadvertently occur, the proponent, in consultation with the Department of Environmental Protection, will take action to recover as much hydrocarbon as is practically achievable to restore groundwater quality.

Knowledge of subterranean fauna

22 On advice from the WA Museum, the adjacent water bore will be cased, sealed and locked in order to be used in future sampling of subterranean fauna.

23 Subterranean fauna which are collected from the adjacent water bore during the operations will be stored and later identified.

Rehabilitation

24 As far as is practically possible, all introduced limestone gravel will be removed from the project area and to a site requested by the Shire of Exmouth.

25 Topsoil will be respread over areas from where it has been removed.

26 Soil surfaces which may have become compacted by the operations will be ripped on a needs basis with care being taken to avoid damage to existing root systems.

27 After the first significant rains in the area following decommissioning, and environmental report on rehabilitation progress will be prepared.

28 Rehabilitation will be monitored and measured by comparing photos of the area before and after drilling. Rehabilitation to be carried out to the satisfaction of the Department of Environmental Protection.

29 If monitoring of rehabilitation, as required by commitment 28 above, shows rehabilitation of the area has not been successful, the proponent will liaise with the Department of Environmental Protection and the Department of Minerals and Energy to identify and implement alternative rehabilitation measures.