MELANIE-1 EXPLORATION WELL
CAPE RANGE PENINSULA

CONSULTATIVE ENVIRONMENTAL REVIEW

prepared for

SUN RESOURCES N.L.

A.C.N. 009 196 810

by

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INVITATION

The Environmental Protection Authority (EPA) invites people to make a submission on this proposal.

Sun Resources NL proposes to drill an onshore petroleum exploration well, on the inland side of Yardie Creek Road, near Exmouth, Western Australia. In accordance with the requirements of the *Environmental Protection Act 1986,* Sun Resources NL has prepared a Consultative Environmental Review (CER) which describes the proposal and its likely effects on the environment. The CER will be available for public review for a period of four weeks, commencing on **Monday 19 May 1997** and closing on **Monday 16 June 1997**.

Comments from Government agencies and the public will assist the EPA in preparing an assessment report in which it will make recommendations to Government.

Why a submission?

A submission is a way to provide information, express your opinion and put forward your suggested course of action - including any alternative approach. It is useful if you indicate any suggestions you have to improve the proposal.

All submissions received by the EPA will be acknowledged. Submissions will be treated as public documents unless provided and received in confidence (subject to the requirements of the *Freedom of Information Act*), and may be quoted in full or in part in the EPA's report.

Why not join a group?

If you prefer not to write your own comments, it may be worthwhile joining a group interested in making a submission on similar issues. Joint submissions may help to reduce the workload for an individual or group, as well as increasing the pool of ideas and information. If you form a small group (up to 10 people) please indicate the names of all the participants. If your group is larger, please indicate how many people your submission represents.

Develop a submission

You may agree or disagree with, or comment on, the general issues discussed in the CER or the specific proposals. It helps if you give reasons for your conclusions, supported by relevant data. You may make an important contribution by suggesting ways to make the proposal more environmentally acceptable.

When making comments on specific proposals in the CER:

- clearly state your point of view
- indicate the source of your information if this is applicable
- suggest recommendations, safeguards or alternatives.

Points to keep in mind

By keeping the following points in mind, you will make it easier for your submission to be analysed:

- Attempt to list points so that issues raised are clear. A summary of your submission is helpful.
- Refer each point to the appropriate section, chapter or recommendation in the CER.
- If you discuss different sections of the CER, keep them distinct and separate, so there is no confusion as to which section you are discussing.
- Attach any factual information you may wish to provide and give details of the source. Make sure your information is accurate.

Remember to include:

- your name
- your address
- the date
- whether you want your submission to be confidential.

The closing date for submissions in **Monday 16 June 1997**.

Submissions should be addressed to:

Chairman
Environmental Protection Authority
Westralia Square
141 St George's Terrace
Perth WA 6000
Attention: Ms Rochelle Smith

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1.0 EXECUTIVE SUMMARY

This Consultative Environmental Review outlines the proposed drilling of the Melanie-1 exploration well on Cape Range Peninsula for a gas and oil target. This document requests approval on behalf of the Proponent, Sun Resources NL, to drill and evaluate the Melanie-1 exploration well. It does not seek approval to develop a gas or oil field. In the event of a discovery such approval will be sought once the resource has been fully appraised to provide information on gas and oil volumes and qualities.

Environmental approval for the well is determined by the Environmental Protection Act (1986) and administered by the Department of Environmental Protection and the Environmental Protection Authority. Each body reviews the Consultative Environmental Review document on scientific and technical grounds and will make recommendations to the Minister for the Environment, who may then administer approval subject to conditions which are designed to ensure that the operations are environmentally acceptable. For the preparation of this Consultative Environmental Review the Department of Environmental Protection has identified the following preliminary 'environmental factors' which have to be addressed:

- Subterranean fauna (stygo and troglobitic)
- Vegetation communities
- Groundwater quality
- Oil
- Drilling fluids
- Visual amenity
- Public perception

Each of these environmental factors is described and assessed in this Consultative Environmental Review.

Exploration for oil and gas commenced on Cape Range Peninsula in 1953, and since then forty two wells have since been drilled in the Peninsula, mainly by WAPET and Ampolex. Permit EP359 was awarded on 12 November 1991 and the drilling of the Melanie-1 exploration well will fulfil the minimum work requirement for Year 5 of this Permit. The general location of the proposed Melanie-1 exploration well was selected following a seismic survey in 1995.

1.1 Existing environment

The 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. At its closest point the western coastline of Cape Range Peninsula, which is also the border of Ningaloo Marine Park, is about 1.3 km to the north of the Project Area. To the west the Project Area is separated from the coast by a rising ridge. The Project Area is approximately 1.2 km inland of the Yardie Creek Road and about 600 metres south of the road to the Vlaming Head Lighthouse.

The Project Area will be confined to an area of about 100 metres by 80 metres, approximately 0.8 hectares.

Defence, tourism, commercial fishing and conservation are the main land uses of Cape Range Peninsula and there is potential for oil and especially gas discoveries. The greater region of the Project Area is a popular tourist destination. The Project Area is located near the bitumenised Yardie Creek Road which provides access to tourist destinations in Cape Range National Park to the south, nearby Ningaloo Marine Park and the town of Exmouth.

The environment of the Project Area was appraised in a regional context by W G Martinick & Associates Pty Ltd during the seismic survey of 1995. At that time no declared rare and priority listed flora and no archaeological sites were found in the immediate vicinity of the Project Area. A site specific environmental assessment of the Project Area was undertaken in April and June 1996 and January and March 1997, and the results are presented in this Consultative Environmental Review.

The climate of the Project Area is hot and semi-arid. Rainfall occurs mainly during the period of January to August. Cyclonic rains generally occur in February and March, when intense precipitation may occur although cyclones can be expected from approximately November to April.

The Project Area is located within the Carnarvon Basin which encompasses Cape Range Peninsula and extends inland for about 160 km. The Carnarvon Basin is a low-lying sedimentary basin with exposed rocks of Permian to Recent origin. A sequence of limestone formations form the core of Cape Range Peninsula. The regional water table of the Peninsula is contained mainly within the permeable limestone system beneath Cape Range and the eastern coastal plain. Cape Range is underlain by a series of caves which developed in response to geological factors, climatic factors and world wide changes in sea level.

The sedimentary rock beneath the Project Area is limestone, which is strongly re-cemented to calcrete and is karstified. The site is at an elevation of approximately 22 metres above sea level, with the majority of the Project Area being located on a relatively flat area between the major ridge to the west and the shoulder of another ridge to the southeast. The soil of the Project Area where present, is a shallow, red/brown, calcareous sandy loam over limestone and limestone conglomerate.

Available regional data and the results of sampling of bores near to the Project Area indicate that potable groundwater is not expected to be encountered beneath the Project Area. The groundwater is likely to have a surface 1-2 metre horizon of brackish water before having a salinity which is approximately similar to that of sea water. More detailed information on the quality of groundwater beneath the Project Area will be made available during the installation of a water bore adjacent to the proposed location for the Melanie-1 exploration well.

The vegetation of the Project Area is common within the Learmonth Landsystem and elsewhere on the Peninsula and beyond and consists predominantly of scattered shrubs of *Acacia bivenosa*, *Acacia pyrifolia*, *Acacia tetragonophylla* and the tree *Banksia ashbyi* over the hard spinifex grass *Triodia pungens*. No rare and priority listed flora species were found

within the Project Area and its immediate surrounds. No broad leafed weeds were found within the Project Area, although a few isolated plants of the introduced grass *Cenchrus ciliaris* (Buffel Grass) were found.

Cape Range National Park contains a variety of ecosystems due to its rugged and complex terrain which provides water catchments in deep gullies and gorges where floral assemblages are found in sheltered areas. In contrast, the Project Area covers a very small area of shallow soils, or no soil over limestone, which provide the basis for a uniform and very common habitat. There are no habitats within the Project Area which could affect the survival of terrestrial (as distinct from subterranean) mammals, birds or reptiles which have been gazetted as rare and/or endangered. Of the gazetted rare or endangered native mammals which might be found on Cape Range Peninsula, only the Pebble-mound Mouse (*Pseudomys chapmani*) is likely to be found in habitats typical of the Project Area.

Extensive subterranean habitats exist within the limestone cavities which honeycomb Cape Range Peninsula and these are known to contain cave fauna which are considered unique. Cave fauna is a simple term used to embrace several categories of animals (troglophiles, troglobites, trogloxenes, stygofauna and stygophiles) which utilise a range of underground habitats varying in void size and type, from dry to fresh and brackish water (Humphreys, 1993). Void sizes may vary from the small spaces between gravel particles beneath stream beds to caverns in limestone of more than 20 cm diameter. The cave fauna includes 34 species (Dr W Humphreys, pers comm 1995), including species of blind cave fish and eels and a large range of invertebrate groups.

An Aboriginal cultural heritage survey confirmed that the Project Area does not contain sites which are of cultural importance to Aboriginal people.

1.2 Proposed Operations

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. 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. The likelihood is high for a natural gas discovery at the Melanie-1 exploration well because the drill target lies between the nearby gas discoveries of Macedon/Pyrenees and Rivoli-1. A discovery of hydrocarbons at the Melanie-1 exploration well may meet local energy needs and could be commercially viable.

An overall management objective is to undertake all site operations with minimal disturbance to the terrain, surface and vegetation and to design the layout so that on completion of drilling it can be readily rehabilitated. Wherever practically possible, it is proposed to use the natural contours of the land within the Project Area for the siting of the various operational facilities, thereby minimising disturbance to the soil and terrain. A number of the facilities and equipment need to be located on level surfaces. Such surfaces will be established by appropriate spreading of limestone gravel which will be obtained from a quarry about 4 km from the Project Area. A number of level pads will be created by this method, with mainly intact vegetation remaining on the balance of the Project Area.

The operations associated with the Melanie-1 exploration well are expected to last for a maximum of six weeks, starting from the time when equipment and limestone is brought in to construct a level pad. Drilling is expected to be completed within a three week period. The physical and visual environment of the Project Area will be temporarily disturbed during this period.

Drilling will be to a depth of 1420 metres. An air-hammer will be used to drill the 22 metre section of surface limestone above the groundwater. This will avoid the need to use chemicals or water in this section and it will rely on air to blast stone chips and crushed stone away from the drilling bit. Once this section has been drilled it will be reamed to a likely diameter of 311 mm and cased. All further drilling will be within the groundwater and will require circulating water to bring stone chips and drilling muds to the surface. Based on regional and local information, cavernous formations beneath the Project Area are not expected to extend beyond a depth of 60 metres below the current water table.

Immediately after the potentially cavernous limestone formation has been drilled to a depth of approximately 250 metres, this 0 to 250 metre section will be fully cased and cemented. This is designed to prevent the escape of any material produced whilst drilling through the non-cavernous formations below 250 metres. From then onwards, all water in the drilling circuit will be recycled and a water-based potassium chloride polymer and bentonite, will be used to facilitate the drilling. The potassium chloride polymer and the bentonite are non-toxic and widely used onshore and offshore in the Carnarvon Basin and elsewhere.

The drilling operation will require approximately 1100 litres of water per minute (or 18.3 litres per second) from the surface of the groundwater downwards. In an ideal situation of no losses, all of this water will be totally recycled within the drilling circuit. The proposal is to abstract this water supply from a bore which will be established about 40 metres adjacent to the proposed Melanie-1 exploration well. This bore will be drilled to a depth of about 80 metres to provide information on the surface limestone formations through which the Melanie-1 exploration well will have to be drilled. Water is likely to be abstracted from a depth of about 30 metres below sea level.

1.3 Management of Potential Environmental Impacts

The Melanie-1 exploration well will be operated under regulations specified by the Petroleum Act (1967) and supervised by the Department of Minerals and Energy. This will ensure that the well will be drilled according to the regulations and that all safety procedures, including pressure testing, are in place.

Drilling of the proposed exploration well and the adjacent water bore will be similar to the drilling which was required to establish the water bores of the existing Exmouth water supply borefield which is located to the east of Cape Range. In March 1997 the Environmental Protection Authority approved an extension to this borefield, which increases annual extraction from the aquifer by 265 million litres per year and increases the number of bores from 31 to 42. This large scale extraction is expected to decrease existing stygofauna populations by 1% per year, a loss which can be readily replaced by normal population dynamics (Environmental Protection Authority Bulletin 843, 1997). The impact of the proposed drilling of the Melanie-1 exploration well on the subterranean fauna habitats and

existing groundwater resources of the region, will be insignificant compared to the drilling associated with the proposed extension of the borefield and its subsequent abstraction of water.

At the same time that extensions to the Exmouth borefield were approved (March 1997), the Environmental Protection Authority recommended to the Minister for the Environment that a proposed limestone mine, quicklime plant and use of existing port facility in the Shire of Exmouth be approved (Environmental Protection Authority Bulletin 846, March 1997). This project has the potential to impact on karst landforms, subterranean fauna, vegetation, fauna and groundwater in a similar environment to that of the Melanie-1 Project Area. The proposed limestone mine will result in an expected 2.5 hectares of area being mined each year to a depth of 25 metres, with a water usage of 55 cubic metres per day. The limestone mine is of a substantially larger scale and potential impact than the proposed Melanie-1 exploration well and is a long term development.

No oil-based drilling fluids will be used in the Project Area. Fuel and oil spillages will be avoided by the diesel fuel storage area being bunded in accordance with the requirements of the Department of Minerals and Energy and Dangerous Goods Legislation. Any fuel spillages will be dealt with immediately, with the contaminated soil being removed for disposal according to the requirements of the local authority.

The Project Area will be photographed prior to the commencement of operations and photographs of similar views will be taken for comparative purposes on completion of decommissioning and again after rehabilitation to ensure that the Project Area is returned to as near to its pre-drilling condition as is practically feasible. A report outlining the completed decommissioning and rehabilitation will be prepared and submitted to the Departments of Minerals and Energy and Conservation and Land Management.

1.4 Social Impacts and Their Management

The Proponent is committed to discussing the proposed project with a wide range of individuals, organisations, groups and agencies which may have an interest in the region, and to establish ongoing and meaningful dialogue. In June 1996 the Company initiated a consultation programme with residents of Exmouth to inform the public about the project; record potential concerns, issues and recommendations; where appropriate, make amendments to the design and or management of the operations to address such concerns; and establish meaningful and ongoing dialogue. As a consequence of these discussions, a number of recommendations and concerns were incorporated into the design and management of the proposed drilling of the Melanie-1 exploration well.

The general consensus amongst the community was that the proposed operations for the Melanie-1 exploration well gave adequate consideration to management of the marine and land environment and that the well was acceptable because it was based on land rather than offshore in the Ningaloo Marine Park. At the conclusion of the consultations of June 1996 the Cape Conservation Group advised that the proposed drilling operation is an example of best practice for environmental management and that the consultations had resulted in establishing meaningful dialogue. The consultations were therefore successful in achieving their initial aims.

The proposed operation and management of the Melanie-1 exploration well has incorporated the concerns and recommendations of relevant government authorities and the local and general community. A common public perception of the proposed operation was, and in some instances still is, that the proposed drilling is of a much larger scale and that it is much closer to the Ningaloo Marine Park and adjacent Jurabi Coastal Park, than in reality. Drilling of the Melanie-1 exploration well will be conducted under strict procedures of environmental management which will help protect the surface and subsurface environment. The Project Area is about 1.3 km from the Ningaloo Marine Park, 18 km from Cape Range National Park and 1.2 km from the Jurabi Coastal Park. These distances from the Project Area are sufficiently substantial to ensure that the drilling will not have an adverse environmental impact on these Parks.

The Melanie-1 exploration well is an example of the Western Australian petroleum industry's commitment to best practice in environmental management. It is anticipated that the proposed drilling will improve general community perception of exploration for gas and oil on Cape Range Peninsula.

1.5 Summary of Issues and Relevant Environmental Factors

A primary purpose of a Consultative Environmental Review is to provide detailed information on a proposal to the Environmental Protection Authority, with a focus on a number of relevant environmental factors. These environmental factors have been identified by the Proponent and the Department of Environmental Protection as having the potential to impact on the physical, biological and social environment of the area relevant to the proposal. The relevant environmental factors for the Melanie-1 exploration well are summarised in the following table and described within the body of the document:

Preliminary Environmental Factor	Present status of environment	Value of site on regional scale	Potential Environmental Impacts	Management Objective	Management Response	Future status of environment	CER reference section
Biophysical							
Subterranean Fauna (stygo and troglobitic)	Occur in limestone cavities of Cape Range Peninsula. The cave fauna includes up to 34 species, several of which are gazetted as rare and/or endangered under the Wildlife Conservation Act (1950). Diversity, distribution and abundance within Cape Range Peninsula is not well understood. Sampling in May 1996 of upholes created for a seismic survey has extended the range of some species.	The total potential maximum loss of underground habitat is estimated to be 16 cubic metres which is insignificant on a regional scale. Due to the absence of surface caves, the environment beneath the Melanie-1 exploration well has limited potential for the study of subterranean fauna.	• Direct loss of approximately 16 cubic metres of habitat. • Possible loss of some subterranean fauna, which will be recorded and documented.	• Ensure that subterranean fauna is adequately protected; • Maintain the abundance, diversity and geographical distribution of subterranean fauna; • Improve understanding of subterranean fauna through appropriate research.	• Well will be fully cased to a depth of 250 metres to prevent possible contamination of subterranean habitats by seepage. • Only water and a drilling fluid consisting of water with some bentonite will be used prior to casing. None of these fluids are toxic. • Loss of habitat will be kept to an absolute minimum. • The water supply bore will be established adjacent to the well. It will be used to collect and document any fauna which are brought to the surface during drilling. It will be kept open at the completion of the project to enable further sampling.	Similar environment as prior to drilling, except for a loss of approximately 16 cubic metres of habitat, which is insignificant on a regional scale.	4.5, 7.3

Preliminary Environmental Factor	Present status of environment	Value of site on regional scale	Potential Environmental Impact	Management Objective	Management Response	Future status of environment	CER reference section
Vegetation Communities	The Project Area contains a vegetation community which is common within the Learmonth landsystem and elsewhere on Cape Range Peninsula. The vegetation consists predominantly of scattered *Acacia* shrubs over spinifex grass. No rare or endangered plant species occur within the Project Area.	The total disturbed area will be 0.8 hectares, which supports a vegetation community which is common within a 57 km^2 area of the 'Stony Footslopes' Landscape Unit, which is part of the Learmonth Landsystem.	Temporary damage to 0.8 hectares of existing vegetation.	Protect the abundance, diversity, geographical distribution and productivity of the vegetation community.	Damage to the vegetation will be minimised by flattening and the pruning of the vegetation rather than clearing, thereby protecting the rootstock and enabling rapid regrowth upon decommissioning. Disturbed vegetation will be rehabilitated and a decommissioning report will be submitted to the Departments of Minerals and Energy and Conservation and Land Management.	Rehabilitated vegetation will be similar to the surrounding vegetation.	4.7, 7.5
Pollution							
Groundwater Quality	Groundwater beneath the Project Area is saline, with a 1-2 metre surface layer of brackish water (5000 mg/L total dissolved solids)	Current groundwater is not of a potable quality and would not be considered valuable for domestic uses.	• No detrimental impact on the quality of groundwater. • Temporary increase in total suspended solids.	Maintain the quality of groundwater consistent with draft guidelines of Environmental Protection Authority Bulletin 711, 1993.	No chemicals or additives will be used which would affect the quality of the groundwater.	Salinity levels in the groundwater will return to their original status.	4.4.2, 7.2.2

Preliminary Environmental Factor	Present status of environment	Value of site on regional scale	Potential Environmental Impact	Management Objective	Management Response	Future status of environment	CER reference section
Oil	No hydrocarbons are present at the surface or directly beneath the Project Area.		There is concern that there is potential for surface and subsurface spillage of oil.	Ensure that oil associated with the drilling process is contained so that it does not adversely affect the surrounding environment	The proposed well will be cased and pressure tested in line with requirements of the Department of Minerals and Energy, to prevent any subsurface and surface seepage of oil. Only small samples of material from within the geological formation which could possibly contain oil will be brought to the surface. Any samples brought to the surface are taken away to a laboratory or flared on site in the flare pit. All surface samples are fully contained.	No pollution of land or marine environment.	5.15, 7.4
Drilling fluids			Introduction of drilling fluids which will temporarily affect the turbidity of groundwater.	Ensure that drilling fluids do not adversely affect the surrounding environment	The drilling fluids to be used will be predominantly water with some bentonite and minor amounts of lime and caustic soda. Once the well has been cased, a potassium chloride polymer which is a naturally occurring salt will be used. No toxic or environmentally harmful drilling fluids will be used during the operations.	No permanent impact on surrounding environment, so status is maintained.	5.3, 7.2.3

Preliminary Environmental Factor	Present status of environment	Value of site on regional scale	Potential Environmental Impact	Management Objective	Management Response	Future status of environment	CER reference section
Social Surroundings							
Visual amenity	The Project Area is shielded from Yardie Creek Road by rising terrain. It is visible from the lighthouse and recently built chalets of the nearby Lighthouse Caravan Park. The Project Area is adjacent to an existing 10 metre wide access track. Several power transmission lines are visible from the Project Area.	The Project Area covers 0.8 hectares in an area which already has several cultural features.	The mast of the drilling rig will be visible from the Vlaming Head Lighthouse and some chalets on a nearby hill. The drilling rig will not be visible from the Yardie Creek Road.	Ensure that the visual amenity of the Project Area is not permanently affected.	The area required for the operations will be kept to a minimum and rehabilitated upon decommissioning. The operations will only be obvious for about six weeks. This is outside of the peak tourist season.	No permanent impact on the visual amenity of the area.	8.1
Public perception	The Exmouth community has been well informed of the proposal and participated in a programme of public consultation. Perception amongst some members of the broader community is ill-informed and frequently incorrect.			Ensure that the public is properly informed in relation to perceived risks associated with the proposed drilling.	Resubmission of the Melanie-1 proposal in a more publicly available document, to ensure that the broader community is better informed in relation to perceived risks.	Increase public awareness of procedures currently used by the petroleum industry to protect the environment and remove the uncertainty concerning perceived risks.	6.0, 8.2

1.6 Summary of Commitments

In order to implement the proposed Melanie-1 exploration well the Proponent, Sun Resources NL, makes two major commitments to environmental management. These commitments are expected to be audited by the Department of Environmental Protection and are as follows:

Commitment 1

The Proponent, Sun Resources NL, will prepare and implement an Environmental Management Plan (EMP) to manage potential environmental impacts resulting from the proposal. A draft form of this EMP is contained in Appendix J. The EMP will be finalised to meet the requirements of the Department of Environmental Protection prior to commencement of the project, and will be implemented throughout the operations to the satisfaction of the Department of Environmental Protection.

Commitment 2

The Environmental Management Plan referred to in Commitment 1, will contain measures to address the following:

i. Disturbance to soil and terrain:

- The layout of facilities within the Project Area will be undertaken on the basis of a site specific assessment, with consideration of terrain features.
- Where possible, wooden or steel duckboards will be used as walkways between operational pads to minimise compaction.
- Dust generation will be suppressed on a needs basis with applications of fresh water.

ii. Disturbance to vegetation:

- 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 rootsystem.
- Where possible vegetation will be flattened rather than cleared.
- The surface of essential operational pads will be spread with limestone gravel which will be removed on decommissioning.
- Clumps of shrubs which are not to be damaged, will be surrounded with flagging.
- Appropriate care will be taken to prevent the introduction of weeds.
- Photographs of the Project Area will be taken before and after the drilling operations from identical positions to provide a reference.

iii. Spillage of waste or materials:

- All fluid and solid waste recovered from the drilling operation will be deposited in a plastic lined sump, which is surrounded by ringlock fencing.
- 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.
- All domestic rubbish and similar waste will be disposed of according to the requirements of the Shire of Exmouth.

- 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.
- 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 adjacent bore.
- All production oil will be flared in the flare pit.

iv. Disturbance to fauna:

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

v. Toxic materials in the subsurface environment:

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

vi. Seepage of harmful pollutants in the subsurface environment:

- The exploration well will be cased through cavernous formations where there is potential for seepage, thereby preventing a loss of material or pressure.
- The casing will be pressure tested according to the requirements of the Department of Minerals and Energy.

vii. Knowledge of subterranean fauna:

- The adjacent water bore will cased, sealed and locked in order to be used in future sampling of subterranean fauna.
- Subterranean fauna which are collected from the adjacent water bore during the operations will be stored and later identified.

viii. Rehabilitation:

- 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.
- After the first significant rains in the area following decommissioning, an environmental report on rehabilitation progress will be prepared.
- Topsoil will be respread over areas from where it has been removed.
- 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.

2.0 INTRODUCTION

The objective of this document is to obtain approval for drilling an exploration well in an environmentally responsible manner using principles of best practice in environmental management. To achieve this objective, the Consultative Environmental Review provides information on:

- Environmental Assessment of the Project Area.
- Identification of environmentally and socially sensitive issues.
- Commitments to environmental management which become legally binding once approval is obtained.
- A draft Environmental Management Plan for the design, management and decommissioning of the proposed operations so that potentially adverse environmental and social impacts are avoided or minimised (Appendix J). The Environmental Management Plan addresses environmentally and socially sensitive issues and allocates tasks and responsibilities to nominated staff.

2.1 The Proponent

The Proponent for the Melanie-1 exploration well is Sun Resources NL (ACN 009 196 810), a publicly listed company with interests in Australia, Papua New Guinea and New Caledonia. Sun Resources NL is the owner and operator of Petroleum Exploration Permit 359.

2.2 History of Project

Exploration for oil and gas commenced on Cape Range Peninsula in 1953, and from Figure 1 it can be seen that 42 wells have since been drilled on that Peninsula. Some of the wells recorded the presence of hydrocarbons but none were of commercial significance. The Melanie-1 exploration well will be an important test of the hydrocarbon potential of the northern part of Cape Range Peninsula.

The location of the Melanie-1 exploration well was selected following a seismic survey in 1995 by Geo Systems Pty Ltd on behalf of Ampolex Limited, the project managers of the then Joint Venture Partners of Petroleum Exploration Permits EP41 and EP359. Permit EP359 was awarded on 12 November 1991 and drilling of the Melanie-1 exploration well will fulfil the minimum work requirement for Year 5 of this Permit.

On advice from the Environmental Protection Authority, the seismic survey was undertaken without formal assessment by the Environmental Protection Authority. A detailed Environmental Management Plan was prepared for the seismic survey and it was implemented under the supervision of the Environmental Adviser of Ampolex Limited. For the duration of the seismic survey W G Martinick and Associates provided a botanist who ensured that no declared rare or priority listed flora were destroyed and

an archaeologist who ensured that no archaeological sites were affected. On completion of the seismic survey Ampolex Limited completed appropriate land rehabilitation and submitted an Environmental Close Out Report to the Department of Minerals and Energy. According to the close-out report *discussions with the Exmouth Conservation and Land Management office indicate that the situation remains satisfactory and that additional rehabilitation is not currently required.* The progress of rehabilitation on the seismic lines was reappraised in August-September 1996 by an officer of the Department of Conservation and Land Management and Ampolex Limited, respectively, at which time regrowth on disturbed areas was progressing satisfactorily. A second environmental close out report was submitted by W G Martinick & Associates Pty Ltd to the Department of Minerals and Energy and the Department of Conservation and Land Management in April 1997.

Potential drilling on Cape Range Peninsula was discussed with Dr W F Humphreys, Senior Curator, Western Australian Museum in 1995. In a letter of 24 April 1995 (Appendix B) Dr Humphreys stated: *As discussed with you these drill holes should provide access to the groundwater in an area where there is no information about the unique and internationally significant subterranean fauna of the area. The lack of information in this region is a perpetual problem. As the protected subterranean species are present on either side of this northern tip it must be assumed, unless proven otherwise, that they are present on the northern tip despite the different geomorphology.* He requested financial assistance to stabilise bore holes established during exploration drilling for hydrocarbons, to permit him to use these for trapping aquatic cave fauna. Sampling was undertaken by Dr Humphreys in some of the upholes left open from the 1995 seismic survey, and a draft report was supplied to Ampolex Limited (Appendix C). The sampling by Dr Humphreys extended the known geographic range of some of the species.

The environment of the Project Area was appraised in a regional context by W G Martinick & Associates Pty Ltd during the seismic survey of 1995. At that time, no declared rare and priority listed flora and no archaeological sites were found in the immediate vicinity of the Project Area. Site specific environmental assessment of the Project Area were undertaken in April and June 1996 and January and March 1997, and the results are presented in this document.

An Environmental Assessment and Management Programme for the Melanie-1 exploration well was prepared by W G Martinick & Associates Pty Ltd and submitted in June 1996 to the Department of Minerals and Energy. Within a week of submission, the Department of Minerals and Energy referred it to the Department of Environmental Protection and the Environmental Protection Authority to determine the level of assessment for this project. On 26 July 1996 the Department of Environmental Protection advised the Proponent that the recommended level of assessment for the proposed exploration well was *informal review with advice given.* This was followed by a period of two weeks during which the public was invited to appeal to the Minister for the Environment against this recommended level of assessment. An appeal from the Conservation Council of Western Australia and another from Greenpeace were received during this appeal period. The appeals were assessed by the Minister for the Environment, and on 30 January 1997 the Minister advised the Minister for Minerals

and Energy that she dismissed the two appeals (Appendix D). On 8 February 1997 the Minister for the Environment nominated a formal assessment for the Melanie-1 exploration well, at the level of a Consultative Environmental Review. The Environmental Protection Authority's guidelines for the Consultative Environmental Review are contained in Appendix 1.

2.3 Location, Size and Access

The Project Area is located on the northwestern tip of Cape Range Peninsula, inland of Yardie Creek Road and behind the line of hills which form the continuation of Cape Range. Its location is shown in Figures 2 and 3 and in Plate 1 which is an aerial photograph of the region. Views of the terrain and vegetation of the Project Area are shown in Plates 2 to 6.

The Project Area is approximately 1.2 km inland of the Yardie Creek Road and about 600 metres south of the road to the Vlaming Head Lighthouse, near shotpoint 252 on seismic line A95M-01 of the 1995 seismic survey. The site is screened from the Yardie Creek Road by rising terrain but is visible from the lighthouse and newly erected chalets on raised terrain of the Lighthouse Caravan Park, some 600 metres to the northeast.

The Project Area will be confined to an area of about 100 metres by 80 metres or 0.8 hectares.

Access to the Project Area is shown in Plates 3 and 4. It will be along approximately 950 metres of an existing gravel road which leads from the Yardie Creek Road to seismic line A95M-01 and about 50 metres of seismic line A95M-01. The gravel track from Yardie Creek Road to seismic line A95M-01 is visible from Yardie Creek Road, however, the section of the seismic line which will be used for access is not visible from this road. There is also no direct sightline from Yardie Creek Road to the Project Area. The section of the seismic line which will be used for access is located on limestone outcrop with a skeletal layer of red soil and sparse vegetation.

Grid co-ordinates and map data for the Project Area are as follows:

Latitude:	21° 48' S	Longitude:	114° 6' E
Easting:	200600 AMG	Northing:	7585000 AMG
Seismic shotpoint:	252	Height above sea level:	22 metres

2.4 Future Development

This Consultative Environmental Review requests approval to drill and evaluate the Melanie-1 exploration well. It does not seek approval to develop a gas and/or oil field in the event of such a discovery. In the event of a discovery, such approval will be sought once the resource has been fully appraised and information has been obtained on the quantities and qualities of the gas and oil fractions. Consultation with members of the Exmouth Community revealed concerns that a significant discovery of oil may lead to the occurrence of tankers exporting oil from Exmouth and that this could have adverse impacts on the marine environment due to potential spillages of oil and physical damage by tankers to the reefs off Exmouth.

Available geological information suggests that the Melanie-1 exploration well is more likely to result in a gas rather than an oil discovery. The local demand for energy is an attractive opportunity which could be met by a modest discovery of natural gas and consequently the drilling of the Melanie-1 exploration well has an attractive exploration potential. In the event of a gas discovery an immediate goal will be to provide energy for the two existing diesel power stations on Cape Range Peninsula. The Exmouth power station has an output of 9 megawatts and the power station for the Naval Communications Station has an output of 18 megawatts. The development of a commercial gas discovery would require the establishment of a gas valve system at the point where the gas comes to the surface. A less likely discovery of commercial quantities of oil can be expected to result in the establishment of a pump at the well head.

At this stage it is difficult to speculate on the type of development which would be required to develop a gas and/or oil discovery. It is known from the seismic data that the exploration target is minor in comparison to major international gas and oil discoveries, but that the target is prospective and situated adjacent to a market for natural gas. Consequently, there is potential for a discovery. It is likely that commercial volumes of oil would be transported out of the region by road tanker. A final decision on the means of exporting oil from the region can only be made after the evaluation of a discovery, and would be subject to an Environmental Impact Assessment by the Environmental Protection Authority as part of any future proposal to develop a resource in this area.

3.0 JUSTIFICATION AND PURPOSE

3.1 Outline of Proposal

The proposed Melanie-1 exploration well will be a standard exploration well. The infrastructure and activities required during drilling and evaluation is used widely by the petroleum industry of Australia and meets the environmental and safety requirements of the Department of Minerals and Energy. The entire operation will be confined to an area of 100 metres by 80 metres (0.8 hectares) which will support a standard drilling rig capable of drilling to a depth of 1,420 metres and a series of level pads for essential support facilities. The approximate layout of facilities within the Project Area is shown in Figure 4. The entire operation will be completed within a period of about six weeks, of which the actual drilling will require about three weeks. All of the infrastructure will be removed during decommissioning.

3.2 Purpose of Proposed Exploration

Drilling of the Melanie-1 exploration well will fulfil the minimum work requirement for year 5 of Petroleum Exploration Permit EP359. The proposed exploration will provide important information about the hydrocarbon potential of the portion of the Carnarvon Basin which lies onshore on Cape Range Peninsula. There are known offshore gas fields further to the north, however there is limited information available for the region surrounding the Melanie-1 exploration well. Consequently, drilling of the Melanie-1 exploration well is expected to provide valuable information for the interpretation of seismic data for the region.

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 the event of a discovery, the likelihood is high for a discovery of predominantly natural gas (rather than oil) as the drill target lies between the nearby gas discoveries of Macedon/Pyrenees and Rivoli-1. A discovery of modest volumes of commercially valuable hydrocarbons at the Melanie-1 exploration well would be viewed favourably by the Proponent since it is likely to meet local energy requirements. A discovery of natural gas has the potential to meet the energy demands of the diesel fuelled power stations currently operating on Cape Range Peninsula. The power station of the Naval Communications Station currently receives a diesel supply from ocean tankers which berth off an existing wharf facility at Point Murat and from there, pump the fuel to a nearby tank farm. Thus even a modest discovery is likely to result in substantial long term benefits to the local community by providing clean and cheaper energy and employment.

The target which is being drilled was identified by the Melanie seismic survey of 1995. An amplitude anomaly in the seismic data indicated the possible existence of a hydrocarbon accumulation in the target horizon, which is most likely to be gas. The Melanie-1 exploration well prospect is expected to have the following potential:

RESERVE SUMMARY			
	LOW	**MEDIUM**	**HIGH**
Closing contour (m secs)	990	1020	1040
Area of closure (sq km)	2.7	9.2	16.7
Porosity %	56	84	126
Sea water %	20	20	20
Nett pay	30	30	30
1/FVF oil	1.1	1.1	1.1
1/FVF gas	120	120	120
Oil in place (MMBBL)	21	73	133
Gas in place (BCF)	16	54	98
Recovery factor % oil	45	45	45
Recovery factor % gas	75	75	75
Recoverable reserves - oil (MMBBL)	10	33	60
Recoverable reserves - gas (BCF)	**12**	**41**	**74**

Abbreviations:

- 1/FVF = 1/formation volume factor
- MMBBL = millions of barrels of oil
- BCF = billion cubic feet

3.3.1 Legislative Requirements and the Approval Process

The operation of onshore petroleum exploration wells in Western Australia are governed by the WA Petroleum Act (1967) which is administered by the Department of Minerals and Energy. Regulations which apply to these wells are listed in a schedule published by the Department of Minerals and Energy (Department of Mines, 1991) and these ensure the safe operation of exploration wells and protection of the surrounding environment. The following regulations are selected examples that typically apply to petroleum exploration wells in Western Australia and are relevant to the Melanie-1 exploration well:

- 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 metres into a competent formation and the minimum surface casing requirement is 20 metres.

- 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 have to 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 the Department of Minerals and Energy.

- An emergency response manual will be prepared.

- 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.

All of the above regulations will apply to the Melanie-1 exploration well and they will ensure that this well is properly cased and pressure tested to prevent surface spillage or underground seepage of hydrocarbons. All conditions set by the Department of Mining and Energy are legally binding.

Environmental approval for the exploration well is determined by the Environmental Protection Act (1986) and administered by the Department of Environmental Protection and the Environmental Protection Authority. Each body reviews the Consultative Environmental Review on scientific and technical grounds and the Environmental Protection Authority will provide advice to the Minister for the Environment, who may then approve the project subject to legally binding conditions which are designed to ensure that the exploration well does not result in unacceptable environmental impacts. The following stages of approval are expected to follow the submission of the Melanie-1 Consultative Environmental Review. A flow chart of the Environmental Impact Assessment process in Western Australia is shown in Appendix E.

i. Melanie-1 Consultative Environmental Review is released to the public and a 4 week public review period follows.

ii. The Environmental Protection Authority prepares a summary of public submissions.

iii. Proponent responds to the summary of submissions.

iv. The Environmental Protection Authority undertakes assessment of the project and reports to the Minister for the Environment.

v. The Environmental Protection Authority releases its assessment report, which makes recommendations on approval for the project.

vi. Public may appeal against the contents of the Environmental Protection Authority's report and recommendations, during a 2 week period.

vii. Minister for the Environment assesses the appeals received and sets conditions for the proposed project.

3.3.2 Other Approvals Obtained

Other approvals obtained by the Proponent for the Melanie-1 exploration well include:

a) **Licence to Take Fauna for Scientific Purposes (Wildlife Conservation Act, 1950):** To permit the sampling and identification of aquatic cave fauna during drilling, thereby providing more data on the distribution of this fauna on Cape Range Peninsula.

b) **Groundwater Well Licence (Rights in Water and Irrigation Act, 1914):** Approval to sink a water bore adjacent to the exploration well to provide a water supply for the drilling circuit.

3.4 Alternative Options

The Proponent recognises that Cape Range Peninsula is an environmentally important and sensitive area, with interesting landforms, geological formations and a wide variety of flora, fauna and habitats. The Peninsula is noted for its scenic values and high tourism interests, due primarily to a warm winter climate, and the presence of Cape Range National Park and Ningaloo Marine Park. Mindful of these attributes and its responsibilities to the environment, the Proponent selected the Project Area from a number of possible drilling locations on the basis of least environmental and social impacts. The selection of a suitable site along seismic line A95M-01 was influenced by the following:

- minimal disturbance to the existing terrain, soil and vegetation,
- minimal visual impact by locating the site behind rising terrain, and
- location of the drilling target.

The layout of facilities within the Project Area was selected on the basis of environmental considerations to minimise potentially adverse environmental and social impacts.

4.0 EXISTING ENVIRONMENT

Regional environmental data for the Project Area were obtained during the 1995 seismic survey and supplemented with site specific information collected in April and June 1996 and again in January and March 1997. During each visit the Project Area and its surrounds were traversed extensively on foot. Samples of all flora within the Project Area and its immediate surrounds were collected for verification of field identifications in the Herbarium of Western Australia, photographs were taken, habitats were identified, soil types and soil depth were noted, and landform and drainage characteristics were described. All signs of animals such as scats, burrows and tracks were recorded. The Project Area was also appraised with respect to the possible layout of facilities so that disturbances to the surface of the Project Area will be minimised.

4.1 Landuse

The Project Area is located on Vacant Crown Land some 18 km to the north of Cape Range National Park. The Ningaloo Marine Park lies offshore to the north and west, the closest distance to the Ningaloo Marine Park being 1.3 km to the north. The Jurabi Coastal Park which is jointly managed by the Shire of Exmouth and the Department of Conservation and Land Management, lies approximately 1.2 km to the east. In the *Red Book* of 1975 the Vacant Crown Land was recommended for inclusion in Cape Range National Park and much of the area under recommendation has since been included in this Park. The region in which the Project Area is located is included on the map attached to the *First Report of the Legislative Council Select Committee on Cape Range National Park and Ningaloo Marine Park* (Edwards, December 1995) as a Red Book recommendation for extension of Cape Range National Park.

Defence, tourism, commercial fishing and conservation are the main land uses of Cape Range Peninsula. There is also potential for oil and gas discoveries. A proposal to mine limestone was recommended for approval by the Environmental Protection Authority in March 1997 and a proposal for a major subdivision development on the eastern side of Cape Range is currently being assessed. A marina is being constructed near Exmouth. Commercial fishing, especially prawning, is an important regional industry which has onshore processing facilities.

The greater region of the Project Area is a popular tourist destination. The Project Area is located near a highway which provides access to tourist destinations of Cape Range National Park to the south, nearby Ningaloo Marine Park and the town of Exmouth.

4.2 Climate

Climatic data were obtained from the Bureau of Meteorology for Learmonth.

The climate of the Project Area is hot and semi-arid with mean monthly maximum and minimum temperatures for nearby Learmonth ranging from 24 to 38°C and 11 to 24°C, respectively (Table 4.1).

TABLE 4.1: Climatic Data

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
MAX (°C)	38	38	37	33	28	25	24	26	29	32	35	37
MIN (°C)	23	24	24	21	16	13	11	12	14	16	19	21
Rainfall (mm)	27	22	27	21	51	50	29	16	3	2	2	2
Pan Evaporation (mm)	385.8	306.2	302.1	239.2	172.8	117.3	134.0	173.9	237.5	315.7	342.3	390.3

Annual average rainfall for Learmonth is 252 mm.

Rainfall occurs mainly during the period of January to August. Cyclonic rains generally occur in February and March, when intense precipitation may occur, and typically last for one and occasionally two days. Isolated records show rainfalls of more than 200 mm per day. The highest monthly rainfall of 361 mm was recorded in January 1967. Reliable winter rains occur mainly during May and June. The mean monthly distribution of rainfall for Learmonth is included in Table 4.1.

Twenty-four hour rainfall events of greater than 100 mm for the period from 1915 to 1995 are given below. The data shows that on 26 occasions rainfall events in excess of 100 mm per day were recorded (Table 4.2). Two of these were in excess of 200 mm and one was greater than 300 mm. During this 80 year period single rainfall events of greater than 100 mm rarely occurred more than once per year, but occurred twice during the years 1918, 1927 and 1933 and on three occasions in 1923. On average, single rainfall events of 100 mm or more can be expected once every 3 years.

TABLE 4.2: Extreme Rainfall Events

RAINFALL (mm)	NUMBER OF OCCASIONS
100 to 119	8
120 to 139	8
140 to 159	4
160 to 179	2
180 to 199	1
200 to 300	2
300	1
TOTAL	26

Annual pan evaporation is about 3150 mm, which exceeds the average annual precipitation of 252 mm by about 2900 mm.

Wind data from Tantabiddi Well in the north of Cape Range National Park indicate winds predominate from the south-southwest with velocities ranging from 1 to 3 metres per second to over 10 metres per second. A sea breeze develops in the late morning, with brisk sea breezes from the south occurring in 70% of the afternoons. Cyclonic winds may be severe, exceeding 150 km per hour.

In October and November winds are associated with the southeast monsoon, whilst from December to March winds are associated with the southwest monsoon. Wind speeds usually range from 7 to 11 knots, exceeding 25 knots for about 5% of the time.

Cyclones can be expected from approximately November to April. The average number of cyclones per annum for Cape Range Peninsula is 1.5 and the average frequency of severe cyclones with central pressures of less than 980hPa is nearly one per year.

4.3 Terrain and Soil

The Project Area is located on limestone which is strongly re-cemented to calcrete and is karstified. The site is at an elevation of approximately 22 metres above sea level. The majority of the Project Area is located in a relatively flat area between a major ridge to the west and the shoulder of another ridge to the southeast, with approximately 30% of the Project Area having a slope of 5 to 10°. This sloping terrain occurs predominantly on the perimeter of the Project Area where the land rises towards a ridge. The area drains mainly towards a gently undulating coastal plain area, which discharges to the sea.

The soil of the Project Area is a shallow, red/brown, calcareous sandy loam over limestone and limestone conglomerate. The central or flatter parts of the Project Area are part of a depositional landscape, where soil has accumulated and is deepest. On the slopes at the perimeter of the Project Area limestone and limestone conglomerate is close to the surface and in many areas the surface consists of exposed limestone.

4.4 Geology and Hydrogeology

The Project Area is located within the Carnarvon Basin which encompasses Cape Range Peninsula and extends inland for about 160 km. The Carnarvon Basin is a low-lying sedimentary basin with exposed rocks of Permian to Recent origin.

The geology and hydrogeology of Cape Range Peninsula was reviewed by Allen in 1993. The rocks which form the core of Cape Range Peninsula are a sequence of limestone formations. The regional water table of the Peninsula is contained mainly within the permeable limestone system beneath the ranges and eastern coastal plain. Groundwater flow is from the ranges via the coastal plain to the ocean, where it discharges largely as sub-sea springs. The limestone is susceptible to leaching by the weak acidic condition of rainfall, occasionally resulting in the formation of extensive systems of caverns and micro-caverns known as karst formations, within the layer of

limestone exposed to the fresh water horizon of the groundwater. A generalised diagram showing the hydrogeology of Cape Range is shown in Figure 5.

4.4.1 Karst Formations

Cape Range is underlain by a series of caves which developed in response to geological factors, climatic factors and worldwide changes in sea level. Over 300 caves are known to exist in Cape Range. The development of a Karst system probably commenced in the late Miocene - early Pliocene, at which time a groundwater flow system from the ridges of Cape Range toward the coast developed. This flow of groundwater would have passed predominantly through the relatively pure and permeable Trealla and Tulki limestones, and over the underlying and relatively impermeable Mandu limestone.

During the Pleistocene era the sea level was about 60 metres below the current sea level. The perpetual rise and fall in sea level, coupled with the flow of groundwater through Trealla and Tulki limestone towards the sea and a steady rise in sea level since this era, has led to the development of cavernous formations from the current sea level to a depth of about 60 metres below the present sea level (Allen, 1993). Drilling in the region has shown that most of the cavernous formations are confined to the present layer of fresh water above the saline groundwater (Kevin Morgan and Angus Davidson pers comm). Substantially less cavernous formations prevail below the current fresh water horizon because of calcification and natural infilling of the limestone formations since the Pleistocene era (Kevin Morgan, pers comm).

The cavernous formations are not expected to extend deeper than approximately 60 metres below sea level (Kevin Morgan and Angus Davidson, pers. comm. and letter of 30 May 1996, Appendix F).

4.4.2 Groundwater

According to Kevin Morgan (pers comm), who has drilled a number of shallow holes to 30 metres depth below sea level in the near vicinity of the Project Area, there is no fresh water aquifer beneath the Project Area. At best, it is likely to have a 1-2 metre layer of brackish water before having a total dissolved solids (salt content) concentration which is approximately similar to that of sea water (35000 mg/L). This is because the limestone in the vicinity of the Project Area has very low rechargeability, no restricted permeability and is close to the sea. These conclusions concur with those of Angus Davidson (pers comm). According to Allen (1993), high salinity in bores near the Project Area suggests the presence of a highly permeable, cavernous aquifer and a very thin layer of groundwater. A generalised diagram of groundwater salinities on Cape Range Peninsula is shown in Figure 6 (Allen, 1993). Recharge to the aquifer comes from a confined catchment on an infrequent basis. This concurs with information provided by Davidson and Morgan.

A bore drilled in 1978 near the lighthouse, on terrain similar to that of the Project Area, encountered groundwater at a depth of 18m, which was approximately equal to the level of sea water. The shallow groundwater in this bore had a total dissolved solids content of about 15,000 mg/L and a flow rate of 12,000 gallons per hour. According to the

drilling contractor, a hard, white rock (presumably limestone) was encountered between 0-6 metres.

Available regional data and sampling of bores near to the Project Area, indicates that potable groundwater will not be encountered beneath the Project Area. More detailed information on the quality of groundwater beneath the Project Area will be made available during the establishment of a groundwater bore adjacent to the proposed location of the Melanie-1 exploration well.

4.4.3 Geological Profile of the Melanie-1 exploration well

For the Melanie-1 exploration well it will be necessary to drill through a series of geological formations before reaching the target Cretaceous formation which may contain hydrocarbons. A geological profile of the drilling path for the Melanie-1 exploration well is shown in Figure 7 and is expected to consist of the following:

- Surface to 240m - Trealla limestone (possibly cavernous especially to 60 metres depth)
- 240 metres to 560 metres - Mandu limestone and Cardabia limestone (non-cavernous)
- 560 metres to 950 metres - Tertiary formations
- 950 metres to 1365 metres - Cretaceous formations
- 1365 metres to 1420 metres - Jurassic formations

4.5.1 Subterranean Fauna

Extensive subterranean habitats exist within the limestone cavities which honeycomb Cape Range Peninsula and these are known to contain cave fauna which are considered unique. Other similar habitats are known for Barrow Island (Humphreys, 1993) but the distribution of individual species is not well understood. This fauna has been reviewed by Knott (1993), Harvey *et. al.* (1993) and Humphreys and Adams (1991). Cave fauna is a simple term used to embrace several categories of animals (troglophiles, troglobites, trogloxenes, stygofauna and stygophiles) which utilise a range of underground habitats varying in void size and type, from dry to fresh and brackish water (Humphreys, 1993). Void sizes may vary from the small spaces between gravel particles beneath stream beds to caverns in limestone of more than 20 cm in diameter. The cave fauna include up to 34 species (Dr W Humphreys, pers comm 1995), including species of blind cave fish and eels and a large range of invertebrate groups. This cave fauna is believed to be a remnant of a diverse surface fauna which prevailed at a time when surface conditions were very wet. Such conditions are estimated to have existed more than 170,000 years ago (Wyrwoll, *et al* 1993).

The extent of limestone cavities and gravel habitats is not known, with the known distribution of cave fauna having been estimated mainly from wells and bores on the coastal plain of the western and eastern sides of Cape Range Peninsula. The extent of habitats and the distribution of species is further complicated by the interaction of salt and fresh water beneath the coastal plain with the aquatic species appearing to prefer habitats of fresh water (Knott, 1993).

Several species of cave fauna which are thought to occur only on Cape Range Peninsula have been gazetted (April, 1994) under the Wildlife Conservation Act of 1950 as rare and/or endangered. These include Cape Range Schizimid Spider (*Schizomus vinei*) and Cape Range Blind Cockroach (*Nocticola flabella*) which occupy the dry caves beneath Cape Range; the Blind Gudgeon Fish (*Milyeringa veritas*), Blind Cave Eel (*Ophisternon candidum*) and two cave-shrimp species (*Stygiocaris lancifera, Stygiocaris stylifera*) which occupy groundwater habitats beneath the coastal plain (Humphreys and Adams, 1991; Humphreys, 1993). Except for *Stygiocaris stylifera*, these species appear to be restricted to Cape Range Peninsula. *Stygiocaris stylifera* has been found in similar cave habitats on Barrow Island (Dr W Humphreys, pers comm). The exact distribution of the habitats of these protected species is uncertain, but it is assumed that these animals could occupy dry and groundwater habitats beneath the Project Area. This is confirmed by recent sampling of shallow bores by Dr Humphreys (pers. comm., June 1996).

The habitats within limestone caverns beneath the Project Area could conceivably consist of:

- Dry to very humid caves which could be occupied by a range of invertebrate troglobite species, including the gazetted Cape Range Spider and Blind Cockroach.

- Fresh to brackish groundwater in caverns and cavernicoles. These could be occupied by up to 34 invertebrate and 3 vertebrate troglobite species, including two gazetted Cave Shrimp species, Blind Cave Eel and Blind Gudgeon Fish.

The groundwater habitats are considered to be of very high conservation value because they are restricted to isolated regions of Western Australia. Humphreys (1993) states that *small disturbances to their physio-chemical environment can have a profound effect on the viability of the troglobite populations*. He concluded that because of the interdependence of cave fauna species *the underground fauna needs to be treated as a separate component of any management plan, and the emphasis placed on the underground habitat rather than the species*.

4.5.2 Recent Findings from Sampling of Subterranean Fauna

During the seismic survey completed by Ampolex Limited in 1995, a number of upholes were left open for Dr W Humphreys to sample and document subterranean fauna. Preliminary findings of this sampling survey established a significant increase in the distribution of the aquatic and terrestrial components of the fauna. The Blind Gudgeon *Milyeringa Veritas*, a listed species, was found in seismic uphole number 7 which is about 1 km to the northwest of the Project Area. This record extends the known geographic range of distribution for this species northwards by 4 km, to the

northern tip of Cape Range Peninsula. No subterranean fauna were recorded in the seismic uphole closest to the Project Area. A copy of this preliminary report is provided in Appendix C.

4.6 Land systems

Cape Range Peninsula was surveyed by the Department of Agriculture of Western Australia (Payne *et al*, 1987) to establish an inventory of landsystems and their condition for the Carnarvon Basin. The Project Area is within the Learmonth Landsystem which includes *sandy outwash plains marginal to Cape Range, supporting mainly soft spinifex hummock grasslands with scattered Acacia shrubs.* This landsystem covers 285 km² and consists of a number of landscape units. The Project Area is part of the *Stony Footslopes Landscape Unit* which comprises approximately 20% (57 km²) of the total Learmonth Landsystem and consists of *gentle footslopes below Cape Range, up to 42 metres above lower units. Soils are shallow clay types, sandy clay grading to medium clay, lightly strewn with limestone gravels and with limestone inclusions throughout.* The landscape unit extends for many kilometres along the western and eastern edges of Cape Range and lies between the coastal plain and the ranges. The Project Area (0.8 hectares) comprises less than 0.01% of the Stony Footslopes Landscape Unit.

A site specific inspection confirmed that the Project Area is typical of the regional description of Payne *et al* (1987). The Project Area is located on the footslopes of Cape Range and the vegetation consists of low open mixed shrubland over spinifex grasses on skeletal to shallow red/brown sandy loams over limestone and limestone conglomerate.

4.7 Flora and Vegetation Communities

4.7.1 Common Flora

The vegetation and flora of the Stony Footslopes Landscape Unit is common within the Learmonth Landsystem and elsewhere on the Peninsula and beyond. The vegetation consists predominantly of scattered *Acacia bivenosa*, *Acacia pyrifolia* and *Acacia tetragonophylla* shrubs over the hard spinifex grass *Triodia pungens*.

The flora within the Project Area and the surrounding ridges is as follows:

- Shrubs and trees between 50 cm and 2 metres in height which include *Acacia bivenosa, Acacia coriacea, Acacia gregorii, Acacia pyrifolia, Acacia tetragonophylla Anthobolus leptomenoides, Banksia ashbyi, Exocarpos aphyllus, Gossypium robinsonii, Hibiscus leptocladus, Melaleuca cardiophylla, Mysporum adscendes, Pimelea ammocharis, Sarcostemma australe* and *Senna glutinosa.*

- Shrubs to 50 cm in height which include *Abutilon exonemum, Chenopodium gaudichaudianum, Heliotropium ramosissimum, Indigofera monophylla, Jasminum didymum* ssp. *lineare, Maireana sedifolia, Phyllanthus fuernrohrii, Psoralea* sp., *Senna glutinosa, Solanum lasiophyllum* and *Tribulus suberosus.*

- Groundcovers and small plants include *Commelina ensifolia*, *Euphorbia drummondii*, *Goodenia muelleriana*, *Haloragis gossei*, *Heliotropium crispatum*, *Hibbertia spicata* ssp. *spicata*, *Hybanthus aurantiacus*, *Psoralea* sp. *Ptilotus clementii*, *Sida rohlene*, *Stemodia viscosa*, *Portulaca pilosa*, *Sphaeranthus indicus*, *Tephrosia rosea* and *Wahlenbergia* sp..

- The annuals *Ptilotus exaltatus* and *Crotalaria Cunninghamii* are also present.

- The most common grasses are the spinifex species *Triodia angusta* and especially *Triodia pungens*. A few plants of the introduced *Cenchrus ciliarus* (Buffel grass) are also present.

4.7.2 Rare and Priority Listed Flora

No declared rare flora have been listed for Cape Range Peninsula. Priority listed flora have been identified based upon lists prepared by the Department of Conservation and Land Management on 1 October 1996 (Table 4.3).

TABLE 4.3: Priority Listed Flora

Species/Taxon	Conservation Code	Distribution	Flower Period
Abutilon sp. Cape Range	2	Cape Range, Yardie Creek, Learmonth	-
Abutilon sp. Quobba	2	Quobba, Cape Range, Minilya	Jul-Oct
Acacia alexandri	3	Cape Range, Exmouth	Jun-Sep
Acacia startii	3	Cape Range, Rough Range, Minilya	Jul-Aug
Acanthocarpus rupestris	2	Cape Range	May-Jun
Brachychiton obtusilobus	4	Cape Range	Aug-Sep
Corchorus interstans	2	Exmouth, Ningaloo Station	May-Sep
Daviesia pleurophylla	2	Cape Range	Sep-Oct
Eremophila occidens	2	Cape Range	-
Eremophila youngii subsp. *lepidota*	4	S Cape Range, Roy Hill, N Mt Vernon, Paraburdoo	Mar, Jun
Grevillea calcicola	3	Cape Range, Learmonth, Yardie Creek	Aug-Sep
Livistona alfredii	4	Millstream, Cave Creek, Cape Range	Nov-Dec
Stackhousia umbellata	3	North West Cape	-
Verticordia serotina	2	Cape Range National Park	Sep

Priority listed species listed below were observed during the seismic survey of 1995. The Project Area was specifically searched for these and the other priority listed species.

- *Daviesia pleurophylla* m.s. (Conservation Code 2). This species is locally common on red sand dunes and crests in the vicinity of seismic lines 1, 2, 5, 6, 7 and 11. All of these locations are remote from the Project Area and on a different Landscape Unit.

- *Brachychiton obtusilobus* (Conservation Code 4). This species is located in gullies on Cape Range and on the foothills of the ranges. It was observed in the vicinity of seismic lines 1, 5, 8 and 9 as scattered individual trees. These trees are not within the immediate vicinity of the Project Area but were observed further afield.

- *Acanthocarpus rupestris* (Conservation Code 2). This species is located on shallow soils over limestone in dune swales and on foothill slopes of Cape Range. It was observed in the vicinity of seismic lines 1, 3, 4, 5, 6, 8 and 9. The species is locally abundant, both in clumps and scattered, but it was not found in the vicinity of the Project Area.

- *Stackhousia umbellata* (Conservation Code 3). This species is located on upper and foothill slopes of Cape Range. Scattered groups of *Stackhousia umbellata* were observed in the vicinity of seismic lines 1 and 3, but this species was not observed in the vicinity of the Project Area.

- *Acacia alexandri* (Conservation Code 3). This species has a scattered distribution, generally in dune swales on shallow soils over limestone. It was observed in the vicinity of seismic line 6, but it was not observed in the vicinity of the Project Area.

No rare and priority listed species were found within the Project Area and its immediate surrounds.

4.7.3 Weeds

No broad leafed weeds were found within the Project Area, but a few isolated plants of the introduced grass *Cenchrus ciliaris* (Buffel Grass) were found. This grass is regarded by many as a naturalised pasture grass and it is widespread and common in the region.

4.8 Fauna

4.8.1 Common Fauna

The fauna of Cape Range Peninsula were reviewed in the 1993 *Symposium of the Biogeography of Cape Range Peninsula* (Slack-Smith, 1993; Harvey *et al*, 1993; Kendrick, 1993; Baynes and Jones, 1993). Various cave fauna have been extensively reviewed, including Arachnids (spiders), Myriapoda (millipedes and centipedes) and non-marine molluscs (land snails). The mammalian, amphibian and reptilian fauna have also been reviewed with an extensive fauna list having been established for Cape Range Peninsula. These species are widely distributed in the habitats of the Project Area, which are extensively represented on Cape Range Peninsula and in Cape Range National Park.

Cape Range National Park contains a variety of ecosystems due to its rugged and complex terrain which provides water catchments in deep gullies and gorges, where floral assemblages are found in sheltered areas. In contrast, the Project Area covers a very small area of shallow soils, or no soil over limestone, providing a uniform and very common habitat. The Project Area does not support any fresh water holes. Animals

observed in or near the Project Area included small skinks and common bird species which utilise low shrubs and trees for shelter and food foraging.

A total of 49 mammals, 84 reptiles, 5 amphibians and about 200 bird species are known to occur on Cape Range Peninsula. Of these, the skink *Lerista allochira* is restricted in its distribution to Cape Range Peninsula. Two bird species, *Colluricincla harmonica rufiventris* (Grey Thrush-shrike) and *Petrophasse plumifera* (Spinifex Pigeon), show distinct morphological variation in locally isolated populations.

A large number of bat species occur on Cape Range Peninsula with most of these roosting in caves and trees which are common in Cape Range National Park. No bats roost in the Project Area due to a lack of caves and other roosting sites.

Vermin species which are likely to be found in the locality of the Project Area include cats, foxes, goats, mice, rabbits and rats. Goats were seen near the Project Area.

4.8.2 Rare Terrestrial Fauna

Of the gazetted rare or endangered native mammals which might be found in the greater project region only the Pebble-mound Mouse (*Pseudomys chapmani*) is likely to be found in habitats typical of the Project Area.

Characteristic mounds of the Pebble-mound Mouse, one of which was thought to be active, were discovered by Muir Environmental (1995) on the coastal plain south of Exmouth in habitats which are very similar to that of the Project Area. This species has been gazetted (April, 1994) under Schedule 1 of the Wildlife Conservation Act (1950), as rare and/or endangered. No pebble mounds were found within or near the Project Area during extensive searches and none were observed during the seismic survey.

Bird species which have been gazetted as rare and endangered, such as the Grey Falcon (*Falco hypoleucos*) and the Peregrine Falcon (*Falco peregrinus*), could be found within the Project Area. These species are wide-ranging in their daily and seasonal habits and they are unlikely to be affected by activities within the Project Area.

There are no habitats within the Project Area which could affect the survival of terrestrial (as distinct from subterranean animals) mammals, birds or reptiles which have been gazetted as rare and/or endangered.

4.9 Conservation Value of Habitats in the Project Area

The flora and vegetation of the Project Area are common and widespread on Cape Range Peninsula and comprise less than 0.01% of the Stony Footslopes Landscape Unit.

The vertebrate habitats at the surface of the Project Area provide the following:

- Refuge, mainly for small lizards, in leaf litter, beneath stones and dense shrubs and spinifex grasses.

- Feeding habitats for bird species when shrubs and annuals are flowering. Both nectar feeding species and insect catching birds are attracted to plants in blossom.

- Feeding habitats for bird species which hunt for invertebrates and small lizards.

- Feeding habitats for birds of prey which hunt small reptiles, mammals and birds which utilise the shrubland habitats.

All of the above habitats are extensively represented on Cape Range Peninsula. The Project Area is therefore not considered to support habitats which are of outstanding regional significance.

4.10 Neighbouring Reserves

The Project Area is located on vacant Crown land which is in a region renowned for its listed conservation reserves. It is not part of an existing reserve, and the Project Area is 18 km to the northeast of Cape Range National Park and 1.3 km to the south of the Ningaloo Marine Park. The Jurabi Coastal Park which comprises a strip of land between the western coast and Yardie Creek Road, is located approximately 1.2 km to the east.

4.10.1 Ningaloo Marine Park

The Ningaloo Marine Park is located some 1200 km to the north of Perth by road. It is a key conservation area which extends for 260 km along the west coast of Cape Range Peninsula and protects Australia's largest fringing coral barrier reef and its associated marine animal and plant communities. Popular for fishing and diving, Ningaloo reef is the only large reef in the world found so close to a continental land mass. The reef is about 100 metres offshore at its nearest point and less than 7 km at its furthest.

At its closest point, the western coastline of Cape Range Peninsula and the border of Ningaloo Marine Park are about 1.3 km to the north of the Project Area. The coast is separated from the Project Area by a rising ridge to the north and northwest (Plate 1).

4.10.2 Cape Range National Park

Cape Range National Park is located on and encompasses about one third of Cape Range Peninsula. The Park contains a diverse assemblage of flora species and numerous fauna species. It abuts the Ningaloo Marine Park and is dominated by a 330 metre high anticline of Miocene limestone which runs the length of the Peninsula. It is a popular tourist destination which is managed by the Department of Conservation and Land Management. Cape Range National Park contains various walk trails, caves, Aboriginal cultural heritage sites, camping areas and the recently constructed Milyering Visitors' Centre.

4.11 Heritage Sites

4.11.1 Aboriginal Cultural Heritage Sites

Aboriginal cultural heritage sites are protected under the WA Aboriginal Heritage Act 1972-95 and may be ethnographic, archaeological or both.

A survey of the Register of Sites of the Department of Aboriginal Affairs suggested that the Project Area does not support sites which are of cultural significance to Aboriginal people. An archaeological survey undertaken for the seismic survey of 1995 and subsequently for the Project Area found no archaeological material within the Project Area and its immediate surrounds (W G Martinick & Associates Pty Ltd, 1993).

In March 1997 the site was inspected by an Aboriginal Elder with traditional affinities with the Project Area and its surrounds and the recognised authority to speak on Aboriginal cultural sites of the region. This Elder had discussed the proposed project with other relevant Aboriginal people and subsequently confirmed that the Project Area and its immediate surrounds do not constitute an Aboriginal cultural heritage site.

4.11.2 European Heritage Sites

There is no evidence to suggest that the Project Area is a European heritage site.

5.0 PROPOSED OPERATIONS AND MANAGEMENT

5.1 Site Preparation

An overall management objective is to undertake all site operations with minimal disturbance to the terrain, surface and vegetation and to design the layout so that it can be readily rehabilitated on completion of drilling. The total area required for the Project Area is about 100 metres x 80 metres (0.8 ha). Wherever practically possible, it is proposed to use the natural contours of the land within the Project Area for the siting of the various operational facilities, thereby minimising disturbance to the soil and terrain. As the Project Area is located in a predominantly flat area, the construction of several level pads for various infrastructure within the Project Area will require minimal disturbance to the existing terrain.

The objective is to avoid or minimise the total clearing of vegetation from the Project Area. This will be achieved, wherever possible, by flattening the natural vegetation in areas which are required as pads, by use of an appropriate earthmoving machine such as a front-end loader which will push a bucket a few centimetres above ground level. Disturbances to the rootsystems of the vegetation will be minimised by this method. Where larger shrubs have to be removed and flattening is not feasible, they will be pruned at ground level to leave the root system undisturbed. The surface of the respective pads will then be levelled with limesand, and following decommissioning it is anticipated that regrowth will occur from the root stock. Most of the remaining vegetation within the Project Area will not be flattened, pruned or destroyed. Prominent stands of bushes which can be retained will be identified and marked with flagging tape to avoid them being accidentally destroyed.

5.2 Site Layout

The main facilities which have to be established on the Project Area are shown in Figure 4 and include:

- Drilling unit complete with ramps
- Catwalk
- Sump
- Suction tank
- Shaker tank
- Fuel tank
- Water tank
- Pipe and casing rack area
- Generator shack
- Pressure accumulator and pressure accumulator walks ("Koomey")
- Pumps
- Choke manifold

The pad for the drilling rig will include the following pits:

- A cellar, approximately 2 metres by 2 metres square and 1.5 metres deep (below ground level), with steel reinforcement of the walls to prevent erosion. This cellar will be in a central position within the pad and it will surround the hole which is to be drilled.

- A polyethylene lined sump, approximately 20 metres by 15 metres and 2.5 metres deep will be established to contain all drilling cuttings and mud. A temporary mesh fence will be constructed around the sump to prevent people and larger animals from falling into the sump.

- A flare pit, about 6 metres by 3 metres and 2 metres deep, with a fire wall on 3 sides. The flare pit will meet design specifications of the Department of Minerals and Energy. It will be located in one corner of the site and will be used to flare hydrocarbons in the event of testing the formation.

All of the required facilities will be contained within a Project Area of about 100 metres by 80 metres (0.8 hectares).

A number of the facilities, machinery and other equipment need to be located on level surfaces. Such surfaces will be established by appropriate spreading of limestone gravel which will be obtained from an existing quarry which is located about 4 km from the Project Area. A number of level pads will be created by this method, with mainly intact vegetation being retained on the remainder of the Project Area. Walkways between these pads will be established and where feasible, they will consist of wooden or steel duckboards placed a few centimetres above ground level to minimise damage to vegetation and compaction of the soil. In 1996 the use of duckboards was recommended by the Cape Conservation Group after they studied an advanced draft of the document which was forwarded for assessment to the Department of Minerals and Energy in June 1996. On decommissioning the introduced limestone gravel will be removed as far as is practically possible to re-expose the underlying vegetation. Most of this vegetation is then expected to recover by sprouting from above ground growth and by regrowth from the rootsystem. In some instances removing all of the gravel will be impossible because of indurated surfaces which are difficult to work with earth moving machinery.

The sump will be constructed on the limestone surface and lined with polyethylene to prevent seepage. It will consist of 2 or more sections to allow the precipitation of drilling mud and stone chips into a section near the drilling rig, and the decanting of water into a section from where water can be recycled to the drilling circuit. On decommissioning the section of the sump containing the drilling mud and stone chips will be drained into adjacent section(s) and the clean water will then be pumped into the groundwater well. The drilling muds are then expected to be dry enough to allow their excavation and removal from the Project Area. If the drilling muds are not sufficiently dry, some of the limestone gravel will be mixed into them until the mixture is sufficiently dry to permit it being handled by a backhoe or similar machinery. This will avoid having to wait long periods for excess water to evaporate from the mud before excavation is possible. A mesh fence will be established around the sump to avoid the

possibility of kangaroos or other large fauna and people falling into the sump during the drilling operations. This was a concern of the Cape Conservation Group. It is highly unlikely that animals will approach the sump during drilling operations because of the associated noise and activities.

To minimise the size of the Project Area and to reduce potential impacts, off-site accommodation will be used for the drilling crew with only the Drilling Supervisors residing at all times on the Project Area. A portable chemical toilet will be on location throughout the drilling of the well. The design of the layout of the operational facilities will be overviewed by the Proponent's Environmental Consultant.

5.3.1 Drilling Operations

Drilling will be to a depth of about 1420 metres. The proposal is to drill the section above the water table (about sea level) with the aid of an air hammer because of the hardness of the surface limestone formations. This technique will not require drilling lubricants or water and will rely on air to blast stone chips and crushed stone away from the drilling bit. Once this section has been drilled it will be reamed to a diameter of 311 mm and cased. From then onwards it is estimated that a further 220 metres of limestone formation will have to be drilled, of which the section to 60 metres below sea level (particularly the first 1-2 metres below sea level) is likely to be cavernous. In a worst case situation, namely where drilling encounters extensive caverns in the limestone formation, it is likely that no water and no drilling wastes will be returned to the surface until this 250 metre section has been cased to stop the material being lost to the caverns. Before this 250m section is cased the proposal is to use water during drilling to facilitate the passage of the drill bit. If pressure is lost during drilling, indicating that a cavernous space has been met, a "hi-vis pill" would be introduced every 10 metres between the depths of 50 metres and 250 metres. These "hi-vis" pills would be approximately 8 to 16 m^3 of fluid and would consist predominantly of water, with the following added components:

- approximately 11kg of bentonite
- approximately 1kg of lime
- approximately 0.11 to 0.23kg of caustic soda

At the above concentrations, these additives will not have a toxic impact on the quality of groundwater. The concentrations are within the limits specified for marine waters and for water used for livestock watering (ANZECC, 1992).

Approximately 20 "hi-vis" pills would be introduced to the Melanie-1 exploration well, between the depths of 50 and 250 metres, which is within the water table and is mostly beyond the most cavernous section of the limestone formation. The addition of water and a "hi-vis" pill to the well assists in bringing drilled stone chips and other drill wastes (crushed rock) to the surface for precipitation into the waste pit. In the event that the well strikes a large cavernous space during drilling, the water and hi-vis pill will be lost.

Immediately after the entire limestone formation has been drilled, this section will be fully cased and cemented to prevent the escape of any waste material produced whilst

drilling into the non-cavernous formations (below 250 metres). Cementing will pass down the inside of the well casing in order to cement the base of the casing, which will be at a depth of 250 metres. From the base upward, cement will fill the annular space between the casing and the wall of the well hole. From then onwards, a water-based potassium chloride polymer will be used to facilitate the drilling and all drilling fluids will be recycled. The potassium chloride polymer is non-toxic and biodegradable and is widely used onshore and offshore in the Carnarvon Basin. The only significant loss of water will then be by evaporation from the surface.

A generalised well design is shown in Figure 8. The diameter of the drill hole will be 311 mm to a depth of 250 metres and 216 mm from then onwards, to the final depth of 1420 metres.

Substantial cavernous limestone is unlikely to be encountered whilst drilling above the water table because of the absence of a fresh water table which would have created such caverns. The Project Area is known to be in a cavernous region but experience from nearby bores suggests that there is a far greater probability of not intercepting caverns than to intercept caverns (Kevin Morgan, pers comm).

5.3.2 Drilling with Water

The drilling operation from the groundwater table downwards will require approximately 1100 litres of water per minute (or 18.3 litres per second) which will, in an ideal situation of no losses, be totally recycled within the drilling circuit. In a worst case scenario, namely one where the drilling encounters large caves within the limestone formations, all of this water could be lost to the caverns. Under such conditions there will be a need for a make up supply of water at a rate of up to 1100 litres per minute. Regional information suggests that this scenario is unlikely to be encountered and consequently it is more likely that a make-up water supply of about 200 litres per minute or less will be required.

The proposal is to abstract up to 1100 litres per minute of make-up water from a bore which will be established about 40 metres adjacent to the proposed Melanie-1 exploration well. This bore will be drilled to a depth of about 80 metres 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 about 30 metres below sea level. This bore will permit all of the water to be abstracted on site. The make-up water bore will be drilled using a contractor who is familiar with the drilling of limestone formations. The proposed bore is expected to be drilled with a percussion cable tool, to a depth of about 80 metres and it will be constructed with PVC. The actual drilling of the water bore will be facilitated with water, which will be carted to the site by a water truck. This method of drilling is commonly used for production bores in limestone areas.

All of the potential losses of water to cavernous environs will be to the aquifer from which the water is being abstracted. Since the water bore will only be about 40 metres from the Melanie-1 exploration well it is highly likely that a system of water recycling below the ground surface will become established in the event of a cavernous limestone

formation being drilled. In the likely event that no cavernous horizons are encountered, most of the water abstracted from the bore will be directed from the Melanie-1 exploration well into the drilling tanks for recycling, with only a small amount of make-up water being required.

The available regional data suggests that the surface 1-2 metres of the water table consist of brackish water with a total dissolved solids content of about 5000 mg/L, and probably more like 15000 mg/L, which changes to a salinity of about 35000 mg/L within a few metres. None of this water will be permitted to escape at the surface into the surrounding environment.

Once the Melanie-1 exploration well has been fully cased, all of the water will be recycled with a small volume being abstracted from the bore as make-up water, possibly up to 200 litres per minute. Non toxic drilling cement which is commonly used onshore and offshore in petroleum exploration wells will be used to seal the casing strings within the Melanie-1 exploration well, from the surface to a depth of 250 metres. The cementing of exploration wells to seal the drilling circuit from the surrounding subsurface environment is a requirement of the Department of Minerals and Energy and will be completed to their specifications. In the event that the Melanie-1 exploration well intercepts a cavernous space during drilling, some cement will be lost into this space. This will result in additional infilling of the cavernous formations. Based on existing information relating to the limestone formations of Cape Range Peninsula and the experience of the drilling contractor, a maximum volume of 9 cubic metres of sealing cement is expected to be lost to cavernous spaces encountered during drilling. No large caves which could take a large proportion of the sealing cement are known or expected for the Project Area.

Within a few days of completion of drilling all of the wastes within the sump are expected to settle. The residual water will then be tested for the presence of any contaminants before being returned to the aquifer from which it was abstracted.

5.4 Testing

Water from the formation in which the gas and/or oil is expected to occur will not be brought to the surface unless such water accompanies the production of hydrocarbons during the testing program. Such formation water could amount to about 5 cubic metres. It is likely to have a total dissolved solids content similar to that of seawater and it is expected to contain some hydrocarbons. Should such formation water be produced then it will be allowed to evaporate or it will be discharged into an approved disposal site. All flaring of any formation water which contains hydrocarbons will be undertaken in the flare pit.

Stimulation of the Melanie-1 exploration well is not planned and consequently no equipment or chemicals will be on site for such evaluations.

In the event of a gas and/or oil discovery, the Melanie-1 exploration well will be production tested prior to appraisal of the field for possible long term commercial production. Samples of gas and oil will be taken during testing and all hydrocarbons

will be flared on site. In the event that hydrocarbons are found in potentially commercial volumes the Melanie-1 exploration well will be fully cased and suspended as required by the Department of Minerals and Energy. Further environmental review will then be prepared to assess aspects relating to commercial abstraction of these hydrocarbons. Typically, only a small land area is required to establish a pipeline system for gas production or a beam pump for the production of oil.

5.5 Rehabilitation

The Project Area will be photographed prior to the commencement of drilling and photographs of similar views will be taken for comparative purposes after rehabilitation to ensure that the Project Area is returned to as near to its pre-drilling condition as is practically feasible.

If the Melanie-1 exploration well does not contain significant quantities of hydrocarbons it will be plugged and abandoned close to ground level and marked in accordance with the requirements of the Department of Minerals and Energy. It is unlikely that the Shire of Exmouth will have a need for this well as a deep bore on account of its salinity. The water bore is of interest for sampling terrestrial and aquatic cave fauna and consequently it will be capped as described by Dr Bill Humphreys (Appendix B).

On decommissioning all waste, rubbish, duckboards and other materials will be removed and wherever practically feasible, limestone gravel will be stripped and removed. By this means the covered vegetation will be re-exposed and vegetation regrowth is expected to be rapid.

Camp accommodation will not be established on the Project Area, thereby simplifying site rehabilitation. The area requiring rehabilitation will therefore be much smaller than on most other exploration well sites.

Wherever possible topsoil removal will be avoided. Where topsoil has been removed it will be stockpiled and respread over affected areas on decommissioning.

Following decommissioning a report will be prepared outlining the decommissioning and rehabilitation which has been implemented. This will be forwarded to the Department of Minerals and Energy and the Shire of Exmouth.

5.6 Timing and Scale

The operations are expected to last for a maximum of six weeks, starting from the time when equipment and limestone is brought to the Project Area for the construction of various level pads. The physical and visual environment of the Project Area will be disturbed during this time.

The entire operations will occupy an area of approximately 100 metres by 80 metres (0.8 hectares), all of which will be rehabilitated as outlined in this Consultative Environmental Review and as directed by the Department of Minerals and Energy.

5.7 Worksite Safety

Sun Resources NL and the drilling contractor both have manuals and policies governing health and safety during the drilling of a well. These policies are in compliance with the safety and occupational health requirements of the Department of Minerals and Energy and legislation of the State of Western Australia and they will be strictly adhered to by all personnel as a condition of their employment. It is not envisaged that any unusual safety matters will apply to the Melanie-1 exploration well other than those relating to the prevention of fire. The Proponent's Corporate Environmental Health and Safety Policies are included in Appendix G.

Emergency training exercises are part of Sun Resources NL's standard procedure for operating exploration wells. The Project Area is in a region which is serviced by good telecommunications and is in close proximity to emergency and evacuation facilities at Exmouth.

5.8 Public Relations

Public relations are important for a drilling project close to a town and in a region with a high tourist interest. The drilling is planned to occur during the tourist off-season, thereby reducing possible impacts on the community. The Shire of Exmouth, the Cape Conservation Group and other local people and organisations have been consulted to discuss and determine acceptable management policies for the operation. This consultation will be on-going and a series of specific site visits by local interest groups will be arranged. Passing tourists may request to visit the Project Area, but for safety and security reasons such visits will not be permitted and public access will be prevented with notices stating *No Access to Unauthorised Personnel.* The drilling operations can be viewed by the public from the bluff on which the lighthouse is situated.

5.9 Incident Contingency Planning

Sun Resources NL has a current set of incident contingency plans. In common with all drilling operations these plans will be applicable to the Melanie-1 exploration well. A *Drilling Operations and Emergency Response Plan Manual* will be produced prior to the spudding of the Melanie-1 exploration well. Blow-out-Preventer drills will be undertaken twice per day from the surface casing point. Fire fighting equipment will be available within the Project Area. The establishment of gravelled pads and the flattening of vegetation will assist in fire prevention.

5.10 Waste Management and Pollution Control

No hazardous chemicals or oil based drilling fluids will be used in the Project Area. A drilling fluid consisting predominantly of water, some bentonite and minor amounts of lime and soda ash will be used between the depths of 50 and 250 metres for the drilling of non cavernous limestone, before the well has been cased. Potassium chloride polymers will be used for the lower sections, after the well has been cased. Bentonite is

a naturally occurring clay which contains no chemical pollutants. Lime has a similar composition to the limestone which is being drilled and the caustic soda will be used to maintain the pH of the water in the drilling circuit. The potassium chloride polymers are non-toxic and biodegradable, breaking down to harmless substances. It is not anticipated that the Melanie-1 exploration well will require weighted mud, as over pressured formations are unlikely to be present and the potential gas column that would be contained within the prospect is relatively small.

All domestic rubbish, including food scraps, will be collected in bins for disposal at a waste disposal site approved by the Shire of Exmouth. Sewerage facilities at the site will not be required as the drill crew will be accommodated off site. A transportable chemical toilet will be located on site.

5.11 Accommodation and Transportation of Workforce

Accommodation for the construction and drill crew will be arranged in the town of Exmouth. It is likely that a contractor will be appointed to bus the workforce to and from the Project Area to their place of accommodation.

Personal safety and hygiene will be the responsibility of each individual. No alcohol or drugs are allowed while drilling is in progress and any employee or contractor suspected of being intoxicated will be immediately dismissed.

5.12 Fire Safety and Firearms

Open fires will not be permitted. Smoking will only be allowed in restricted sections of the Project Area and notices to this effect will be displayed prominently.

Fire fighting facilities will be present in the Project Area. A review of fire fighting equipment and personnel training will be undertaken immediately prior to the commencement of drilling operations. Recommendations of the local bushfire brigade will be implemented prior to spudding of the Melanie-1 exploration well, and an adequate supply of water will be available at all times to fight and control an accidental bush fire within the Project Area and to prevent regional fires invading the Project Area.

Sun Resources NL's *Drilling Operations Manual* prohibits any firearms, projectile weapons, or other similarly dangerous materials in operational areas such as a well site. This will be strictly enforced and any person contravening this ban will be immediately dismissed.

5.13 Tracks and Construction Disturbances

All land disturbances during construction and drilling will be strictly kept to an essential minimum. All traffic will be confined to the nominated access track and no unnecessary cross-country driving will be tolerated.

5.14 Weeds

Weeds are currently not a problem within the Project Area. Care will be taken to avoid the introduction of weeds to the Project Area. This applies to all weeds, but particular care will be taken to ensure that Double-gee (*Emex australis*) seed which is readily distributed by footwear and vehicle tyres is not introduced to the Project Area.

To avoid the introduction of weeds to the Project Area all vehicles, earthmoving and other construction machinery and the drilling rig will be required to arrive on site in a clean condition. All tyres will be inspected for Double-gee seed prior to departure to the Project Area and again on arrival at the Project Area. All contractors have to confirm in writing that on departure to the Project Area and on arrival all vehicles and machinery have been cleaned thoroughly and all tyres and footwear have been checked for Double-gee seed. This applies to all vehicles which enter the site for the first time. Vehicles which are to be used to transport workers and equipment along local roads will be cleaned immediately prior to the first site visit.

Construction material, such as limestone gravel which is transported to the Project Area will be taken from weed free gravel pits and stock piles. Following the first substantial rains after decommissioning, the Project Area will be inspected for weeds and regrowth. All weeds will be sprayed at that time with appropriate herbicide.

5.15 Storage of Hydrocarbons

Fuel and oil spillages will be avoided by the diesel fuel storage area being bunded in accordance with the requirements of the Department of Minerals and Energy and Dangerous Goods Legislation. Any fuel spillages will be dealt with immediately, with the contaminated soil being trucked away for disposal according to the requirements of the Shire of Exmouth.

All used vehicle and machinery lubrication oil will be collected in drums for recycling or for acceptable disposal. Oily waste from machinery and accidental spills will be removed to oily waste disposal sites which are available within the Shire of Exmouth.

5.16 Air Quality

If necessary, dust will be suppressed by spraying with fresh water which will be transported to the Project Area.

5.17 Noise

Wherever appropriate, all operators will be required to wear ear protection equipment.

Noise will not be a problem for members of the general public because of the distance of the Project Area from residential areas. The caravan park near the lighthouse will be sheltered from noise emanating from the Project Area by elevations in the natural terrain. Some noise may be audible from the newly erected chalets at the Lighthouse

Caravan Park, however the noise generated by equipment in the Project Area will be low enough for operators to not require ear protection equipment. Consequently, no special noise restrictions with respect to the public are proposed for the operations. The operations are expected to meet the limits specified for a Category A1 operation in the *Noise Abatement (Neighbourhood Annoyance) Regulations (1979).*

5.18 Traffic

Public roads in the vicinity of the Project Area are regularly frequented by local residents and tourists. Sun Resources NL will alert all truck drivers and drilling personnel that at all times they must strictly adhere to the relevant speed limits and be alert to unsuspecting tourist traffic.

5.19 Cyclone Contingency Plan

In June 1996 a draft of this document was discussed with Dr Chris Henderson and Mr John Blinkhorn, President and Vice President of Cape Conservation Group, respectively. They commented that the document did not outline management procedures for cyclonic events. Their concern was that in the event of an early cyclone, extensive rainfall could result in flooding of the sump and subsequent loss of drilling muds and saline water to the surrounding environment. This concern was subsequently discussed on-site during an inspection of the Project Area by Dr Henderson and Mr Blinkhorn in the presence of Dr Wolf Martinick. The following contingency plan was then prepared:

a) In the event of a cyclone warning being received during drilling, the need to bund the sump and cellar will be determined by site inspection and an appropriate bund around the sump and cellar will be constructed to prevent flooding of these facilities. The bunding requirement is likely to be very minimal, about 1 metre in height, since the catchment upslope of the Project Area is very small.

b) The appropriateness of the bunding can be inspected by Dr Henderson and Mr Blinkhorn.

5.20 External Services

The proposed drilling is estimated to cost about $1 million. Wherever practically feasible, efforts will be made to purchase local supplies and to hire local contractors, so that commercial benefits to local businesses and the local population are maximised.

6.0 PUBLIC CONSULTATION

Liaison between Sun Resources NL and the Petroleum Division of the Department of Minerals and Energy will be ongoing. Through the Department of Minerals and Energy liaison will be maintained with the Environmental Protection Authority, Department of Environmental Protection, Department of Conservation and Land Management, Department of Land Administration and other government departments that may need to be consulted. The Proponent will also continue to liaise closely with the Shire of Exmouth.

The Proponent is aware that gas and oil exploration on the Project Area and Cape Range Peninsula in general is of considerable public interest because of the environmental sensitivity of the region and the presence of Cape Range National Park and the Ningaloo Marine Park. The most contentious public issues are therefore expected to be conservation and tourist related.

The Proponent has committed to discuss the proposed project with a wide range of individuals, organisations, groups and agencies which may have an interest in the region and to establish ongoing and meaningful dialogue.

6.1 Initial Public Consultation

In June 1996 a consultation programme with residents of Exmouth was commenced to:

- inform the public about the project;
- record potential concerns, issues and recommendations;
- amend the design and management of the operations to address such concerns; and
- establish meaningful and ongoing dialogue.

A list of the individuals, organisations, groups and agencies involved in the consultation programme was established in discussion with the Shire of Exmouth. This list was expanded during the consultation process.

The individuals, organisations, groups and agencies listed below were consulted. During each discussion the proposed operations and environmental management were described and photographs of the site and proposed equipment were shown, and a draft copy of the document was offered to each individual.

PERSON	GROUP	POSITION	LOCATION
Mr David Richardson	Shire of Exmouth	President	Exmouth
Mr Kerry Graham	Shire of Exmouth	Shire Clerk	Exmouth
Mr Doug Bathgate	Gascoyne Development Commission	Senior Regional Adviser	Exmouth
Dr Chris Henderson	Cape Conservation Group	President	Exmouth
Ms Anna Lightowler	Cape Conservation Group	Member	Exmouth
Mr John Blinkhorn	Cape Conservation Group	Vice President	Exmouth
Mr John Grieve	Exmouth High School	Headmaster	Exmouth
Mr Cliff Harris	Exmouth High School	Deputy Principal (Science teacher)	Exmouth
Ms Leonie Horak	Exmouth Expression/Cape Conservation Group	Editor	Exmouth
Mr Robbie Atkinson	Lighthouse Caravan Park	Owner	Exmouth
Mr Gino Gabellini	Exmouth Chamber of Commerce	President	Exmouth
Ms Rachel Siewert	Conservation Council of WA	President	Perth
Mr Doug Myers	Conservation and Land Management	District Manager	Exmouth
Mr Frank Batini	Conservation and Land Management	Wildlife	Perth
Mr Angus Davidson	Water and Rivers Commission	Hydrogeologist	Perth

Several issues were raised during the public consultation programme, and wherever practically possible these were incorporated into the design and management of the Melanie-1 exploration well. A detailed description of the public consultation programme is contained in Appendix H.

6.2 Ongoing Dialogue with Members of the Exmouth Community

The initial public consultations established the basis for ongoing dialogue to keep the Exmouth community informed, address their concerns and where appropriate, incorporate suggestions and amendments into the Environmental Management Programme. The following issues arose out of the initial consultations and have been incorporated into the draft Environmental Management Programme for the Melanie-1 exploration well.

a) Ongoing Dialogue

- Prepare a display board for the proposed drilling operations to be placed in a prominent location at Exmouth.

- Prepare and give a presentation to school children at Exmouth District High School prior to commencement of the drilling operations. This talk should focus on the environmental issues surrounding gas and oil exploration. The school requires two to three days of notice.

- Prepare a press release for Ms Leonie Horak of the Exmouth Expression, which includes a brief overview, site plan and possibly a photograph. This should be forwarded for publishing in the edition closest to the commencement of operations.

- Inform the North West Cape Planning Study of the proposed drilling operation before drilling commences.

- Keep the community informed through regular consultations.

- If requested, tours to the Project Area should be conducted during drilling with due regard to all necessary safety regulations.

- Forward a copy of this document to:

    - Shire of Exmouth for public display.
    - Gascoyne Development Commission.
    - Exmouth District High School as a library copy.

- Arrange a visit to the Project Area during drilling and on decommissioning for members of the Cape Conservation Group.

b) Changes to the Exploration Programme Arising from Consultations

- A Cyclone Contingency Plan has been incorporated into the exploration programme.

- Surround the sump in the Project Area with mesh fencing to prevent fauna becoming trapped in the mud.

- Use duckboards over walkways to reduce soil compaction and damage to the vegetation.

- Investigate means to reduce compaction of soils.

- In the event that the Melanie-1 exploration well results in an economically viable discovery of hydrocarbons, necessary processing facilities are to be located on the eastern side of Cape Range, preferably near to existing infrastructure.

- On decommissioning, use metal capping instead of PVC on the water bore, in consultation with Dr W.F. Humphreys to facilitate sampling of aquatic fauna.

6.3 Conclusion of the Consultation Programme

As a consequence of these discussions a number of recommendations and concerns were incorporated into the design and management of the Melanie-1 exploration well.

After the public consultations in mid 1996 it appeared that the general consensus amongst the community was that the proposed programme for the Melanie-1 exploration well adequately considered the marine and land environment of Cape Range Peninsula and that the exploration well was acceptable because it was based on land rather than offshore in the Ningaloo Marine Park. At the conclusion of the June 1996 consultations the Cape Conservation Group advised that the proposed drilling was *an example of best practice for environmental management* and that the consultations had resulted in establishing meaningful dialogue.

During follow up consultations, the Cape Conservation Group confirmed their opinion that the exploration for gas and oil did not raise any major concerns, but that the discovery of a commercially viable quantity of gas or oil was a major concern. They requested greater detail about the probable method of processing and transporting hydrocarbons out of the region in the event of a commercially viable discovery. They do not wish to see oil or gas being exported from the Point Murat Jetty because of possible spillages and potential damage by tankers to coral reefs. An evaluation of the likely methods for processing and transporting hydrocarbons will only be undertaken after the discovery of commercially viable volumes of gas or oil. Such an evaluation will address the development and processing of the hydrocarbons and will be the subject of a separate environmental and commercial assessment, to be properly assessed by relevant Government departments.

7.0 POTENTIAL ENVIRONMENTAL IMPACTS AND MANAGEMENT

7.1 Existing Terrain and Drainage

A level drilling pad and other operational pads will be constructed from introduced limestone gravel which will be placed on top of the existing land surface. There will not be any major excavation to produce a level pad on the Project Area. This will effectively minimise soil and surface disturbance. On decommissioning most of the introduced limestone gravel will be removed to expose the underlying natural surface. The naturally indurated surface is likely to prevent the removal of all of the introduced limestone gravel without some damage to the natural surface. Consequently, it is likely that small pockets of limestone gravel will remain on the surface. On completion of decommissioning the terrain and drainage will thus be re-established to its pre-drilling condition.

Erosion by water is not considered to be a problem during the operations due to the small area involved, the drilling being undertaken in the drier months of the year and especially since the Project Area does not receive substantial run-off. Wind erosion is also not considered to be a problem due to the minimal disturbance to terrain and vegetation and the small area which will be affected. In addition, potential dust problems will be addressed on a needs basis by spraying fresh water which will be transported to the Project Area in a water truck.

Compaction of the soils in the Project Area is not considered to be a problem because of the skeletal depth of soil, the frequent absence of soil and, wherever practically feasible, the use of duckboards.

7.2 Geology and Hydrogeology

7.2.1 Possible Infilling of Karst Formation

The geological formations beneath the Project Area could consist of cavernous limestone known as karst formations, which are common throughout Cape Range Peninsula. From regional data (Allen, 1993) and local information (Davidson, 1996) it is apparent that cavernous limestone could occur to a depth of 60 metres below the water table. If cavernous limestone is encountered, there is potential for stone chips and drilling mud produced during drilling to infill parts of the cavernous limestone. A maximum of 6 cubic metres of existing rock material would be displaced during drilling and this could potentially infill karst formations. On a regional scale this is an insignificant volume. It will be impossible to recover these wastes from the cavernous formations. Further infilling of caverns could occur if a substantial cavern is encountered when cement is being introduced to the well for the purpose of cementing casing strings (sealing) as required by the Department of Minerals and Energy. The sealing cement is non-toxic and is widely used in onshore and offshore drilling for gas and oil. Based on the experience of the drilling contractor and the nature of the limestone formations along seismic line A95M-01, a maximum of 9 cubic metres of

sealing cement could be lost to cavernous spaces during drilling of the initial 250 metres of the exploration well.

Regional information suggests that the cavernous formations are most likely to prevail in a 1-2 metre layer above the surface of the aquifer. Consequently, the section of the limestone profile which is most at risk of being infilled is this 1-2 metre section, in which waste obtained from a hole of 311 mm diameter could be dispersed.

To minimise the volume of drilling wastes which could possibly infill the karst formation, the section of the Melanie-1 exploration well which passes through the potentially cavernous formation (surface to a depth of 250 metres) will be cased and cemented immediately on completion of drilling this section and before the well is drilled to a greater depth (Figure 8). The initial 250 metres are expected to be drilled over a one day period.

7.2.2 Groundwater Quality

No site specific information on the groundwater of the Project Area is available. Information obtained from nearby bores and from the general region suggests that it is most likely that the groundwater of the Project Area is saline. In the unlikely event of fresh water being encountered, it is almost certainly confined to the surface 1-2 metres of the aquifer and it is likely to be brackish, with a total dissolved solids content of about 5000 mg/L. From there downwards the salinity is expected to increase rapidly to that of sea water. Consequently, abstracting water from the bore adjacent to the Melanie-1 exploration well will not result in any detrimental impacts on the quality of the groundwater. In the event of cavernous limestone being encountered during the drilling, the abstraction of water from the bore will result in a cycling of water below the ground surface from the water bore to the Melanie-1 exploration well, without any adverse impact on the salinity levels of the groundwater.

In the event of brackish water being present as a 1-2 metre layer in the surface profile of the groundwater, the recycling of water from the Melanie-1 exploration well to the water bore is likely to increase the salinity levels of this layer to that of about sea water. This will have a localised effect because mixing in this vicinity will be confined to a few hours. Thereafter the drilling will be at greater depth and the associated mixing will also be confined to the greater depth.

In the very likely event that caverns are not encountered, this recycling of water will be considerably reduced, resulting in a reduction in the mixing of waters of different salinities. It will also result in most of the drilling waste being brought to the surface and deposited into the sump.

The introduction of bentonite and minor amounts of lime and caustic soda to the groundwater beneath the Project Area will not have an adverse impact on the quality of groundwater resources in the region. It is expected to cause a temporary increase in the total suspended solids content of the water, which will settle out of solution following decommissioning. The potential radius of influence of the introduced bentonite above and below the watertable, has been calculated as being no greater than 26 metres,

assuming a worst case scenario. Consequently, it is assumed that any losses of bentonite, water and waste rock to cavernous formations will not extend laterally into the subsurface environment any further than the size of the drill pad itself.

7.2.3 Drilling Fluids

No hazardous chemicals or oil based drilling fluids will be used during the drilling operations. During drilling of the initial 250 metres, before this section is cased and cemented, a non-toxic drilling fluid consisting predominantly of water with some bentonite will be used. The fluid also contains small quantities of lime and caustic soda. Bentonite is a non-toxic, naturally occurring clay which is widely used in onshore and offshore drilling projects in Australia. Lime has a similar composition to the limestone rock which is being drilled and will consequently not involve the introduction of any foreign material. Only small amounts of caustic soda will be used in order to maintain the pH of the water used in the drilling circuit. Consequently, the proposed drilling will not result in the dispersal of toxic or environmentally harmful pollutants.

7.3 Subterranean Fauna

7.3.1 Loss of Habitat

There is a possibility of subterranean fauna prevailing in the cavernous limestone formations below the Project Area. As the exploration well may intercept some caverns in the interval between the surface and about 60 metres below sea level, there is a possibility that limestone chips and sealing cement could partly infill the caverns and reduce the amount of habitat available for the subterranean fauna. Most of the cavernous formations below sea level are expected to have been infilled since the Pleistocene era (Kevin Morgan and Angus Davidson, pers. comm.) and extensive caverns are not likely to be encountered at depth during drilling. The possibility of intercepting caverns in which drilled material could be dispersed cannot be totally discounted and consequently, in a worst case scenario during drilling, a maximum of about 16 cubic metres of limestone chips and sealing cement could be dispersed to cavernous spaces. On a regional basis, reducing the cavern void of Cape Range Peninsula by about 16 cubic metres is not significant.

In the event of drilling wastes being dispersed from the drill hole to the cavernous environment, then the water quality in the immediate vicinity of the drill hole will be temporarily affected by substantial increases in suspended solids. This will be a very localised effect which will prevail until the suspended solids have been precipitated. The quality of the water will then be restored although some of the caverns will be partially or totally filled with the waste, resulting in a small but permanent loss of potential cavernous habitat for aquatic fauna.

7.3.2 Maintenance of Diversity, Abundance and Distribution

The drilling operations are of a temporary duration and a small proportion of the subterranean habitat may be affected permanently through infilling of a small area of karst formation. Approximately 6 cubic metres of habitat may be lost through infilling

from limestone chips and existing mud. A further unknown volume of habitat will be lost when sealing cement is introduced to the well to seal and protect casing, and a limited amount of sealing cement will flow into intercepted caverns. This inflow will result in a loss of pressure which is immediately shown on instruments at the surface. At the most, a maximum of 9 cubic metres of habitat are expected to be lost via infilling of sealing cement. This figure of 9 cubic metres is based on the experience of the drilling contractor and knowledge of the nature of limestone formations in the area. Owing to the small scale of the operations and that subterranean fauna are known to occur throughout Cape Range Peninsula, the diversity, abundance and distribution of subterranean fauna will not be significantly affected.

The drilling of the Melanie-1 exploration well and the adjacent water bore will be similar to the process of drilling which established the water bores of the existing Exmouth water supply borefield, located on the eastern side of Cape Range. The Environmental Protection Authority recommended that approval be granted for an extension to this borefield in March 1997, to increase annual abstraction from the aquifer by 265 million litres. This large scale abstraction will require the drilling of a further 11 water bores and the increased annual abstraction is expected to decrease existing stygofauna populations by 1% per year. It is estimated that this population decrease can be readily replaced by normal population dynamics (Environmental Protection Authority Bulletin 843, 1997). The proposed drilling of the Melanie-1 exploration well is insignificant in impact on subterranean faunal habitat and existing groundwater resources compared to this approved extension to the water supply borefield.

Subterranean fauna in the immediate vicinity of the Melanie-1 exploration well are expected to move away from noise and vibrations associated with the drilling. Nevertheless, the possibility of some damage to the local population of subterranean fauna cannot be excluded. Consequently, a licence was obtained from the Department of Conservation and Land Management by W G Martinick & Associates Pty Ltd on behalf of Sun Resources NL, the managers of the well, to take fauna for scientific purposes during the drilling (Appendix I).

7.3.3 Research

Dr W F Humphreys, Senior Curator of the Western Australian Museum has requested that on decommissioning the proposed water bore be converted to a sampling site for subterranean fauna. He has sampled the vicinity of the Project Area on recent occasions, but not to the depth which the proposed bore will allow (about 80m). He requested that the bore be cased, sealed and locked, as outlined in correspondence to Ampolex (Appendix B). This will provide the means to increase the regional database on the distribution of stygofauna and troglobitic fauna.

To collect and document any subterranean fauna which may be present in the water which is abstracted from the water bore, a suitably sized mesh will be placed within the bore to capture any fauna before they can enter the drilling circuit. This mesh will be designed in consultation with the Water and Rivers Commission and Dr Humphreys.

7.4 Hydrocarbons

7.4.1 Potential for Surface Spillage

The possibility of a large scale spillage of hydrocarbons at the surface of the Project Area is highly unlikely. In common with all petroleum exploration wells and in compliance with the safety and environmental conditions of the Department of Minerals and Energy the drilling circuit will be sealed and pressure tested to prevent any possible loss of hydrocarbons.

In the event of a gas and/or oil discovery, small samples of gas and oil will be collected for analysis and the balance will be flared on site. This will reduce the risk of spillages. In the event of an accidental spillage, all affected soil will be removed to an oily waste disposal site which is available within the Shire of Exmouth. The possible disposal of these wastes has been discussed with representatives of the Shire of Exmouth.

The proposed drilling will be undertaken during the drier months of the year. Consequently, engine oil or lubricants are highly unlikely to be washed by rain from machinery onto the surface of the Project Area. Oily waste from servicing machinery will be collected and stored on-site for removal to approved disposal sites.

7.4.2 Potential for Subsurface Seepage

Potential subsurface seepage of hydrocarbons is prevented by the section of the well which passes through the potentially cavernous limestone formations being fully cased. This casing is a standard safety and environmental requirement of the Department of Minerals and Energy for petroleum exploration wells. The remaining geological formations below the cavernous limestone formation 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.

In accordance with the requirements of the Department of Minerals and Energy, the Melanie-1 exploration well will be pressure tested prior to drilling the geological formation which could contain gas and/or oil. This process is designed to detect any cracks within the well. Drilling will not proceed unless adequate pressure is maintained to demonstrate that there is no potential for subsurface seepage. Additional sealing may then be required. Consequently, it is highly unlikely that subsurface seepage of hydrocarbons will occur.

7.5 Vegetation and flora

The proposed operations will not destroy unique vegetation or any rare and priority listed flora.

The disturbance of vegetation will be confined to the Project Area (0.8 hectares) and a 50 metre long access track which is 5 metres in width and part of a seismic line which was established in 1995 and on which satisfactory regrowth is currently taking place (Plate 4).

Damage to vegetation, especially existing rootsystems, will be minimised by the proposed flattening and pruning of vegetation, the use of duckboards and the complete removal as far as is practically possible, of all introduced limestone gravel. Following decommissioning, regrowth of a diverse flora is expected and it will be monitored by Sun Resources NL. A report will subsequently be submitted to the Department of Minerals and Energy and the Shire of Exmouth.

7.6 Weeds

The Project Area is free of weeds apart from a few plants of Buffel Grass which is regarded by many as a naturalised pasture grass of Western Australia's North West. This grass is widespread in the North West, including Cape Range Peninsula and its possible eradication from the region would have to be addressed on a regional basis and not for an isolated area such as the Project Area.

There is a risk that without appropriate care the proposed operations could result in the introduction of weeds to the Project Area and its surrounds. The proposed hygiene procedures for vehicles, machinery and boots including a follow-up inspection after the first substantial rains following decommissioning and herbicide applications if required, will ensure that this risk is minimised.

7.7 Fauna

The proposed operations will not result in the destruction of habitats on which locally common and/or rare fauna are dependant for their survival.

The habitats of the Project Area will be disturbed for approximately six weeks, and during this period it is possible that some fauna species will be displaced. Following decommissioning and after the vegetation has recovered, it is highly likely that disturbed areas will be progressively recolonised by local fauna. During the drilling operations light, noise and human activities are likely to frighten some of the fauna which occupy the region and prevent them from coming into the immediate vicinity of the Project Area. The overall conclusion is that the impact on local fauna will be minimal and temporary and that gazetted rare and/or endangered species will not be affected.

7.8 Fire

Fire is a potential risk. Appropriate precautions will be in place to ensure that fire risks are minimised and managed responsibly. The operational procedures are designed to minimise the risk of fire, to prevent the spread of accidental fires from the Project Area to the surrounds, and prevent regional fires from spreading into the Project Area.

Fire fighting facilities will be present in the Project Area. A review of fire fighting equipment and personnel training will be undertaken immediately prior to the commencement of drilling. Recommendations of the local bushfire brigade will be implemented prior to spudding the well, and an adequate supply of water will be

available at all times to fight and control an accidental bush fire within the Project Area and to prevent regional fires invading the Project Area.

7.9 Air Quality and Dust

Air emissions will be confined to exhaust gases from the diesel engines on the drilling rig and vehicles associated with the operation. These exhaust fumes are expected to rise high into the atmosphere and they will occur mainly during the three weeks required for drilling. In the event that small quantities of hydrocarbons are brought to the surface during testing of the target formation, they will be flared in the flare pit. Vapours produced from this flaring-off will be introduced to the atmosphere for a short period.

Dust is not considered to be an operational problem due to the minimal surface disturbance and the wet drilling operations. In the unlikely event that dust is a problem, it will be controlled by appropriate applications of fresh water from a water truck.

7.10 Noise

Noise from the proposed operations is not expected to be a problem due to the remoteness of the Project Area and because of the undulating terrain which will ensure that noise is likely to be sufficiently deflected from the Lighthouse Caravan Park.

7.11 Traffic

For a period of about six weeks the operations will result in an increase in truck and vehicle traffic from Exmouth to the Project Area. This is entirely along established public roads with heavy traffic confined mainly to the commissioning and decommissioning of the drilling operations. During the drilling phase the need for transportation will be relatively minimal and confined to transporting consumables and drilling personnel.

The overall impact is that the daily traffic will probably increase on the affected roads by about 10 vehicle movements per day.

The proposed operations have been timed to avoid the peak tourist season. Consequently, the traffic associated with the drilling will have a minimal impact on tourism and local traffic.

7.12 Earthquake Risk

The acceleration coefficient for the Project Area is the same for all of the northwest Western Australia coastline (Australian Geological Survey Organisation, 1991). The risk of an earthquake in the region of the Project Area is insignificant.

8.0 POTENTIAL SOCIAL IMPACTS AND MANAGEMENT

Petroleum exploration on Cape Range Peninsula has provided tangible benefits to the community. Examples include wells for long term water extraction and the Mesa Camp earthworks. The proposed well will be in saline water and consequently there is no scope for it to be considered as a potential water source in the event that hydrocarbons are not discovered.

The project has the potential to discover a sufficiently large gas resource to permit the two power stations on Cape Range Peninsula to be converted from diesel fuel to natural gas. Similarly, it has the potential to provide employment opportunities and it will lead to consumables and supplies being purchased locally during the drilling operations.

8.1 Visual Amenity

The proposed operations will be shielded from Yardie Creek Road by rising terrain. This road is used by the public for access to the western side of Cape Range Peninsula.

Sections of the drilling rig will be visible, particularly from the Vlaming Head lighthouse from where many other larger developments on the eastern side of Cape Range Peninsula can be seen. Minor scenic impairment of the area will occur during the six week period of commissioning, drilling and decommissioning. Thereafter the scenic views of the Project Area will be restored. The presence of the drilling rig and its proximity to public access may create public interest, however unauthorised access to the Project Area will be prohibited for safety reasons.

8.2 Public Perception

Some of the public's perceptions of the proposed operations are that it is of a large scale (ie, similar to open cut mining) and that the drilling pad is located offshore within the Ningaloo Marine Park. This perception is not a realistic one as the Project Area covers a total area of 0.8 hectares, with limited infrastructure and is located onshore, about 1.3 km inland of the coast. There is no potential for surface and subsurface spillage of oil or for oil to reach the Ningaloo Marine Park, which is perceived as being a possible scenario. The Project Area is separated from the Ningaloo Marine Park by a major ridge and a substantial distance of 1.3 kilometres.

Drilling of the Melanie-1 exploration well will be conducted under strict procedures of environmental management which protect the surface and subsurface environment. The Project Area is sufficiently removed from the Ningaloo Marine Park and Cape Range National Park to ensure that these Parks are not affected by the proposed drilling.

The Melanie-1 exploration well is an example of industry best practice in environmental management and it is anticipated that its operation is likely to improve general community perception of exploration for oil and gas on Cape Range Peninsula

and the greater region. The Proponent, Sun Resources NL, has conducted a programme of public consultation with the Exmouth community, who have provided general approval for drilling of the Melanie-1 exploration well. Unfortunately, an incorrect perception of the scale and safety of the proposed operations still appears to prevail amongst the broader community. It is anticipated that the availability of the Consultative Environmental Review document will improve the public's awareness of the Melanie-1 proposal.

8.3 Tourism

The drilling project will be conducted in the tourist off-season and will not interfere with tourist activities. The drilling is assumed to be able to commence in October/November 1997, whereas the peak tourist season in Exmouth is from May to September.

8.4 Exmouth Infrastructure

The proposed operations will have a beneficial effect on the Exmouth economy by providing some employment and use of associated infrastructure such as accommodation, transport and supplies.

9.0 STUDY TEAM

The following persons participated in this study:

Dr Wolf Martinick:	Project Leader; Earth Scientist.
Ms Dayna Simpson:	Environmental Scientist
Dr Robert Holmes:	Environmental Scientist/Zoologist
Dr Dennis Backshall:	Botanist
Mr Ray Cranfield:	Botanist
Ms Glenda Martinick:	Editing
Mr Darren Cooper:	Archaeologist
Ms Christine Mellersh:	Wordprocessing

10.0 ACKNOWLEDGMENTS

Assistance provided by Mr Kevin Morgan of Kevin Morgan and Associates, a firm of groundwater consultants, was greatly appreciated. Similarly, technical assistance provided by Mr Angus Davidson, hydrogeologist with the Waters and Rivers Commission is also gratefully acknowledged.

The time volunteered by members of the Exmouth Community who participated in the public consultation is gratefully acknowledged.

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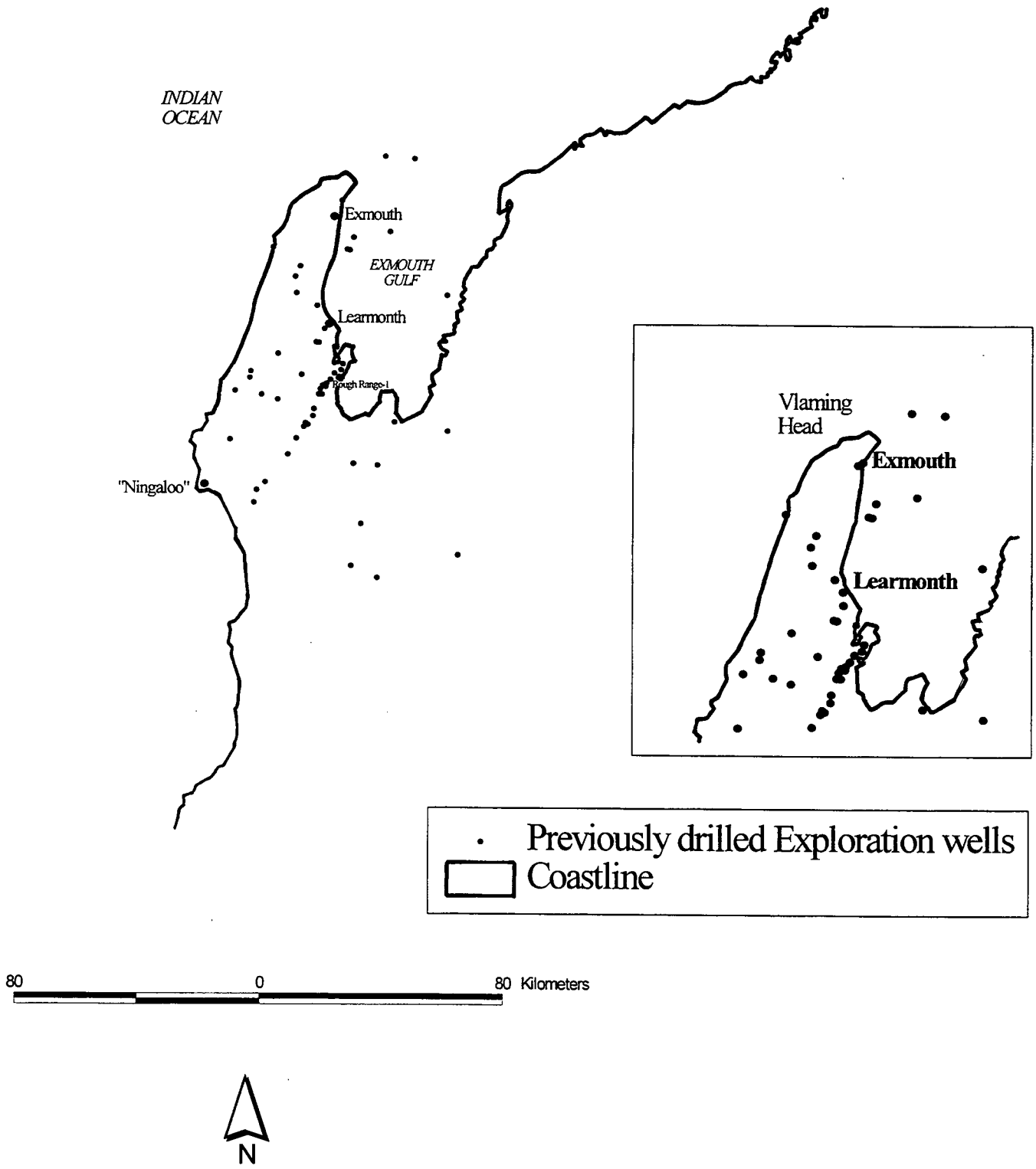


FIGURE 1: **LOCATION OF PREVIOUSLY DRILLED WELLS ON CAPE RANGE PENINSULA**

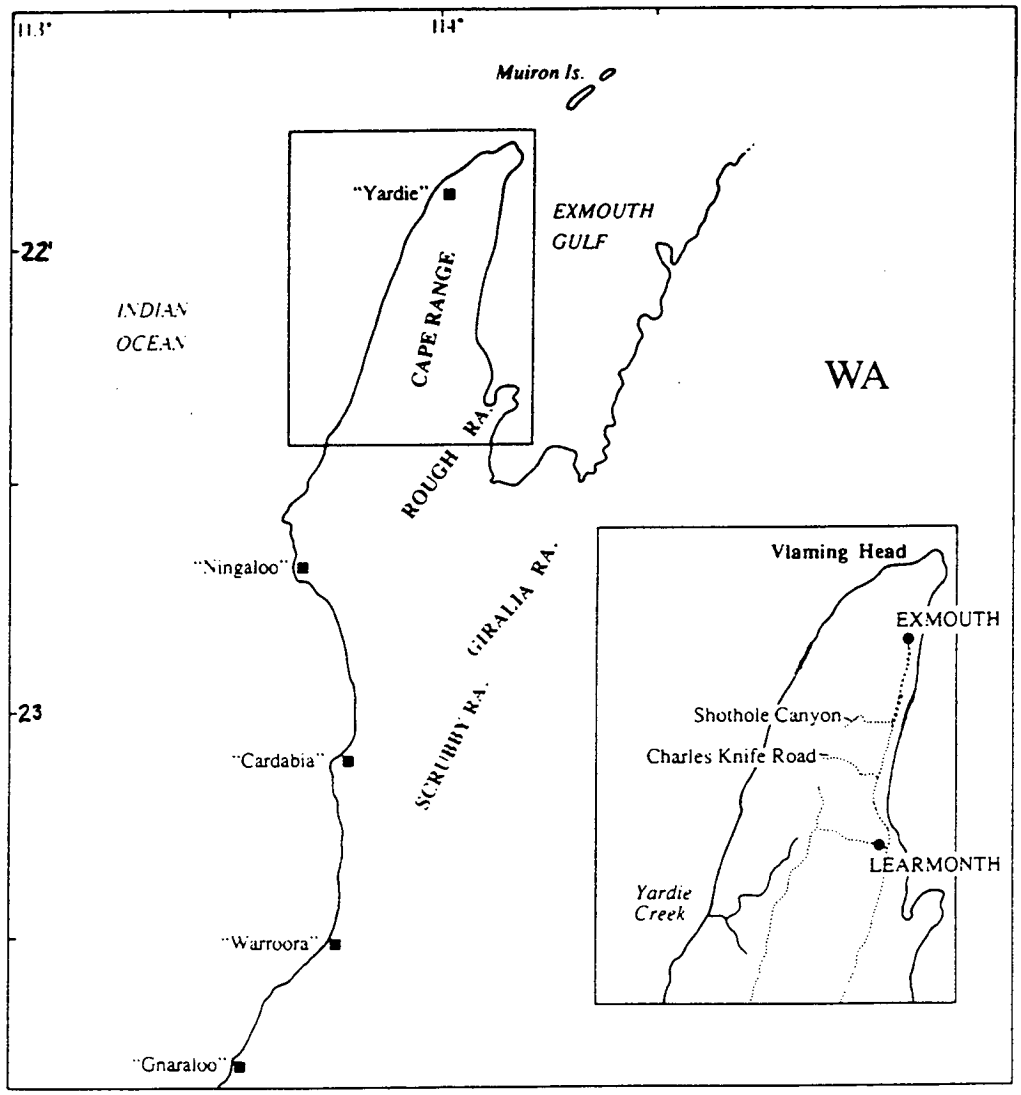
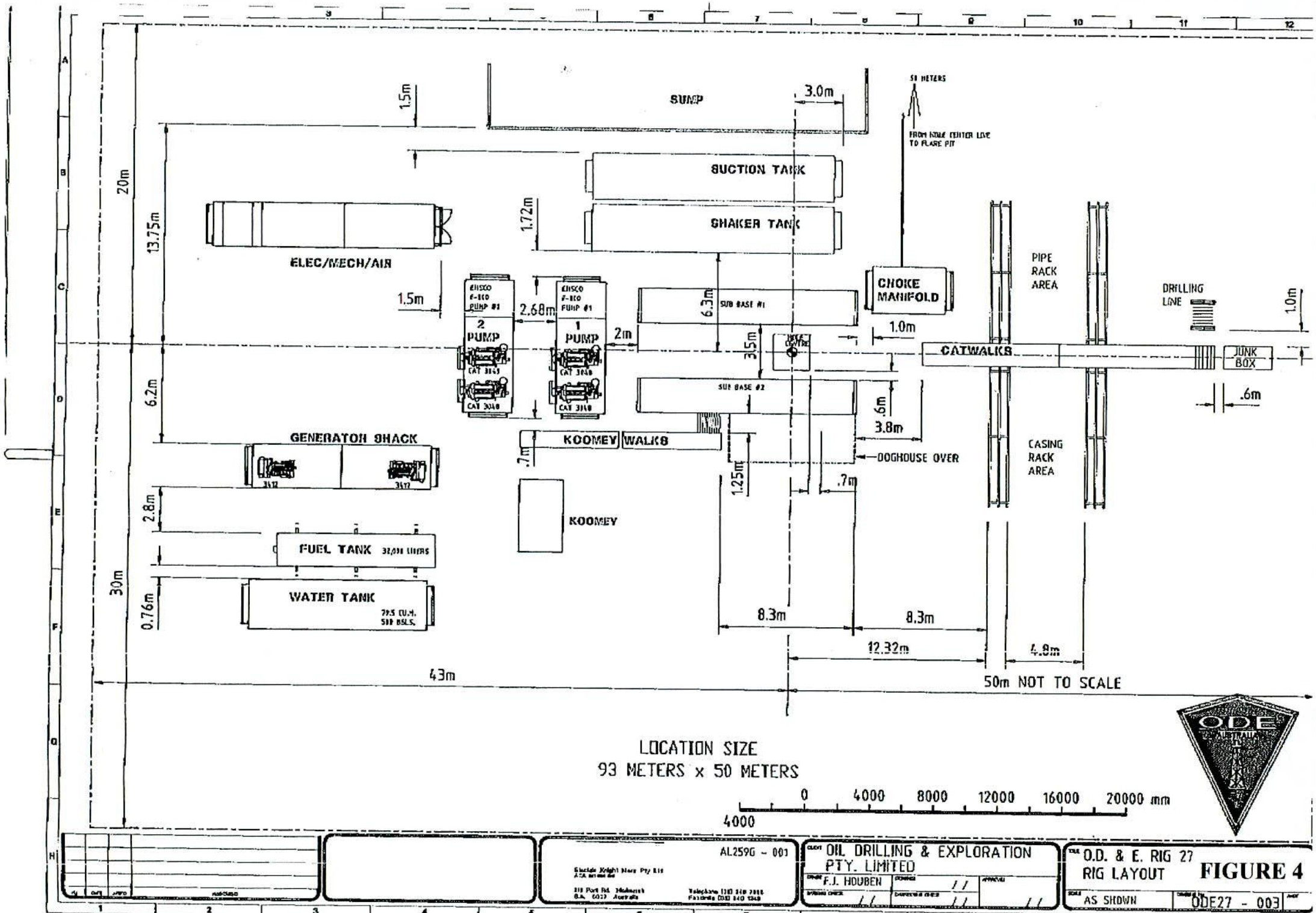


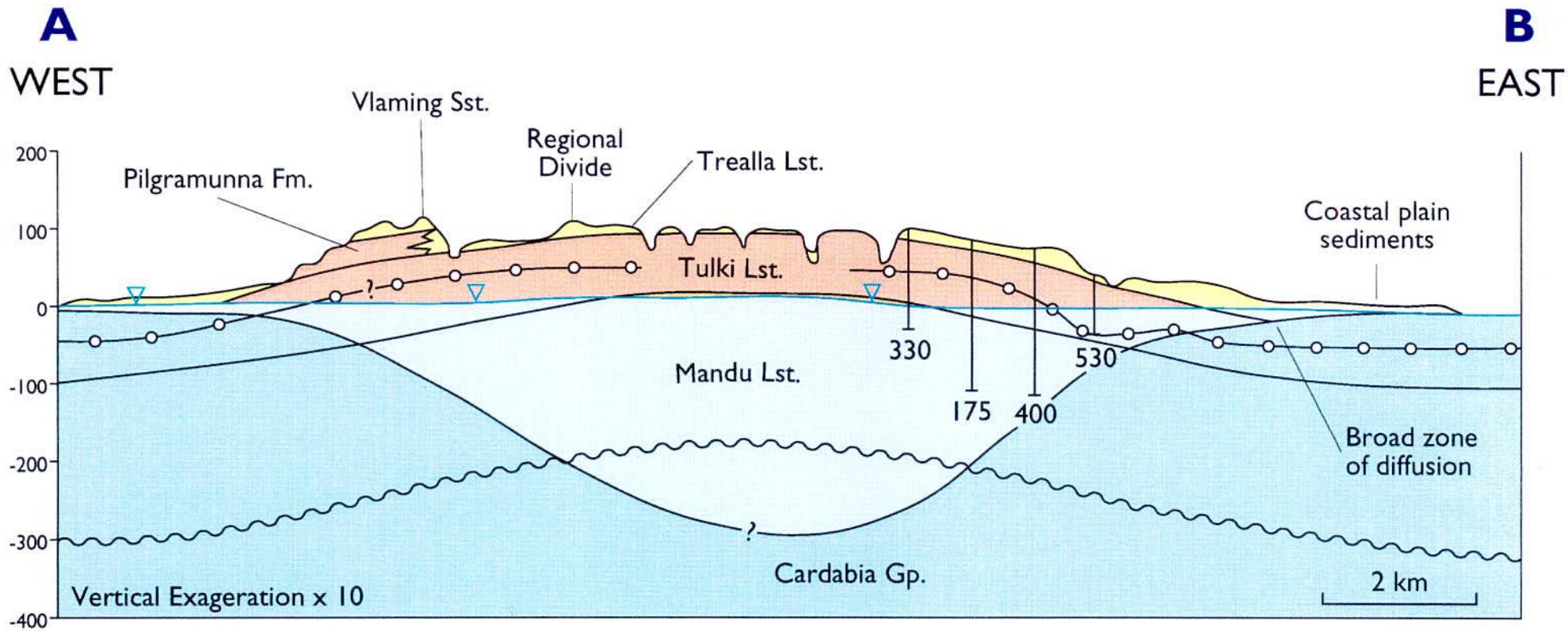
FIGURE 2: LOCATION OF THE PROJECT AREA IN A REGIONAL CONTEXT

LOCATION MAP, MELANIE-1

FIGURE 3:


SUMP
1.5m
3.0m
50 METERS
FROM HOLE CENTER LINE TO FLARE PIT
SUCTION TANK
SHAKER TANK
1.72m
ELEC/MECH/AIR
20m
13.75m
6.2m
2.8m
30m
0.76m
1.5m
2.68m
2m
6.3m
3.5m
SUB BASE #1
SUB BASE #2
CHOKE MANIFOLD
1.0m
PIPE RACK AREA
DRILLING LINE
1.0m
CATWALKS
JUNK BOX
.6m
.6m
3.8m
DOGHOUSE OVER
CASING RACK AREA
GENERATOR SHACK
KOOMEY WALKS
.7m
1.25m
.7m
KOOMEY
FUEL TANK
WATER TANK
8.3m
8.3m
12.32m
4.9m
43m
50m NOT TO SCALE
LOCATION SIZE
93 METERS x 50 METERS
0
4000
8000
12000
16000
20000 mm
4000
AL259G - 001
OIL DRILLING & EXPLORATION PTY. LIMITED
F.J. HOUBEN
O.D. & E. RIG 27
RIG LAYOUT
FIGURE 4
AS SHOWN
ODE27 - 003

HYDROGEOLOGY OF CAPE RANGE



Approximate base of karstification

Water Table

Interfingering formations

Unconformity

Freshwater

Seawater

175 *Bore with salinity (mg/L T.D.S.)*

FIGURE 5

(Allen, 1992; Martin, 1990)

CO-ORDINATED DRAFTING SERVICES PTY LTD (09) 474 3369
VICPET/96-319/SECTION.FH3/20-12-96/LM

REGIONAL GROUNDWATER SALINITY AT ABOUT THE WATER TABLE

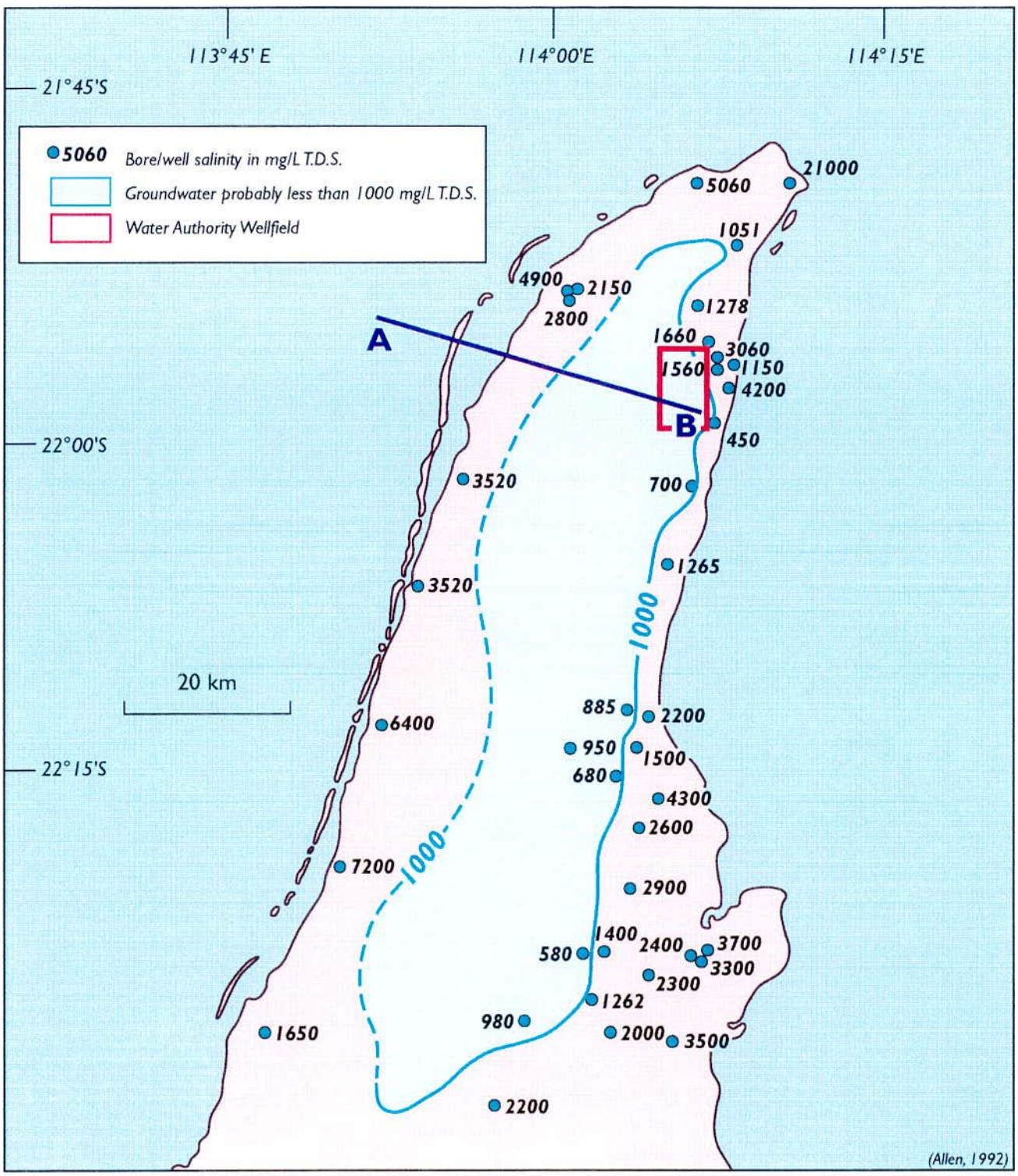
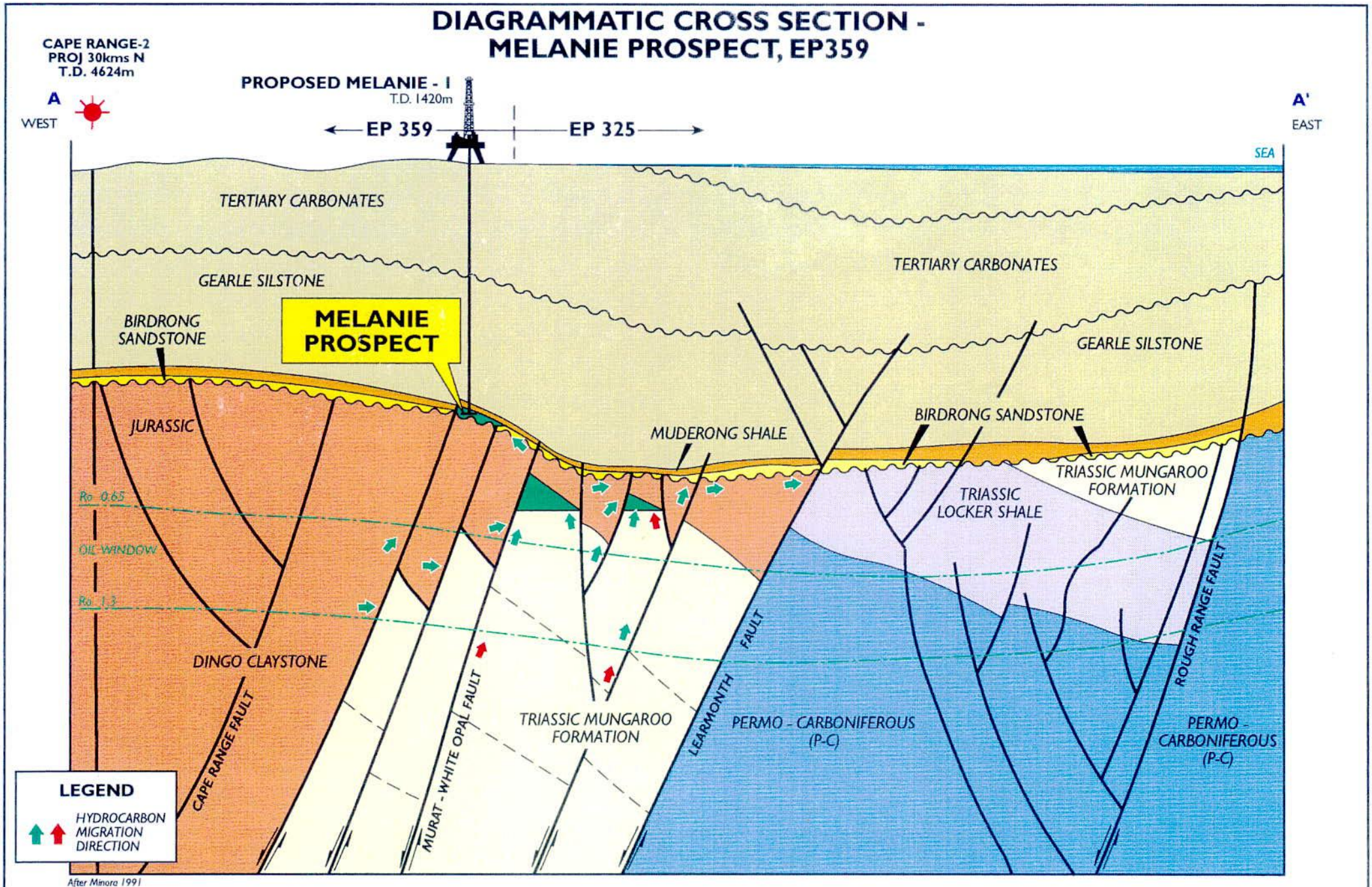


FIGURE 6

CO-ORDINATED DRAFTING SERVICES PTY LTD (09) 474 3369
VICPET/96-319/GROUND.FH3/20-12-96/LM

DIAGRAMMATIC CROSS SECTION - MELANIE PROSPECT, EP359



CO-ORDINATED DRAFTING SERVICES PTY LTD (09) 4743369

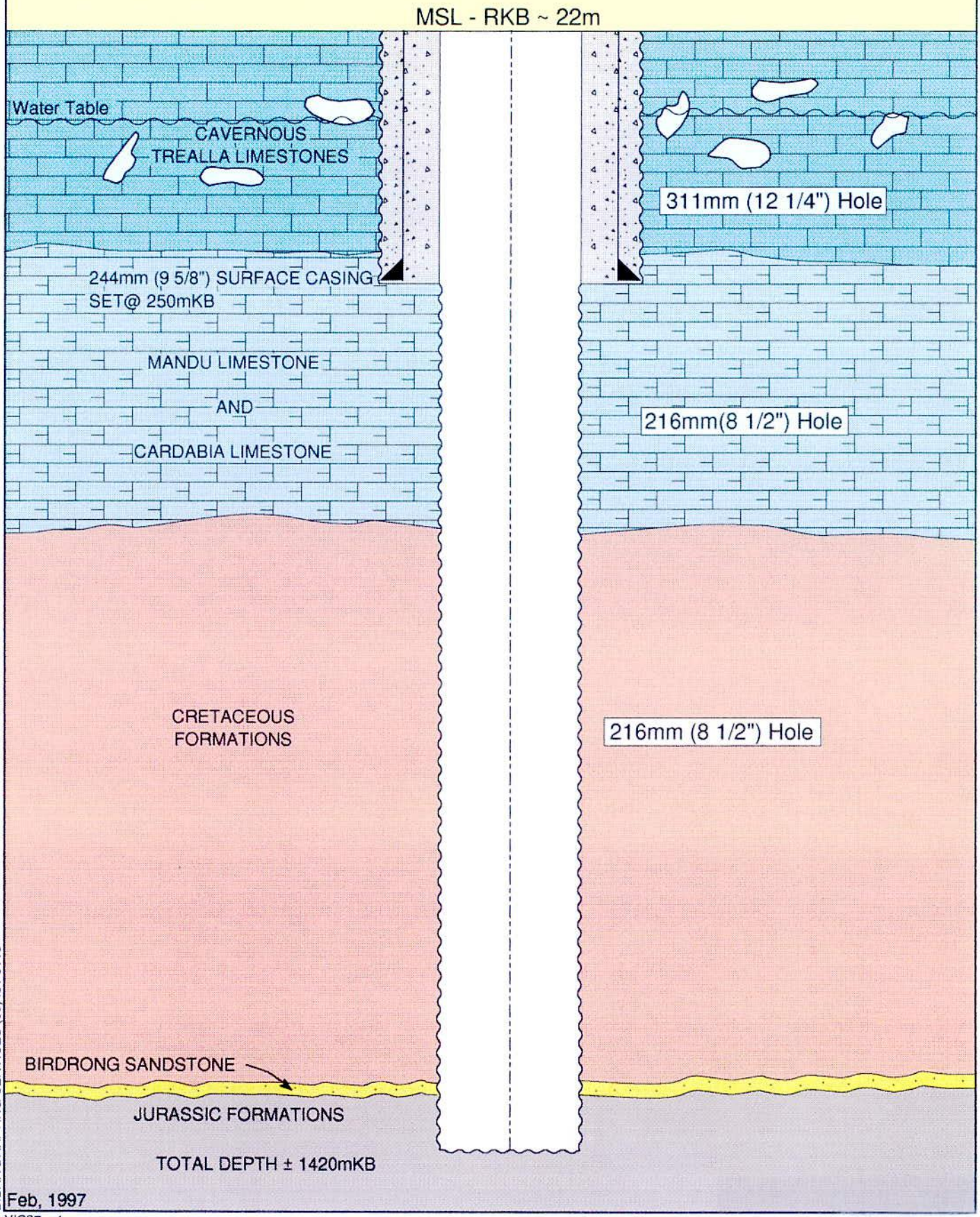
VICPET/96-274/MELSCT.FH3,8-10-96, MKB

FIGURE 7

EP-359

MELANIE-1

WELL SCHEMATIC DIAGRAM



BIBRA DRAFTING SERVICES (09)481 3113

FIGURE 8

TITLES FOR PLATES

PLATE 1:	Aerial photograph of the Project Area
PLATE 2:	General view of the Project Area
PLATE 3:	View of the Commonwealth access track, which leads to the Project Area
PLATE 4:	View of the vegetation and slope on the Project Area, facing west-northwest Seismic Line A95M-01 is obvious in the left side of the view
PLATE 5:	View of the Project Area, its surrounds and seismic line A95M-01 on the right side, facing east-southeast
PLATE 6:	General view of the Vlaming Head Lighthouse, Caravan park chalets and Indian Ocean
PLATE 7A:	View of a drilling rig in the Bonaparte Basin which is similar to that to be used for drilling of the Melanie-1 exploration well
PLATE 7B:	A close up view of the drilling rig shown in Plate 7A

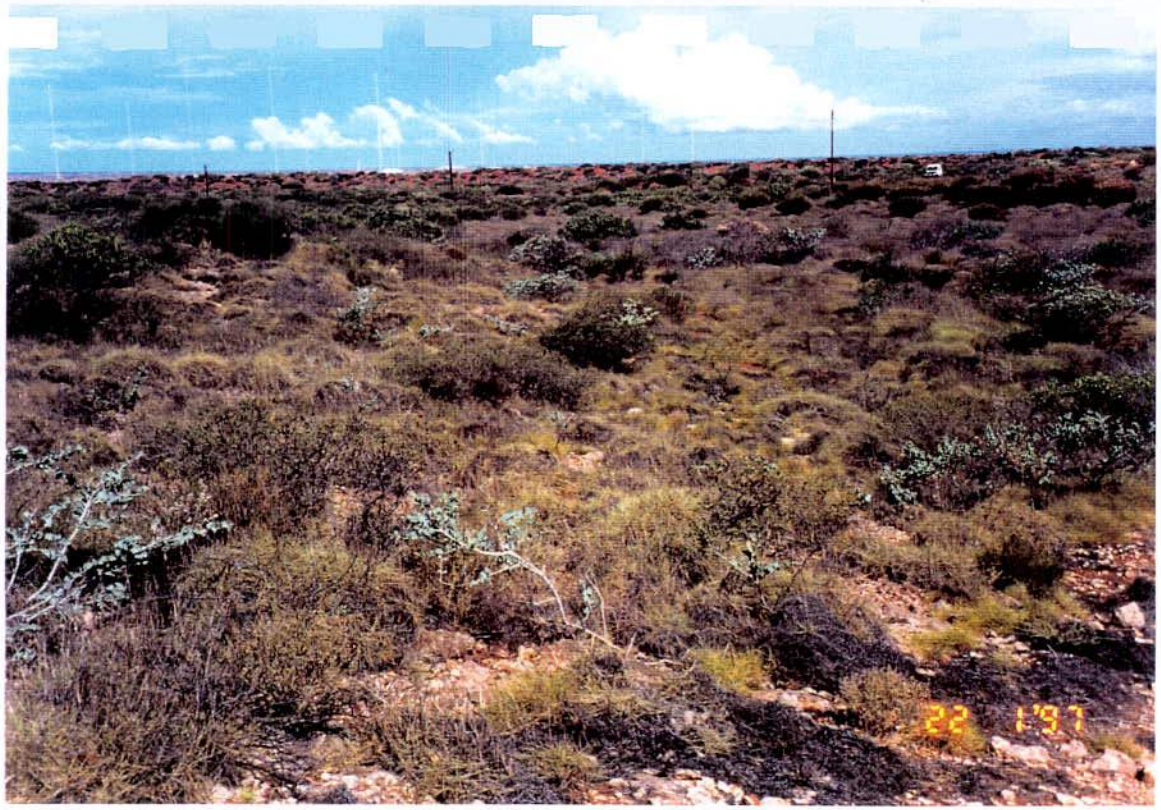


PLATE 2

PLATE 3


PROJECT AREA
200
0
400 Meters
N

PLATE 4

PLATE 5

PLATE 6

PLATE 7A

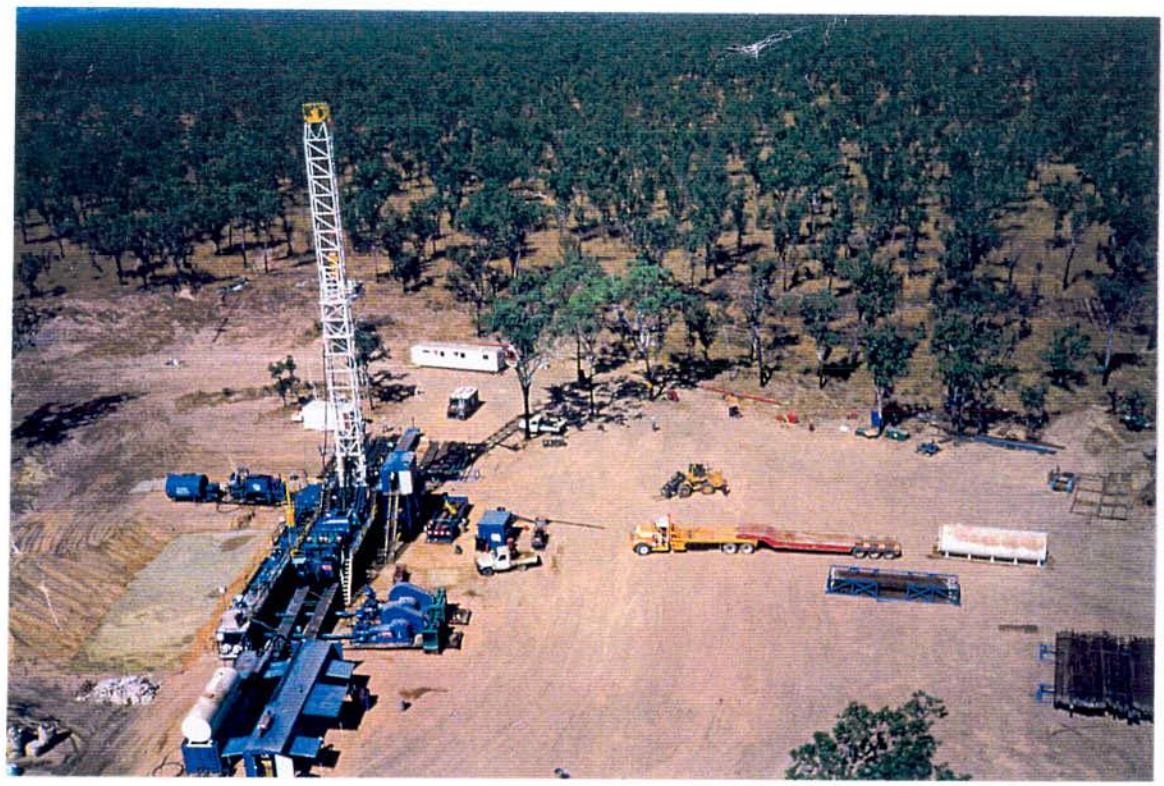


PLATE 7B

APPENDIX A

ENVIRONMENTAL PROTECTION AUTHORITY GUIDELINES FOR THE MELANIE-1 CONSULTATIVE ENVIRONMENTAL REVIEW

Environmental Protection Authority

MELANIE - 1 PETROLEUM EXPLORATION WELL, CAPE RANGE PENINSULA

VICTORIA PETROLEUM NL

CONSULTATIVE ENVIRONMENTAL REVIEW GUIDELINES (Assessment No. 1085)

Introduction

Victoria Petroleum NL are proposing to drill a land-based exploration well, Melanie-1, near the tip of Cape Range Peninsula on vacant Crown land 18 km north of Cape Range National Park (figure 1). Drilling is proposed to a depth of 1360 m, and the first 60 m is expected to be through cavernous limestone.

Overview

All environmental reviews have the objective of protecting the environment. The primary purpose of the Consultative Environmental Review (CER) is to provide information on the proposal to the Environmental Protection Authority (EPA). Environmental impact assessment is deliberately a public process in order to obtain broad ranging advice. The review requires the proponent to describe the proposal, existing environment, potential environmental impacts and the management of the issues arising from the environmental impacts, so that the environment is protected to an acceptable level.

Throughout the assessment process it is the objective of the EPA to assist the proponent to improve the proposal such that the environment is protected in the best manner possible. The Department of Environmental Protection, on behalf of the EPA, will co-ordinate relevant government agencies and the public in providing advice about environmental matters during the assessment of the CER for this proposal.

These Guidelines have been prepared to assist the proponent in identifying issues which should be addressed within the CER. They are not intended to be exhaustive, and the proponent may consider that other issues should also be considered within the document. The aim of the CER is to emphasise those relevant environmental factors which have the potential to impact on the physical, biological and social environment of the area relevant to the proposal.

Environmental Management

The proponent should approach environmental management in terms of best practise. Best practice environmental management includes:

- an overall objective to reduce as far as practical potential impacts on the environment;
- development of an environmental policy;
- agreed environmental objectives;
- management of environmental objectives;
- involve the public as appropriate;
- audit performance against agreed indicators;
- regular reporting to the EPA (or nominated agencies);
- commitment to a quality assured management system and continuous improvement based upon the principles of ISO 14000;
- periodic (for example 5 yearly) review in conjunction with the EPA or nominated agencies.

Contents of the CER

The contents reflect the purpose of the CER, which is:

- to communicate clearly with the public (including government agencies), so that the EPA can obtain informed public comment to assist in providing advice to government;
- to describe the proposal adequately, so that the Minister for the Environment can consider approval of a well-defined project; and
- to provide the basis of the proponent's environmental management programme, which shows that the environmental issues resulting from the proposal can be acceptably managed.

The language used in the body of the CER should be kept simple and concise, considering the audience includes non-technical people, and any extensive, technical detail should either be referenced or appended to the CER. It should be noted that the CER will form the legal basis of the Minister for the Environment's approval of the proposal. Hence the CER should include a description of all the main and ancillary components of the proposal, including options where relevant. The CER should form the substantial part of the submissions to the EPA and should provide sufficient information to assist the EPA to form its opinion on the content of the EPA report to the Minister, as defined by section 44 of the Environmental Protection Act.

The contents of the CER should include:

Overview

- introduction of the proposal, including a brief history of the project and location, and possible future stages. A clear overlay of a suitably scaled aerial photograph, which clearly indicates the nature and extent of works proposed. A regional map should be included which identifies the proposal within a social and regional setting.

Justification

- justification and objectives for the proposed development;
- the legal framework, decision making authorities and involved agencies;
- consideration of alternative options.

The proposal

- description of the components of the proposal, including details of the ultimate scale, and proposed stages. This information could be presented in the form of a table which describes the key characteristics of the proposal; and
- timing and staging of project.

Existing environment

- description of the existing environment which may be impacted;
- potential impacts on the karst system, including underground fauna (stygofauna);
- flora and vegetation communities which may be affected by the drilling of the exploration well;
- potential impacts on Cape Range National Park and Ningaloo Marine Park; and
- potential impacts on groundwater.

Environmental factors

The environmental factors can be determined from a consideration, called scoping, of the potential impacts from the various components of the proposal on a receiving environment, including people. The CER should focus on the relevant environmental factors for the proposal, and it is recommended that these be agreed in consultation with the EPA and relevant public and government agencies. A description of the project component and the receiving environment should be directly included with, or referenced to, the discussion of the issue. The technical basis for measuring the impact and any specifications or standards for assessing and managing the issue should be provided.

The EPA considers that the proponent should provide, within the body of the document, a table which describes, with regards to the relevant environmental factors (those upon which the EPA is likely to report on to the Minister for the Environment). The following elements should be addressed in the table:

(a) the present state of the environment;

(b) values of the site in a regional context;

(c) potential impacts of the proposal on the environment;

(d) nominate environmental management objectives(s) for those aspects which require management;

(e) environmental management response to manage impacts to meet the above objective(s); and

(f) envisaged state of the environment.

The environmental factors from which the relevant environmental factors are derived (and their corresponding objectives) at this stage should be set out below under the following categories:

- biophysical;
- pollution; and
- social surroundings.

Further key issues may be raised during the preparation of the CER, and on-going consultation with the DEP and relevant agencies is recommended. Minor issues which can be readily managed as part of normal operations for similar projects may be briefly described. Information used to reach conclusions should be properly referenced, including personal communications. Assessments of the significance of an impact should be soundly based rather than unsubstantiated opinions, and the assessment should lead to a discussion of the management of the issue.

Relevant Environmental Factors

Preliminary relevant environmental factors identified and the EPA's management objective for these factors have been identified in the attached table.

At this stage, the EPA believes the preliminary relevant environmental factors for this project are Subterranean fauna (stygo and troglobitic fauna), Vegetation, Groundwater quality, Oil, Drilling fluids, Visual amenity and Public perception. These factors should be addressed within the CER for the public to consider and make comment to the EPA. Those factors which are considered relevant by the EPA will then be addressed in the EPA's report to the Minister for the Environment.

- impacts on subterranean fauna (stygo and troglobitic fauna) underlying the project area as a result of drilling and associated activities;
- impacts on vegetation communities as a result of drilling and associated activities, including vegetation included in the EPA's Conservation Reserves for Western Australia System 9;
- impacts on groundwater quality as a result of potential contaminants introduced through drilling and associated activities;
- risk of potential oil spills and impacts resulting from such spills;
- impacts associated with the use of drilling fluids;
- impacts on the visual amenity of the project area and surrounds; and
- impacts perceived as a potential risk by the public, such as potential impacts on the neighbouring Cape Range National Park and Ningaloo Marine Park, and measures to address and clarify such issues.

The EPA expects the proponent to take due care in ensuring any other relevant environmental factors which may be of interest to the public are addressed.

Management :

- discussion of the preliminary relevant environmental factors as related to relevant policies, objectives and/or standards which may apply;

- discussion of the management of the preliminary relevant environmental factors, including commitments to appropriate action. This should include the proposed measures to minimise impacts on subterranean fauna and vegetation communities; measures to ensure protection of groundwater resources in the Cape Range area; protective measures proposed to prevent drilling fluids and hydrocarbons leaking into aquifers or between aquifers; discussion on the surface (wellhead) management of drilling fluids and any hydrocarbons produced from the well such that they are controlled or contained to prevent contamination of the adjacent environment; minimising impacts on visual amenity; and addressing impacts perceived as potential risks by the public. This may refer to management of previous petroleum exploration wells drilled in similar areas; and

- a summary of the environmental management programme, including the key commitments, monitoring work and the auditing of the programme.

Public consultation

A description should be provided of the public participation and consultation activities undertaken by the proponent in preparing the CER. It should describe the activities undertaken, the dates, the groups/individuals involved and the objectives of the activities. Cross reference should be made with the description of environmental management of the issues which should clearly indicate how community concerns have been addressed. Those concerns which are dealt with outside the EPA process can be noted and referenced.

Environmental management commitments

The method of implementation of the proposal and all commitments made by the proponent become legally enforceable under the conditions of environmental approval issued by the Minister for the Environment in the statement. Proponents are encouraged to consolidate the important commitments in the public review document, and these are attached to the Minister's statement.

Commitments which address relevant environmental factors will be audited by the DEP, along with the environmental conditions. The commitments should have the form of:

> • the proponent (who) will prepare a plan or take action (what) to meet an environmental objective (why) by doing something (how/where), to a time frame (when), and to whose requirements or advice, if not the DEP, the action/plan will be prepared. These commitments may be addressed in tabular form.

Other commitments, which address less contentious issues (and may be contained either within the public review document or in the summary of commitments), show that the proponent is dedicated to good environmental management of the project. The DEP expects that the proponent will audit these commitments by internal processes (under an Environmental Management System). Though not subject to routine audit by the DEP, it may periodically request that compliance with these commitments be demonstrated, so as to verify satisfactory environmental performance in the proponent's implementation of the proposal.

All commitments should define the objective and action in sufficient detail so that the achievement of compliance can be measured. The DEP acknowledges that, with the implementation of best practice and continuous improvement, the procedures to implement the commitment may need to be changed; these changes can be made in updates to the environmental management programme, whilst ensuring the objective is still achieved.

MELANIE-1 PETROLEUM EXPLORATION WELL, CAPE RANGE PENINSULA

CONSULTATIVE ENVIRONMENTAL REVIEW

FINAL GUIDELINES

Preliminary Relevant Environmental Factors	Environmental Objective	Proposed Management of Factor
Biophysical		
Subterranean fauna (stygo and troglobitic fauna)	Ensure that subterranean fauna are adequately protected, consistent with the *Wildlife Conservation Act 1950.* Maintain the abundance, diversity and geographical distribution of subterranean fauna. Improve our understanding of subterranean fauna through appropriate research including sampling, identification and documentation.	Managed under Part IV of the Environmental Protection Act [1986].
Vegetation Communities	To protect the abundance, diversity, geographical distribution and productivity of the vegetation community type.	Managed under Part IV of the Environmental Protection Act [1986].
Pollution		
Groundwater quality	To maintain the quality of groundwater consistent with the *Draft Western Australian Quality Guidelines for Fresh and Marine Waters* (EPA Bulletin 711, October 1993).	Managed under Part IV of the Environmental Protection Act [1986], in consultation with the Water and Rivers Commission.
Oil	To ensure that oil associated with the drilling process is contained so that it does not adversely affect the surrounding environment.	Managed under Part IV of the Environmental Protection Act [1986], in consultation with the Department of Minerals and Energy

Drilling fluids	To ensure that drilling fluids used during drilling do not adversely affect the surrounding environment.	Managed under Part IV of the Environmental Protection Act [1986], in consultation with the Department of Minerals and Energy.
Social surroundings		
Visual amenity	To ensure that the visual amenity of the area adjacent to the project is not unduly affected by the proposal.	Managed under Part IV of the Environmental Protection Act [1986].
Public perception	To ensure that the public is properly informed in relation to perceived risks associated with the proposed drilling.	Managed through public consultation as part of the assessment process.

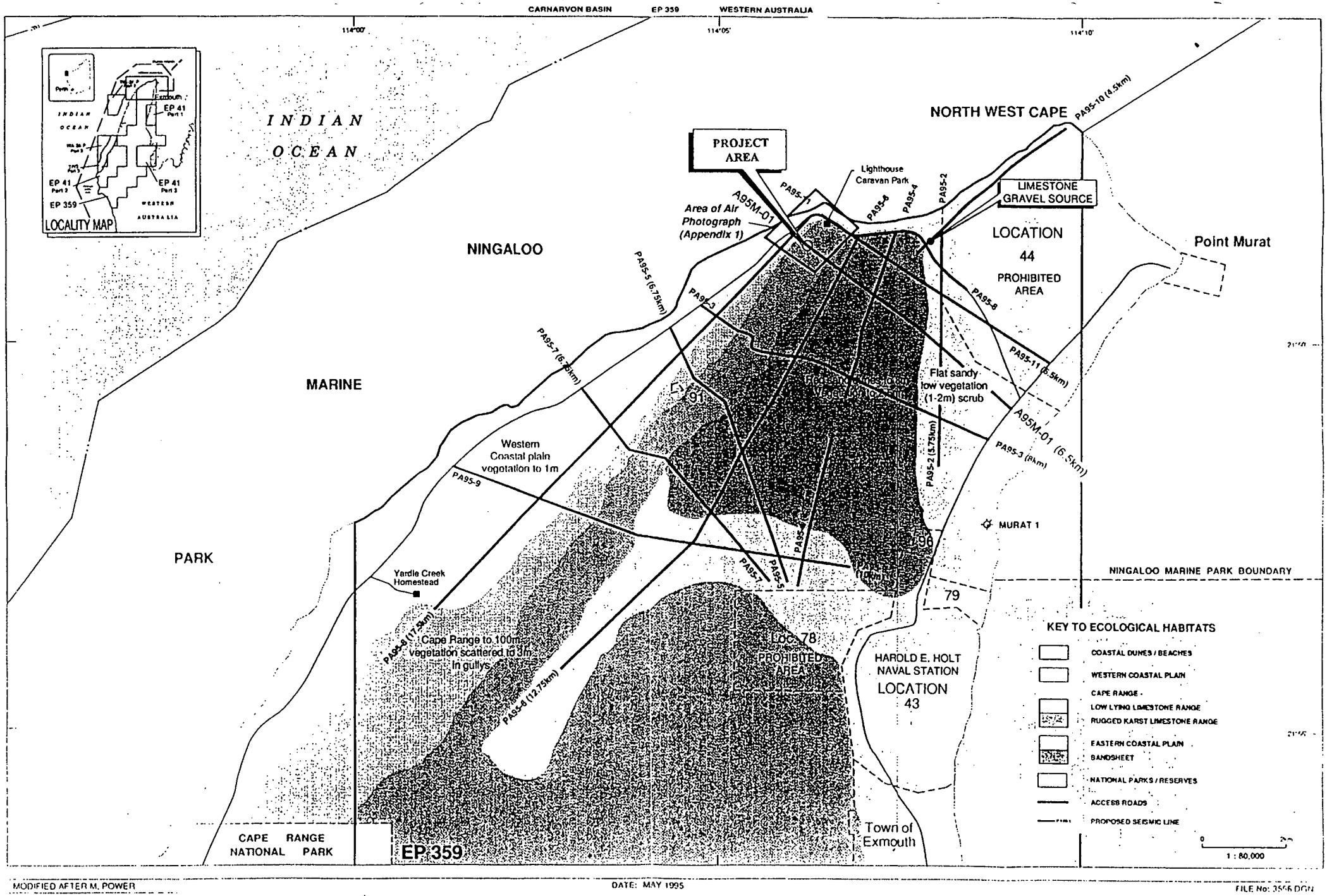


FIGURE 1: LOCATION OF PROJECT AREA, SEISMIC LINES AND REGIONAL ECOLOGICAL HABITATS

APPENDIX B

LETTER FROM DR W.F. HUMPHREYS OF THE WESTERN AUSTRALIAN MUSEUM, 24 MAY 1995

Western Australian museum

Francis Street Perth
Western Australia 6000
Telephone (09) 328 4411
Facsimile (09) 328 8686

Biogeography, Ecology and Biospeleology
Department of Terrestrial Invertebrate Zoology

Telephone +61 9 427 2753
Facsimile +61 9 328 8686
email humphw@muswa.dialix.oz.au

24/4/95

Mr Ashley Duckett
Ampolex Limited
QV1
GPO Box L902
Perth
WA 6001

Dear Ashley,

Thank you for your letter of 18 April and the map showing the location of the proposed drill holes on NW Cape.

As discussed with you these drill holes should provide access to the groundwater in an area where there is no information about the unique and internationally significant subterranean fauna of the area (see attached notes and references). The lack of information in this region is a perpetual problem — as the protected subterranean species are present on either side of this northern tip it must be assumed, until proven otherwise, that they are present on the northern tipdespite the different geomorphology.

I would like to request the support of Ampolex to stabilized 14 of these drill holes (by the method attached) and to sample the holes for fauna within two months of drilling— allowing time for drilling muds to dissipate. The total cost for this project would be about $2123.

If support is forthcoming then I will take over responsibility for the future maintenance to the required standard or closure of these drill holes.

I would appreciate an early response to this request as I will be away all of May in Exmouth (I could be contacted there on **fax** — 099 491 618).

Yours sincerely

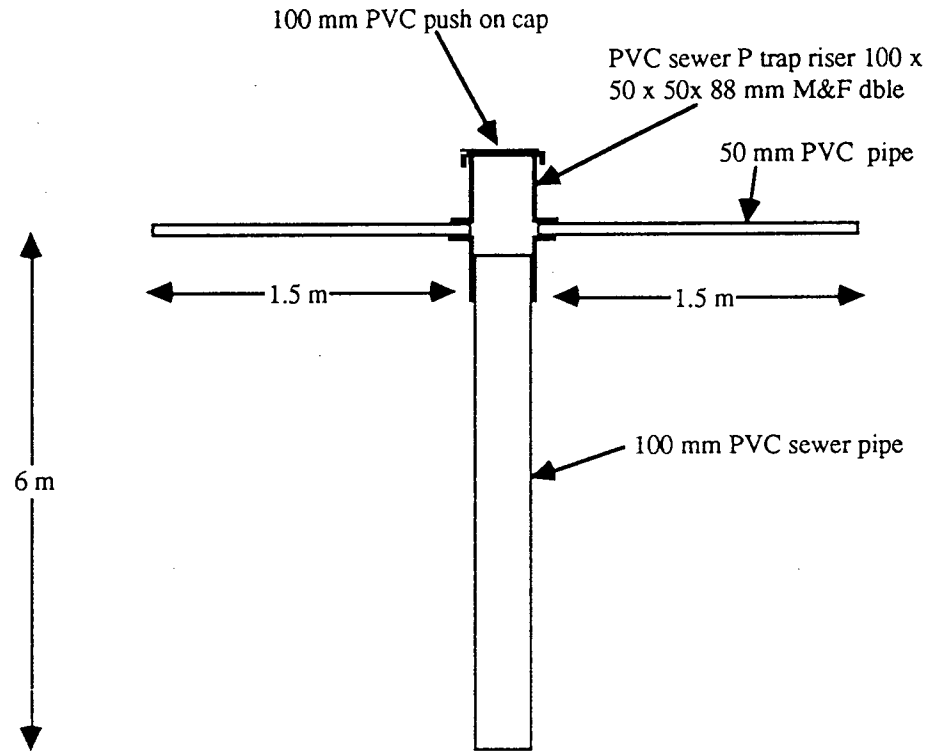
ph 099 493552
64
34

Bill Humphreys

Dr W.F. Humphreys
Senior Curator

Proposed method of stabilization of drill holes.

I have devised a scheme which I believe will adequately protect the top of the holes and protect the fauna from the holes.



The cost of piping will be $45.5 per hole at Perth prices and the installation cost minimal as a pipe will merely have to be dropped into the hole by the drillers after assembling three glued joints. I have identified 14 of these holes, the maintenance of which will give a good coverage of the area while minimising subsequent impact.

Item	Unit	$/ unit	Unit / hole	Cost / hole
100 mm PVC sewer 6 m length	6 m	28.00	1	28
50 mm PVC 6 m length	6 m	15.00	0.5	7.5
100 mm push on cap	1	2.00	1	2
Sewer P trap riser 100x50x50x88 M&F dble.	1	8.00	1	8
Sum				45.5
Total for 14 holes				$637

In addition, to make the preliminary investigation of the holes would require an airfare ($622) accommodation ($430) and a vehicle ($434) for one week (total $1486). The W.A. Museum would provide salary and sampling equipment.

Subterranean fauna of the North West Cape

Background

The species density of fauna and flora on the exposed limestones of the Cape Range peninsula and Barrow Island is exceptionally high for the region owing to the geomorphological diversity of the area. The surface biota is, nonetheless, unexceptional being essentially an arid zone biota with little endemism (papers in Humphreys 1993a). By contrast the subterranean fauna is exceptional as the below ground habitats have been buffered from the major surface changes associated with the onset of aridity.

The humid caves contain species that represent what is essentially a rainforest fauna in this now arid area and comprising species that are specially adapted to living underground. All the cave fauna is endemic and there is an exceptional degree of generic endemism.

The groundwater contains many relict taxa otherwise known from congeneric species in the North Atlantic and which represents a very ancient fauna associated with the Tethys Sea. The area contains the only representatives known in the southern hemisphere of entire classes, orders, families and genera of animals.

The fauna has mostly been discovered recently and is sparsely documented. It comprises a number of distinct components.

Aquatic fauna

The obligatory inhabitants of underground waters (stygofauna) contains orders, families, genera and species not otherwise represented in Australia, nor indeed in the southern hemisphere, and as such it makes a significant contribution to biodiversity in Australia — it is highly diverse in a world context.

Status

Aquatic fauna

The fauna is of high national estate and scientific significance, and of great conservation value, being endemic to the Cape Range Formation and highly disjunct from related fauna (which, for the most part, occur only in the Canary Islands and the Caribbean region). The fauna comprises a relict community derived from the ancient Tethys Sea (Humphreys 1993b, 1993c; Knott 1993) that separated the continents of Gondwana and Laurasia and which persisted from the Triassic until the late Eocene (200-40 Ma). It may well have been separated from its relatives with the break-up of Pangea and dispersed by seafloor spreading—in either case the fauna is very ancient.

Terrestrial fauna

The affinities of the terrestrial troglobitic fauna lie with the litter fauna of closed moist forests, both temperate and tropical, that are today typically found on the eastern seaboard of Australia. The fauna is considered to be relictual, isolated from similar taxa by the onset of aridity in the late Miocene or early Pliocene and it contains some very ancient elements with clear eastern Gondwanan affinities (papers in Humphreys 1993a; 1993d).

The troglobite fauna is entirely comprised of endemic taxa, often at the generic level (plus one family), to the Cape Range Formation and as such it makes a significant contribution to biodiversity in Australia.

Troglobitic animals are found extensively in Cape Range proper. A related but

discrete fauna is found on the coastal plain which has some species in common with Barrow Island.

Overall significance of the fauna

The Cape Range peninsula and Barrow Island have a high species density and exceptional endemism in its subterranean component (papers in Humphreys 1993a). Of the described specialist underground fauna known from the worlds tropics, *c.* 6.5% are known only from this area which comprises only 0.07% of Western Australia (*ibid.*).

References related to the subterranean fauna of the Cape Range peninsula

Chronological order

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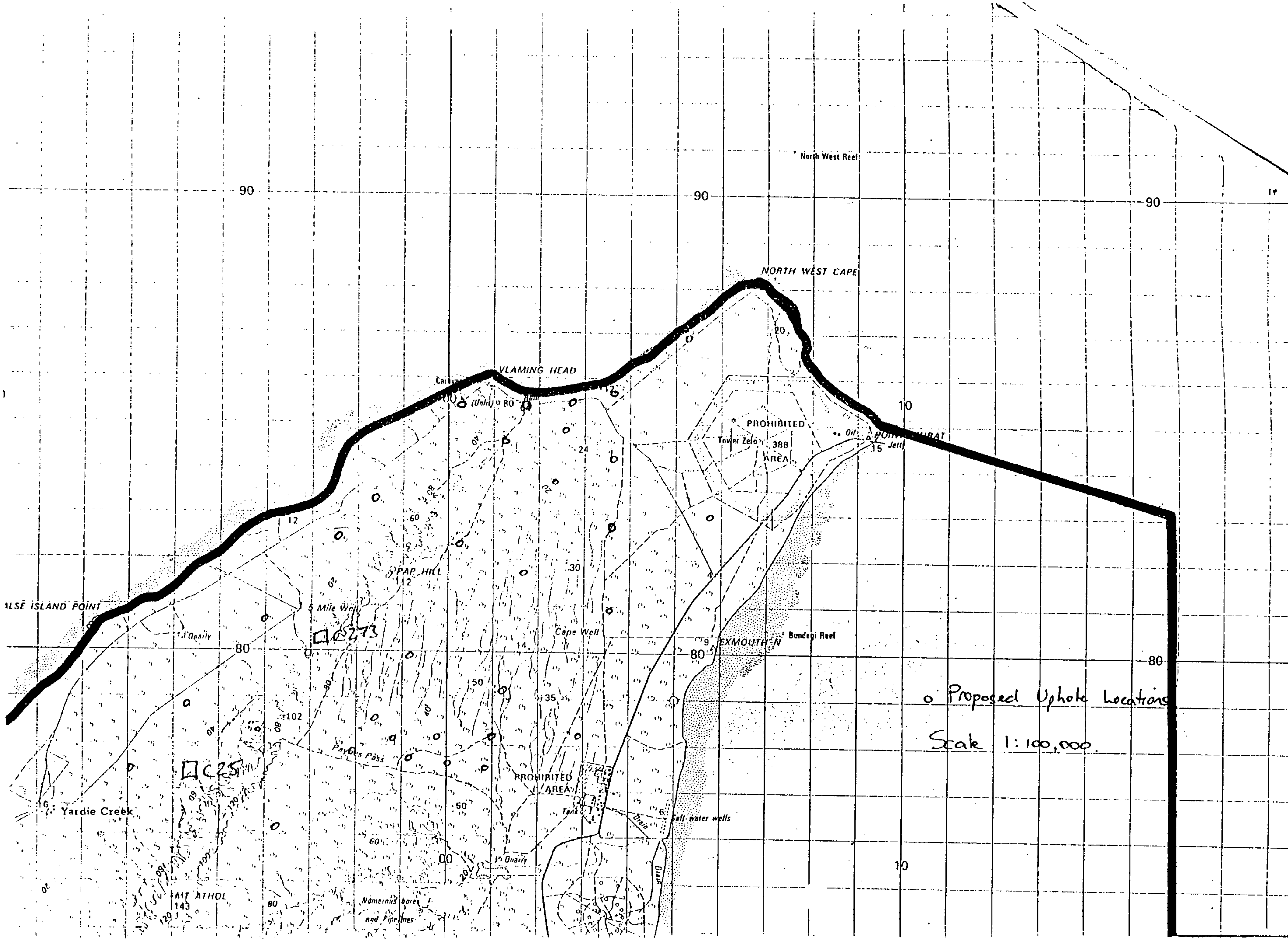

North West Reef
90
NORTH WEST CAPE
VLAMING HEAD
PROHIBITED
Tower Zelo
388
AREA
15
Jetty
PAP HILL
5 Mile Well
ALSE ISLAND POINT
Quarry
C273
Cape Well
EXMOUTH N
Bundegi Reef
80
10
o Proposed Uphole Locations
Scale 1:100,000.
Paybes Pass
C25
PROHIBITED
AREA
Tank
Salt water wells
Yardie Creek
MT ATHOL
143
Numerous bores
and Pipelines
Quarry
Drain
00

APPENDIX C

PRELIMINARY REPORT ON RESULTS OF SUBTERRANEAN FAUNA SAMPLING BY DR W. F. HUMPHREYS, MAY 1996

AMPOLEX LIMITED

ACN 000 113 217

QV1, 250 ST. GEORGES TERRACE, PERTH, WESTERN AUSTRALIA 6000.
POSTAL ADDRESS: G.P.O. BOX L902, PERTH, WESTERN AUSTRALIA 6001

Telephone: (09) 429 3200 Facsimile: (09) 429 3276

11 April 1996

Dr W Humphreys
W A Museum
Department of Terrestrial Invertebrate Zoology
Francis Street
PERTH WA 6000

Dear Bill,

MELINDA SEISMIC SURVEY

Ampolex are currently in the process of finalising our records and finishing field operations associated with the Melinda Seismic Survey acquired near Exmouth in July 1995. You will no doubt recall that the EP359 Joint Venture agreed to your request to leave 14 selected upholes open for sampling by the WA Museum and to provide funding to sample these same upholes.

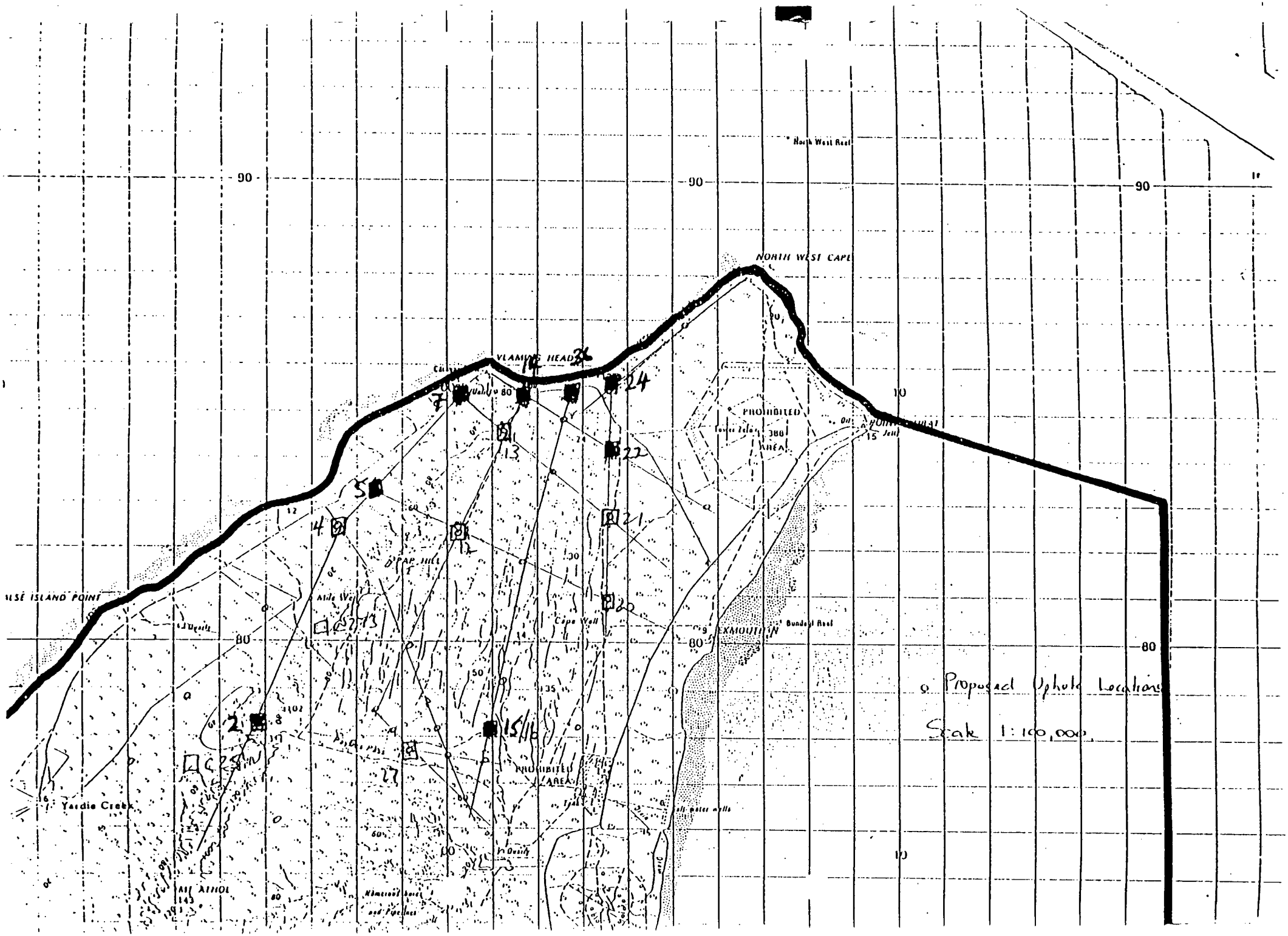
Recent discussions with you have indicated that of the 14 upholes drilled and left open for sampling of subterranean fauna you had no further requirement for 8 of these upholes (Numbers 2, 5, 7, 14, 36, 24, 22 and 15), but that you still had fauna traps down 6 upholes (Numbers 20, 21, 13, 12, 4 and 27).

Ampolex seek to confirm the above and request you advise us of the timeframe required to complete your field sampling of the remaining open upholes. We would also appreciate a copy of your preliminary findings in the search for subterranean fauna in the region.

Yours faithfully,
AMPOLEX LIMITED

R L MILLER
WESTERN AUSTRALIA ASSET TEAM LEADER

Ref: AKD025:skw
File: EP359



o Proposed Uphole Locations

Scale 1:100,000.

Western Australian museum

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Western Australia 6000
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Biogeography, Ecology and Biospeleology
Department of Terrestrial Invertebrate Zoology

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10/5/96

Mr R.L. Miller
Ampolex Limited
GPO Box L902
Perth
WA 6001

Dear Mr Miller

Melinda Seismic Survey

I enclose a copy of the preliminary findings resulting from the fauna survey using some of the upholes left open from this seismic work.

The opportunity to sample these holes has proved very valuable. It has substantially extended the range for some specialist subterranean animals and has shown that they occur to the tip of the Cape Range peninsula and also beneath the Holocene dunes.

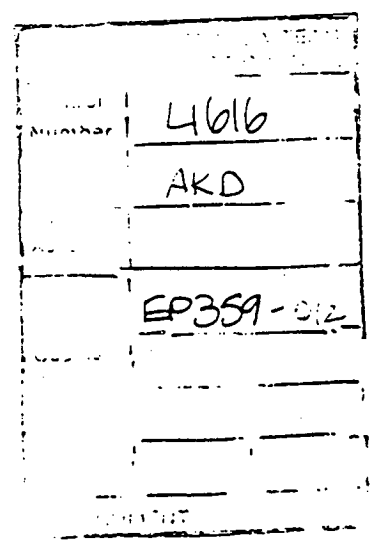
Two sites are especially valuable in that they have permitted undescribed terrestrial taxa to be sampled, these are numbers 22 and 'A'. At your convenience I would like to discuss with you how it may be possible to stabilise these two bores and maintain them as long term sampling sites. Work on the remaining bores is complete, although number 7 would also be a valuable addition to the available sampling sites for the aquatic fauna.

New species descriptions take time and are out of my control but I will send copies of any publications resulting from this sampling when they become available.

I much appreciate the cooperation of Mr Ashley Duckett in establishing this small project.. On behalf of the Western Australian Museum I would like to express our appreciation for the cooperation and support of Ampolex in this research.

Yours sincerely

Dr W.F. Humphreys
Senior Curator



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Geraldton Region Museum
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Albany Residency Museum
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Western Australia 6330
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Facsimile (098) 41 4027

Museum of the Goldfields
PO Box 25 Kalgoorlie
Western Australia 6430
Telephone (090) 21 8533
Facsimile (090) 91 2791

Report on the examination of fauna in upholes drilled by Ampolex on the northern tip of the Cape Range peninsula in 1995.

W.F. Humphreys

May 1996

Introduction

In 1995 Ampolex conducted a petroleum exploration programme on the northern tip of the Cape Range peninsula. The seismic work involved drilling a series of upholes through the karst some of which intercepted the groundwater. The bores could provide access to the groundwater in an area where there is no information about the unique and internationally significant subterranean fauna of the area. The lack of information in this region is problematic as protected subterranean species are present on either side of this northern tip. Hence, at the request of the Western Australian Museum, and after discussion with the Department of Minerals and Energy, Ampolex agreed to leave open for a limited period a number of these upholes and to temporarily secure the top of the holes. Ampolex provided sufficient funding to permit a limited sampling programme for any aquatic fauna in bores. Additional work conducted using other grant funding to the Western Australian Museum permitted limited sampling for any terrestrial component of the fauna.

Background to the regional fauna

The Cape Range peninsula and Barrow Island together contain numerous troglobitic animal species —obligatory inhabitants of subterranean air and water-filled voids — that comprise a series of faunas of great national and international importance. The troglobite fauna is entirely comprised of endemic taxa, often at the generic level (plus one family), to the Cape Range Formation and as such it makes a significant contribution to biodiversity in Australia. It is one of the richest areas in the world for such faunas. Of the described specialist underground fauna known from the worlds tropics, *c.* 11% are known only from this area which comprises only 0.07% of Western Australia (*ibid.*).

A number of the species are listed under Schedule 1 of the *Wildlife and Conservation Act 1950* as amended.

The affinities of the terrestrial troglobitic fauna lie with the litter fauna of closed moist forests, both temperate and tropical, that are today typically found on the eastern seaboard of Australia. The fauna is considered to be relictual, isolated from similar taxa by the onset of aridity in the late Miocene or early Pliocene and it contains some very ancient elements with clear eastern Gondwanan affinities (papers in Humphreys 1993a; 1993d).

The obligatory inhabitants of underground waters (stygofauna) contains the sole representatives known in the southern hemisphere of entire classes, orders, families and genera of animals (Poore and Humphreys, 1992; Bruce and Humphreys, 1993; Yager and Humphreys, 1996), and as such it makes a significant contribution to biodiversity in Australia — it is highly diverse in a world context. The fauna comprises a relict community derived from the ancient Tethys Sea (Humphreys 1993b, 1993c; Knott 1993) that separated the continents of Gondwana and Laurasia and which persisted from the Triassic until the late Eocene (200-40 Ma). It may well have been separated from its relatives with the break-up of Pangea and dispersed by seafloor spreading—in either case the fauna is very ancient.

The fauna has mostly been discovered recently and is sparsely documented. The fauna is of high national estate and scientific significance, and of great conservation value, being endemic to the Cape Range Formation and highly disjunct from related fauna (which, for the most part, occur only in the Canary Islands and the Caribbean region).

Methods

Aquatic fauna were sampled using phreatobiological nets (similar to plankton nets) and by traps (like mini cray-pots) left in place overnight; these have become the standard methods in the area (Humphreys 1994).

The terrestrial fauna was sampled using leaf litter traps left in place for several months (Table 1: see Humphreys 1991; Shear and Humphreys in press).

Results

Both aquatic and terrestrial troglobitic fauna were sampled from the upholes as well as a number of epigean species (Table 2).

The epigean species included oonopid and desid spiders, polyxenid millipedes and blattids.

Significant increases in the distribution of both the aquatic and terrestrial components of the fauna were made using the upholes. The Blind Gudgeon *Milyeringa veritas*, a listed species, was found to occur to the northern tip of the peninsula at Vlaming head, being taken from uphole number 7. This record is a 4 km extension of the range of the species to the north and shows that the species

occurs to the tip of the peninsula. Both *M. veritas* and the melitid amphipods were taken from bores of high salinity.

A new species of the micro whip-scorpion *Draculoides* sp. nov. was taken from two bores baited with leaf litter (numbers 20 and 'A') and extend the range of this species 27 km NNE of the only other known location. The data demonstrates that components of the terrestrial troglobite fauna occur in karst areas entirely buried by fixed Holocene red dunes, such as the northeast sector of the tip of the peninsula; large areas of southern Cape Range are buried beneath similar dune field that are evidence of a more arid past.

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Table 1: Summary of Ampolex upholes sampled adjacent to North West Cape, 1996.

Uphole	GR	Notes	Aquatic sample?
2	50194400E; 7578830N	Litter trap 13/11/95 No bore ?	No
4	50197667E; 7582465N	Litter trap 13/11/95	
5	50198389E; 7583356N		Yes: Lost traps
7	50200083E; 7585310N		Yes
12	50200413E; 7582560N	Black foul smelling sediment water ±1.5m deep	Yes
13	50201370E; 7584419N	Litter trap 13/11/95; could not get to water table	No
14	50201802E; 7585353N	Water rank black sediment ?mangrove	Yes
15/16		Not found	No
20	50203736E; 7580370N	Stinking black sediment too thick to penetrate with net ?algal ooze	Yes
21	50203830E; 7582681N	Litter trap 13/11/95; fine light brown sediment algal bloom type	Yes
22	50203844E; 7584181N		Yes
24	50203480E; 7585150N		Yes
36	50202676E; 7585544N		Yes
A	50200042E; 7577630N	Litter trap 13/11/95; Bore dry	No
B	50198006E; 7577884N	No bore, drilling mud and gravel on ground	No
C	50200965E; 7579203N	No bore, drilling mud and gravel on ground	No
D	50192900E; 7579338N	±3 m to water which is c. 2 m deep	Yes

Table 2: Summary of the salinity and fauna in Ampolex upholes sampled adjacent to North West Cape, 1996.

Uphole	Salinity	Aquatic fauna	Terrestrial fauna
2	-	-	-
4	-	-	-
5	24.7	*Milyeringa veritas*; harpacticoid copepods	ant
7	25.7	*M. veritas*; melitid amphipods; harpacticoid and calanoid copepods	Polyxenida: Polyxenidae: Diplopoda; blattid; Collembola
12	5.5		Nasute termite
13	-	-	-
14	6.7	-	-
15/16	-	-	-
20	-	-	Oonopidae (*Opopaea* sp.); Collembola; Isopods; ?Scutigeromorpha; Schizomida (*Draculoides* sp. nov.)
21	12.2	-	Ant remains
22	24.8	-	-
24	25.2	-	Blattid; ant
36	20.2	melitid amphipod	-
A	-	-	Isoptera; Schizomida (*Draculoides* sp. nov.)
B	-	-	-
C	-	-	-
D	15.1	*Milyeringa veritas*	Ant; Salticidae (unidentati group); Desidae (?*Forsterina* juvenile)

APPENDIX D

REPORT BY THE APPEALS CONVENOR FOR THE ENVIRONMENTAL PROTECTION ACT (1986) TO THE MINISTER FOR THE ENVIRONMENT, 23 JANUARY 1997

Appeals Convenor for the Environmental Protection Act (1986)
12th Floor, Dumas House
2 Havelock Street, West Perth WA 6555
Telephone: 321 0144 Fax: 321 0155

HON MINISTER FOR THE ENVIRONMENT

I refer to your request for my report on the following appeals:

NO. OF APPEALS:	2: 116, 117
APPELLANTS:	Greenpeace Australia and the Conservation Council of WA
PROPONENT:	Victoria Petroleum
PROPOSAL:	Melanie-1 Petroleum Exploration Well, Cape Range Peninsula
NATURE OF APPEALS:	The appeals are lodged in objection to the level of assessment as set at Informal Review with Public Advice by the Environmental Protection Authority.
APPEAL GROUNDS:	See attached appeal decision summary reports.
CONDUCT OF APPEALS:	See appeal report.
RECOMMENDATIONS:	Dismiss the appeals.
ATTACHMENTS:	1. Appeal report. 2. Draft letters to appellants. 3. Draft letter to the Minister for Mines.

D Carew-Hopkins
APPEALS CONVENOR for the
ENVIRONMENTAL PROTECTION ACT (1986)

23 January 1997

APPEAL REPORT

APPEAL AGAINST LEVEL OF ASSESSMENT: MELANIE-1 PETROLEUM EXPLORATION WELL CAPE RANGE PENINSULA

THE PROPOSAL

Victoria Petroleum propose to drill a petroleum exploration well near the tip of Cape Range Peninsula on vacant Crown land 18km north of the Cape Range National Park. Drilling is proposed to a depth of 1360m with the first 60m through cavernous limestone. The proponent will also be drilling a shallow bore for water supply.

Victoria Petroleum also propose to drill a second exploration well, White Opal-1, on Commonwealth land at the nearby communications station. At this stage the White Opal-1 well is being considered for assessment by the Commonwealth EPA.

EPA ASSESSMENT

The EPA considered the likely environmental impacts of the proposal and set the level of assessment at Informal Review with Public Advice.

APPEALS

Appeals against the level of assessment were lodged by Greenpeace Australia and the Conservation Council of WA.

The grounds of appeal are:

- That the project poses the potential for significant environmental as well as aesthetic impact on the environmentally and recreationally important area of Cape Range Peninsula, through its proximity to Cape Range National Park and its location immediately adjacent to Ningaloo Marine Park. The area in question has been recommended (Red Book 1975) for inclusion in the National Park.

- That there is potential for oil pollution of Ningaloo Marine Park via surface or subterranean routes. Tidal movements of up to 2 km inland have been recorded in cave systems in the area, and the drilling site would be located less than 1 km from the boundary of the marine park.

- The proposed exploration drilling poses the risk of loss of unique and unstudied biodiversity (underground cave fauna of international significance) through the potential for:

  oil and other chemical contamination of groundwater;

  the possible loss of salinity stratification; and

  noise and vibrations from drilling activities.

- That the proponent has almost total lack of information on the nature and properties of groundwater in the project area and can only surmise as to the nature of the substratum through which it will be drilling:

- That the company has been licensed to "take fauna for scientific purposes".

CONDUCT OF APPEALS

I have received advice from the DEP and from Victoria Petroleum on appeal grounds.

I have held discussions with the DEP, Victorian Petroleum and the Association of Petroleum Production and Exploration Association (APPEA) at the request of the former Minister for the Environment, the Hon Peter Foss.

Letters have been sent to Senator Robert Hill and Hon David Hull regarding Commonwealth/State co-operation in the environmental assessment of the Melanie-1 and the White Opal-1 exploration wells (see attached).

DEP APPEAL ADVICE

The DEP has advised that there is a need for more information and consultation with relevant technical experts to ensure that groundwater is protected from pollution and that there is a need to assure the community that the management measures are adequate. The DEP believes that further information is required on:

- oil spill prevention methods;
- oil spill contingency planning, in particular the need for an impermeable barrier at the surface to precent spills from seeping into the ground;
- methods to prevent escape of hydrocarbon gas and other potential pollutants into the cave systems;

The DEP has recommended that the appeals be upheld and that the level of assessment be set at CER. (see attached).

ENVIRONMENTAL ASSESSMENT AND MANAGEMENT PROGRAM

The proponent has prepared a detailed Environment Assessment and Management Program (EMP) produced by Consultants Martinick and Associates (see attached). The EMP provides details of the proposals, environmental appraisal of geology, hydrogeology, flora and fauna and conservation habitat and heritage sites. The proponent has undertaken initial public consultation with the Shire of Exmouth, CALM, Water and Rivers Commission, Conservation Council of WA, Exmouth Chamber of Commerce and the Cape Conservation Group. The initial public comment assisted the proponent in making and modifying a number of commitments.

The EMP makes 26 commitments, the main ones being :

- minimise disturbance to soil, terrain and vegetation,
- store any solid waste or spillage in plastic lined sump and dispose appropriately, according to the requirements of the Shire of Exmouth,
- all fuel storage to be bunded, and
- re-spread top soil over the site and arrange for the Cape Conservation Group to visit the area before, during and after drilling and to consider recommendations that the Group makes.

KARST REPORT

The Karst Report was produced in August 1996 and received significant media coverage at the time. The report is a draft titled "Karst Management Considerations for the Cape Karst Province, Western Australia" and was prepared by Rethink Consulting Victoria, Kevin Kiernan Tasmania, and Andy Spate from NSW for the Western Australian DEP. I have reviewed the report in relation to these appeals and other appeals against the recommendations of the EPA on a special rural subdivision south of Exmouth.

The team which prepared the report was commissioned by the DEP to report on the significance of the Exmouth/Cape Range region, key Karst management issues and to contribute towards the development and review of environmental policy for the region.

The draft report is remarkable for its lack of scientific detail on environmental factors and for its heavy emphasis on emotional statements and expressed opinions. The report also deviates markedly from its terms of reference and makes recommendations about planning and tourism. As such, the recommendations of the report have little substantial backing and have not been adopted as policy.

The inadequacies of the report have been recognised by the DEP which has initiated a review of the report to identify parts of the report which are:

a) potentially defamatory;
b) outside the terms of reference;
c) outside the authors' areas of expertise;
d technically or factually incorrect, or;
e) statement made or opinion expressed which require further substantiation.

Consequently, in the analysis of appeal points, I have taken little account of the Karst Report.

PROPONENT'S RESPONSE TO APPEAL ISSUES

The proponent has responded to the grounds of appeal. The proponent's consultant has advised that:

a) no toxic chemicals will be used during drilling of Melanie-1 and the only additives to be used during drilling are bentonite (natural clay) and potassium chloride (salts).

b) no material, other than water, will escape into the cavernous limestone from the well during drilling and the surface casing will be sealed with cement. Well construction will not permit any gases or oil to escape into any formation below the ground.

DEPARTMENT OF MINERALS AND ENERGY (DME)

The DME has advised that, on the completion of the environmental process, it will be approving the drilling of both the Melanie-1 and White Opal-1 petroleum exploration wells and will place conditions on the approval. The DME has verbally agreed to include the proponent's commitments as conditions and can include additional conditions requested by the Minister for the Environment and/or the EPA.

AUSTRALIAN PETROLEUM PRODUCTION AND EXPLORATION ASSOCIATION (APPEA)

The issues relative to this appeal have been discussed with APPEA which has agreed that the petroleum industry needs to become more pro-active in regard to the research and investigation of underground cave fauna. APPEA has agreed to assist and fund research into cave fauna with the aim of developing guidelines and standards for petroleum explorations in and around Cape Range. The research may extend to other areas of the State and will benefit the EPA in providing more information in the environmental assessment of projects.

DISCUSSION AND CONCLUSION

The appellants have raised issues concerning potential pollution of groundwater and impacts on underground cave fauna.

The proponent has carried out a detailed environmental assessment and management program and made a number of commitments to minimise and manage environmental impacts.

The proponent's commitments can be incorporated into approvals by the Department of Mines and Energy including matters relating to rehabilitation and control of any spills.

There has been some 40 petroleum exploration wells drilled in the Cape Range region and more than 100 groundwater extraction wells, none of which has been required to undergo formal environmental assessment.

The probability of an oil spill at the site is no greater than at many existing operations in Exmouth or from the transport of fuel and oils. In the event of an oil spill at the site it is extremely unlikely that contamination would reach the coastal waters of the Ningaloo Marine Park.

While it is agreed that an overall policy to guide and manage the drilling of wells at Cape Range is required I do not believe that it is fair and reasonable to single out the Melanie-1 proposal for formal environmental assessment without greater justification.

The former Minister for the Environment, the Hon Peter Foss MLC wrote to the Federal Ministers for the Environment and Administrative Services requesting that environmental assessment of the White Opal-1 be carried out by the State EPA and that he (now you) be consulted prior to a decision by the Commonwealth (copy of letters attached). Communication with his office has suggested that a decision on White Opal-1 is not imminent and the proponent has requested that appeals on Melanie-1 be progressed. I agree that it is fair and reasonable that the appeals are determined now.

I have concluded that there are no extenuating or unusual circumstances relating to the drilling of Melanie-1 petroleum exploration well which warrants greater environmental assessment or public review, and in this regard I concur with the EPA's decision on level of assessment being Informal Review with Public Advice.

RECOMMENDATION

Dismiss the appeals.

Draft letters to appellants and to the Minister for Mines have been prepared and are attached.

D Carew-Hopkins
APPEALS CONVENOR for the
ENVIRONMENTAL PROTECTION ACT (1986)

23 January 1997

MINISTER FOR THE ENVIRONMENT;
EMPLOYMENT AND TRAINING

HON MINISTER FOR MINES

MELANIE-1 PETROLEUM EXPLORATION WELL CAPE RANGE PENINSULA

Victoria Petroleum proposed to drill the Melanie-1 petroleum exploration well near the tip of the Cape Range Peninsula. The Environmental Protection Authority (EPA) has recently set the level of environmental assessment for the proposal at "Informal Review with Public Advice".

The level of assessment set by the EPA was appealed by two groups on the grounds that there is potential environmental impact on underground water and on underground cave fauna.

I have considered the issues of the appeals and dismissed all appeal grounds. During the investigation of appeal matter the Appeals Convenor had discussions and reached agreement with Mr Peter Bailey of the Department of Minerals and Energy regarding the inclusion of various conditions in the approval to drill to be issued by the Department.

The proponent's consultant Martinick and Associates, has prepared a report on the Environmental Assessment and Management for the proposal and has included a number of commitments to minimised and manage environmental impacts.

I am writing to request that these commitments are included in the DME approval for construction of the well and that the DME liaise with the Departmental of Environmental Protection (Mr Colin Murray) prior to the issue of approval.

CHERYL EDWARDES (Mrs) MLA
MINISTER FOR THE ENVIRONMENT;
EMPLOYMENT AND TRAINING

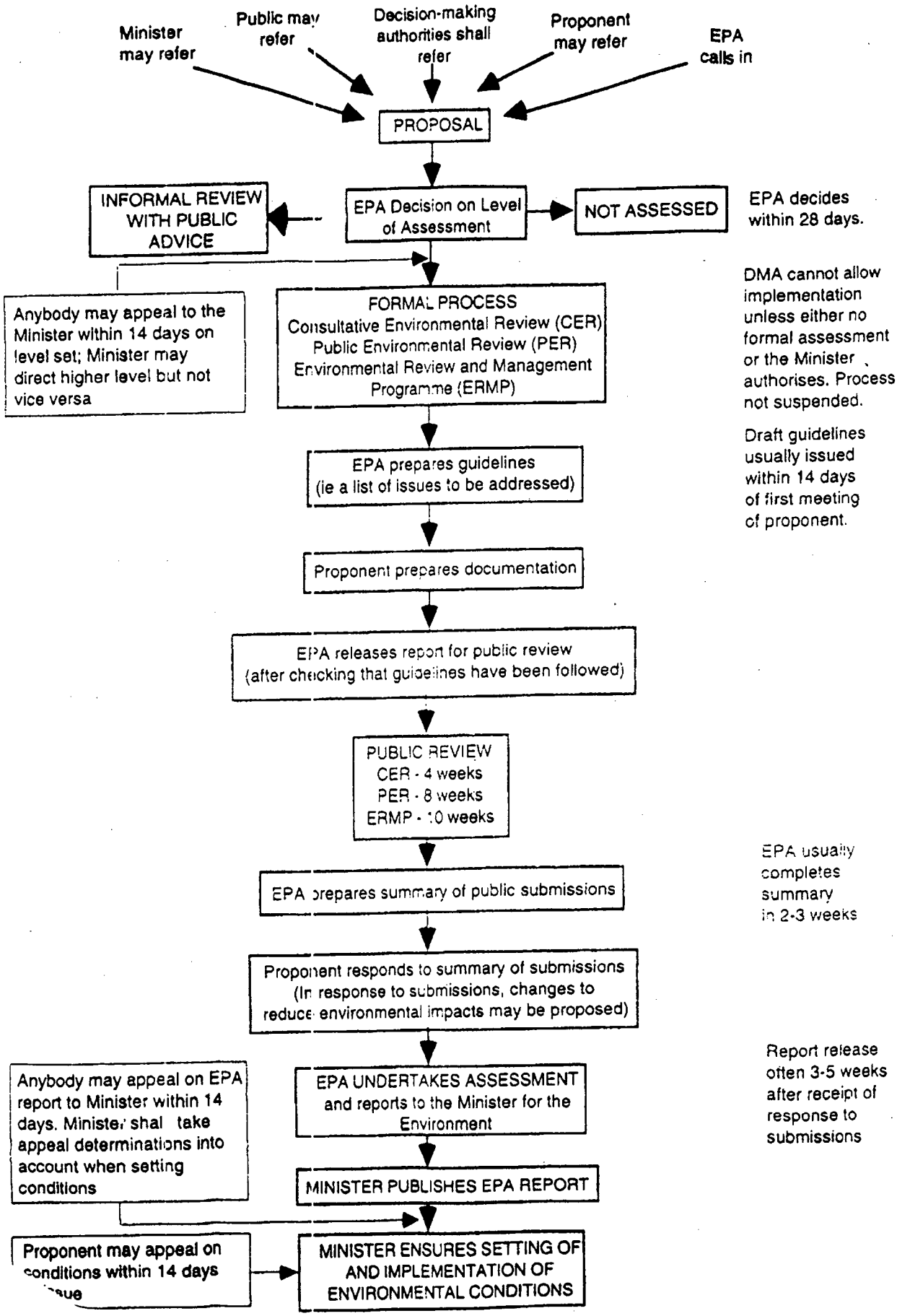
30 JAN 1997

18th FLOOR, ALLENDALE SQUARE, 77 ST. GEORGE'S TERRACE, PERTH 6000 TELEPHONE: (09) 421 7777 FACSIMILE: (09) 221 4665/8

APPENDIX E

FLOW CHART OF THE ENVIRONMENTAL APPROVAL PROCESS IN WESTERN AUSTRALIA

EIA PROCESS FLOW CHART



APPENDIX F

LETTER FROM WATER AND RIVERS COMMISSION, 30 MAY 1996

WATER AND RIVERS
COMMISSION

YOUR REF
OUR REF
ENQUIRIES Mr Angus Davidson
DIRECT TEL 278 516

Mr Wolf Martinick
W.G. Martinick and Associates Pty Ltd
4/114 Churchill Avenue
Subiaco WA 6008

Dear Mr Martinick

Your draft document titled "Environmental Assessment And Management Study : Melanie - 1 Exploration Well Cape Range Peninsula" has been reviewed w th interest by Mr Angus Davidson, Supervising Hydrogeologist, Groundwater Investigation Brar ch of the Resource Investigations Division.

Your draft report accurately quotes Mr Davidson's comments on hydrogeology, however, a typographical error occurs on page 9. The sixth paragraph sho.ld read-

"...Below approximately -60 m AHD..."

In actual fact, the base of the cavernous material may be substantially higher than 60 m below AHD. This, of course, can only be verified by drilling.

Your assessment has utilised the most recent work including a report by Dr. A.D. Allen (1993) and the Water and Rivers Commission concurs with your summation of the project. Approval to attach these comments to the licence application for a water bore are given.

Yours sincerely

Bruce Hamilton
DIRECTOR
Resource Investigations

30 May 1996

HYATT CENTRE 3 PLAIN STREET EAST PERTH WA 6004
PO BOX 6740 HAY STREET EAST PERTH WA 6892 TEL (09) 278 0300 FAX (09) 278 0301
MANAGING AND PROTECTING WESTERN AUSTRALIA'S WATER RESOURCES

APPENDIX G

SUN RESOURCES NL'S CORPORATE ENVIRONMENTAL, HEALTH AND SAFETY POLICIES

SUN RESOURCES N.L.

A.C.N. 009 196 810

ENVIRONMENTAL POLICY

Sun Resources NL is committed to conducting all its operations and activities in an environmentally sound and responsible manner.

The Company is committed to planning and managing all of its activities in a manner which will avoid or minimise disturbance to the environment in which it operates. To achieve this, the company utilises environmental standards consistent with development in technology, industry, codes of practice and all relevant statutory requirements.

Sun Resources NL requires all of its employees and contractors to undertake their work in an environmentally sound manner and to consider environmental protection, especially the protection of native flora and fauna, landforms and drainage in its operations as one of their responsibilities.

The Code of Environmental Practice of the Australian Petroleum Production and Exploration Association Ltd (APPEA) has been accepted by Sun Resources NL as providing the most appropriate basis for its Environmental Management Programme. The basic principals adopted require the Company to:

- Comply with applicable Commonwealth and State Government statutory requirements for the protection of the environment.

- In the absence of specific regulatory prescription or guidelines, adopt the best practicable means available to minimise and ameliorate adverse environment impacts.

- Consult appropriate government agencies and other parties to meet all statutory requirements and to facilitate effective liaison with government and non-government bodies.

- Ensure timely and effective consultation with landholders (owners or lessees) and where land is held or managed by Aboriginal communities ensure liaison is with relevant and authorised representatives.

- Assess the regional and local environment of the intended area of operations, recognise areas of high environmental sensitivity and adopt strategies to avoid or protect such areas.

- Plan to locate, design, operate and commission all facilities and associated infrastructure to avoid or mitigate adverse environmental impact.

- Monitor environmental effects and audit environmental performance at all stages of exploration, development and production.

- Provide adequate training to enable employees to recognise the potential implications of their activities and be equipped to act in an environmentally responsible manner.

SUN RESOURCES N.L.

A.C.N. 009 196 810

CORPORATE HEALTH, SAFETY AND ENVIRONMENTAL POLICY

Sun Resources NL is committed to undertaking its petroleum exploration and production operations in a safe, efficient and environmentally responsible manner.

The Company believes that its corporate objective of maintaining consistently high standards of health, safety and environmental practice are compatible with, and complementary to the goal of maximising the value of the Company to its shareholders.

To this end, health, safety and environmental considerations always take precedence over immediate production and financial concerns. The philosophy being that in the long term, a safe and environmentally aware and efficient operation will maximise returns.

It is the responsibility of line management and all employees and contractors to co-operate in striving for high standards of health, safety and environmental practice.

This is to be achieved only through a commitment to undertake all tasks in the safest, least environmentally damaging and most efficient manner possible. A positive attitude to maintaining and improving upon existing standards is expected of all employees and contractors of Sun Resources NL.

Training plays a central role in achieving good health, safety and environmental performance. No task should be undertaken unless all personnel involved fully understand the safety, environmental and operational significance of the task at hand. It is the responsibility of line management to ensure that all personnel have received proper training and are issued with all necessary safety equipment prior to commencing any operation. It is the responsibility of all personnel to bring to the attention of line management any task that they are not correctly equipped to perform with respect to safety, environmental care and efficiency.

The Company will at all times follow the Code of Environmental Practice - Onshore of the Australian Petroleum Production Exploration Association Ltd.

Notwithstanding the Company's commitment to the safety and welfare of its employees, it remains the responsibility of each individual to conduct themselves with due respect to his or her health and safety, the well-being of the environment and the laws of the land.

APPENDIX H

DESCRIPTION OF DIALOGUE DURING INITIAL PUBLIC CONSULTATION PROGRAMME

In the following, detail of the discussions which took place during the public consultation programme for the Melanie-1 exploration well is provided.

a) Shire of Exmouth and Gascoyne Development Commission

The Shire President (Mr David Richardson), Shire Clerk (Mr Kerry Graham) and Senior Regional Adviser of the Gascoyne Development Commission (Mr Doug Bathgate; also a former President of the Shire) were consulted jointly. They advised as follows:

i. The North West Cape Planning Study, a committee with large representation, eg DME, CALM, DEP, EPA, Shire, Ministry of Planning, WA Museum, Gascoyne Development Commission, Fisheries, has been established to identify existing and potential economic development in the Exmouth region and to rationalise the orderly development of regional resources. They should be informed as soon as possible of the proposed drilling and potential development opportunities. This should be undertaken before the drilling commences.

ii. The Cape Conservation Group Incorporated, an umbrella group which represents the various conservation groups of the region should be consulted to obtain conservation views and input.

iii. WAPET developed good community relationships through regular public consultations. This is to be encouraged and Sun Resources NL is to be encouraged to keep the community informed.

iv. The Shire and the Gascoyne Development Commission welcomed Sun Resources NL's initiative to consult with them and the public. They consider such consultations to be an important part of the total project, and they congratulated the Company on this approach.

v. The Shire and the Gascoyne Development Commission want regional economic diversification and they fully support the proposed drilling subject to sound environmental management to protect the environment of Cape Range Peninsula.

vi. The Community of Exmouth should be kept informed of progress, and tours should be undertaken of the Project Area during drilling. People known to be critical of the project should be invited to visit the drilling operations.

vii. An ongoing programme of consultation should be developed for the drilling programme.

viii. A copy of this document is to be forwarded to the Shire for public display and a copy is to be forwarded to the Gascoyne Development Commission.

ix. If requested, the Shire and the Gascoyne Development Commission will submit written support for the project, subject to sound environmental management.

b) Cape Conservation Group Incorporated - Initial visit

Dr Chris Henderson, President of the Cape Conservation Group, was consulted on 7 June 1996 by Dr Wolf Martinick. A copy of a draft of this document was faxed to him so that he could be appropriately prepared for the meeting. Also present was Ms Anna Lightowler, a member of the Cape Conservation Group. The following is a summary of the outcome of the consultation:

i. Ms Anna Lightowler stated that she was totally opposed to any drilling for oil and gas, but particularly oil, on Cape Range Peninsula, and would never agree to it. In her opinion the oil and/or gas industry is incompatible with the tourist industry and potential of the region, and it has the potential to result in great environmental damage. She excused herself from the meeting after about 20 minutes.

ii. Dr Chris Henderson had read the faxed draft of this document, and he discussed details of the proposed operations. As a consequence of his comments, a number of changes and additions were made to the draft. The following main points were raised:

- *Issue:* A document was presented by a Conservation Group member (Darren Brooks) expressing a number of concerns about the seismic survey of 1995. A main concern was why the seismic lines have to be dead straight; why can they not avoid important stands of vegetation and interesting rock formations?
- *Answer:* Relevant information was forwarded to Dr Chris Henderson. The concerns raised in this document were addressed by Discovery Petroleum NL.

- *Issue:* Would it be possible for members of the Cape Conservation Group Incorporated to visit the Project Area before commissioning, during drilling and on decommissioning, and will views expressed by members of this Group be considered in the rehabilitation of the Project Area and in formulating an Environmental Management Programme for the operations.
- *Answer:* It was agreed that such visits will be arranged and that views/recommendations will be evaluated and, where appropriate, introduced into the Environmental Management Programme and site rehabilitation. Meaningful dialogue was established during the meeting and the suggestions above were discussed, and where considered appropriate (by the Proponent and Dr Chris Henderson), they were subsequently incorporated into this document.

- *Issue:* What cyclone precautions, especially with respect to flooding, have been developed for the project? A delay in drilling could cause the drilling to coincide with a cyclone.
- *Answer:* The drilling is scheduled for September/October, which is outside of the cyclone season. A Cyclone Contingency Plan was subsequently incorporated into the document.

- *Issue:* Drilling of the Mesa-Camp Well in the early 1980's apparently resulted in animals being trapped in the drying mud of the sump despite it having been fenced with 3 or 4 strands of wire. It was requested that efforts be made to avoid a repeat of such events, and that the area be surrounded with ringlock fencing during and after the operations.
- *Answer:* The operations have been suitably amended so that drilling mud will be removed during decommissioning and the sump will be surrounded with ringlock fencing during and after the operations.

- *Issue:* Is there a possibility that the flare pit will attract baby turtles which would then move inland instead of into the sea?
- *Answer:* The drilling is scheduled for September/October which is outside of the turtle nesting season. They tend to be active between January-February. Importantly, the flare pit will be kept near horizontal, and it will be behind raised terrain and not visible from the road. During a visit later that day to the site by Dr Chris Henderson, Mr John Blinkhorn (Vice President of the Cape Conservation Group Incorporated, and a Shire Councillor) and Dr Wolf Martinick it was agreed that the flare will not be visible from the beach and that it is highly unlikely to be a problem for the turtles.

- *Issue:* Soil compaction on the access track may be a problem, although for most of its length the surface of the access track is exposed limestone. Dr Chris Henderson requested that if the Cape Conservation Group Incorporated came up with sound recommendations, that these would be considered.
- *Answer:* It was agreed that compaction may be a problem but that it may be difficult to avoid or rectify. On decommissioning, the need for ripping to reduce soil compaction on the access track and its practicality will be determined by a site inspection.

- *Issue:* Dr Chris Henderson would like Sun Resources NL to prepare some material about the proposed drilling which could be displayed in a prominent location to inform members of the public.
- *Answer:* It was agreed that such a display is acceptable.

- *Issue:* In the event of a discovery of commercial quantities of hydrocarbons, could necessary processing facilities be located on the eastern side of Cape Range Peninsula on land with existing infrastructure to minimise environmental and visual impacts. He felt that this was probably the single most important request to come out of the meeting.
- *Answer:* It was agreed that Dr Wolf Martinick and Dr Chris Henderson would jointly inspect the Project Area later that day to further discuss the proposed operations and his recommendations/concerns.

c) Cape Conservation Group Incorporated - Inspection of Project Area

Following initial discussions between Drs Chris Henderson and Wolf Martinick, the Project Area was visited to further discuss the proposed drilling and the issues previously raised by Dr Chris Henderson, and to become familiar with the Project Area. Also present during the site visit were Mr John Blinkhorn and Mr Lou de Vattimo, the nominated drilling supervisor. Mr Lou de Vattimo was able to discuss specific operational details and how he proposes to incorporate the various items of infrastructure.

Following this meeting, Mr John Blinkhorn asked Dr Chris Henderson to advise Dr Wolf Martinick as follows:

i. The proposed drilling operation is an example of Best Practice because the site for the Project Area was carefully selected so that it is out of public view, the layout is carefully designed to minimise environmental impact and because the Proponent has initiated a consultation process which has established meaningful dialogue.

ii. Site visits are important and the Cape Conservation Group and others should be given the opportunity to visit the Project Area shortly before, during and after drilling. (This has been agreed to).

iii. The proposed operations have obviously been carefully designed with respect to environmental care. The question is, will site management be equally as careful during its implementation?

iv. Could duckboards be used to avoid the need for walkways and consequently reduce damage to vegetation? This was discussed with Mr Lou de Vattimo, and he agreed to use such duckboards (probably steel mesh) wherever practically feasible.

v. The Cape Conservation Group would like compaction of soil on access tracks to be given special attention. It was agreed that on decommissioning ripping may not always be practical because of the dominance of limestone surfaces and small areas of very shallow soils. It was suggested that other means should be investigated.

d) Headmaster of Exmouth High School - Mr John Greive

The proposed project was discussed with Mr John Greive. He made the following comments/requests:

i. He appreciated being informed about the project and he had advised his staff that we may give a presentation to the children later that same day. It was agreed that such a talk would be given in the near future, and the school would like 2-3 days notice.

ii. WAPET and other Companies have given similar talks to school children during public consultation programmes and these talks were well received. He would like the talk to focus on the environmental issues which relate to oil and gas exploration and environmental management procedures rather than purely on oil and gas exploration/production since these topics have been covered previously.

iii. He would like a copy of the final document for the library so that it could be used by school children for study projects.

iv. What security measures are likely to be in place if the exploration is successful and an oil beam pump or a gas valve system is established on a remote site?

v. Can a visit of the Project Area be arranged for school children during the drilling?

e) Exmouth Chamber of Commerce - Mr Gino Gabellini, President

The proposed project was discussed with Mr Gino Gabellini, who made the following comments:

i. The Exmouth Chamber of Commerce (ECC) has three important criteria in assessing projects, namely:

- They must be environmentally safe and rely on statutory environmental procedures to determine the environmental safety of projects.
- They must be commercially sound as they do not want numerous examples of commercial failure.
- They must not "dramatically" alter the culture or lifestyle of the Exmouth community, including the 8 000 tourists who annually visit Cape Range Peninsula.

ii. The proposed project meets the above criteria and consequently it has the full support of the ECC.

iii. The ECC would like to see the establishment of a broad range of industries on Cape Range Peninsula so as to become less reliant on tourism. The proposed drilling has the potential to achieve this.

iv. There are about 157 registered businesses in Exmouth, with several families owning more than one. Of about 80 registered businesses in the Exmouth area, the ECC represents 54.

v. If requested, the ECC would prepare a submission of support for the proposed project.

f) Ms Leonie Horek, Editor, Exmouth Expression (a monthly local newspaper)

Ms Leonie Horek was very involved with the establishment of the Ningaloo Marine Park, is a member of the Cape Conservation Group Incorporated and is an editor of the Exmouth Expression. The proposed project was discussed and she made the following comments/requests:

i. She is not a great supporter of the oil industry because of Exmouth's proximity to oil fields and consequently its closeness to the risks associated with damage to the fragile marine and terrestrial environment of the region. She is concerned about the potential risks and environmental damage that an oil field poses, especially to the marine environment.

ii. The potential environmental risks associated with the Melanie-1 exploration well can be better addressed because the Project Area is located on land and not in the sea.

iii. She has no major reservations about the Melanie-1 exploration well but 'keeps her fingers crossed' that they do not discover oil.

g) Mr Robbie Atkinson - Owner of Lighthouse and Yardie Creek Caravan Parks

Mr Robbie Atkinson was consulted because of the proximity of the Lighthouse Caravan Park to the Project Area and because the Proponent may elect to accommodate the workforce in his facilities. The proposed project was discussed, and he made the following comments:

i. He acknowledges that with modern methods the drilling on land for oil and gas can be undertaken with minimal environmental damage.

ii. He is opposed to the proposed drilling because he is convinced that the Proponent is exploring for a large oil deposit, and such a discovery would almost certainly result in a request to construct a floating pipeline to off-shore tankers. This would have enormous environmental consequences and could result in the destruction of Ningaloo Reef.

iii. He requested detailed information on the proposed downstream processing and transportation procedures. He was informed that such planning had not yet been undertaken because in the absence of the exploration results such planning would be totally speculative. He rejected this and was adamant that downstream processing and handling of the products should be determined now.

As a consequence of Mr Robbie Atkinson's comments, more information has been included in this document on the potential of the drilling target which was identified during the seismic survey.

h) Conservation Council of Western Australia

Ms Rachel Siewert of the Conservation Council of Western Australia was informed of the proposal and given a copy of an advanced draft of the document. She indicated that due to other commitments she was not able to thoroughly study the submission and she intended to take a closer look at the document and discuss it with two other relevant people in her office, namely Ms Giz Watson and someone else. Her initial concerns were:

- The effect on troglobitic and stygofauna.
- The location of the Project Area to turtle populations.
- Whether the Project Area was part of the region which the Conservation Council has nominated for inclusion into extensions to Cape Range National Park.

Ms Siewert promised to provide further comments after 20 June 1996, however she did not do so and later appealed against the nominated level of assessment of 'informal review with advice given', which was allocated to the proposal in July 1996.

i) Water and Rivers Commission

A draft of this Environmental Assessment and Management Programme was reviewed by Mr Angus Davidson, Hydrogeologist with the Waters and Rivers Commission, and in a letter of 30 May 1996 (Appendix F) he commented that "Your assessment has utilised the most recent work including a report by Dr A D Allen (1993) and the Water and Rivers Commission concurs with your summation of the project. Approval to attach these comments to the licence application for a water bore are given."

APPENDIX I

LICENCE TO TAKE FAUNA FOR SCIENTIFIC PURPOSES ISSUED BY THE DEPARTMENT OF CONSERVATION AND LAND MANAGEMENT

DEPARTMENT OF CONSERVATION AND LAND MANAGEMENT

Enquiries: 50 HAYMAN ROAD, COMO, WESTERN AUSTRALIA
Telephone: 09 334 0333
Facsimile: 09 334 0466

Correspondence: P.O. Box 104 COMO WA 6152

PAGE 1
LICENCE NO. SF002111
RECEIPT NO. AMOUNT
$0.00

WILDLIFE CONSERVATION ACT 1950
REGULATION 17

LICENCE TO TAKE FAUNA FOR SCIENTIFIC PURPOSES

THE UNDERMENTIONED PERSON MAY TAKE FAUNA FOR RESEARCH OR OTHER SCIENTIFIC PURPOSES AND WHERE AUTHORISED, KEEP IT IN CAPTIVITY, SUBJECT TO THE FOLLOWING AND ATTACHED CONDITIONS, WHICH MAY BE ADDED TO, SUSPENDED OR OTHERWISE VARIED AS CONSIDERED FIT.

EXECUTIVE DIRECTOR

CONDITIONS

1 THE LICENSEE SHALL COMPLY WITH THE PROVISIONS OF THE WILDLIFE CONSERVATION ACT AND REGULATIONS AND ANY NOTICES IN FORCE UNDER THIS ACT AND REGULATIONS.

2 UNLESS SPECIFICALLY AUTHORISED IN THE CONDITIONS OF THIS LICENCE OR OTHERWISE IN WRITING BY THE EXECUTIVE DIRECTOR, SPECIES OF FAUNA DECLARED AS LIKELY TO BECOME EXTINCT, RARE OR OTHERWISE IN NEED OF SPECIAL PROTECTION SHALL NOT BE CAPTURED OR OTHERWISE TAKEN.

3 NO FAUNA SHALL BE TAKEN FROM ANY NATURE RESERVE, WILDLIFE SANCTUARY, NATIONAL PARK, MARINE PARK, TIMBER RESERVE OR STATE FOREST WITHOUT PRIOR WRITTEN APPROVAL OF THE EXECUTIVE DIRECTOR. NO FAUNA SHALL BE TAKEN FROM ANY OTHER PUBLIC LAND WITHOUT THE WRITTEN APPROVAL OF THE GOVERNMENT AUTHORITY MANAGING THAT LAND.

4 NO FAUNA SHALL BE TAKEN ON ANY PRIVATE PROPERTY OR PASTORAL LEASE WITHOUT THE CONSENT IN WRITING OF THE OWNER OR OCCUPIER, OR FROM ANY ABORIGINAL RESERVE WITHOUT THE WRITTEN APPROVAL OF THE ABORIGINAL LANDS TRUST COUNCIL.

5 NO FAUNA OR THEIR PROGENY SHALL BE RELEASED IN ANY AREA WHERE IT DOES NOT NATURALLY OCCUR, NOR HANDED OVER TO ANY OTHER PERSON OR AUTHORITY UNLESS APPROVED BY THE EXECUTIVE DIRECTOR, NOR SHALL THE REMAINS OF SUCH FAUNA BE DISPOSED OF IN SUCH MANNER AS TO CONFUSE THE NATURAL OR PRESENT DAY DISTRIBUTION OF THE SPECIES.

6 THIS LICENCE AND THE WRITTEN PERMISSION REFERRED TO AT CONDITIONS 3 & 4 MUST BE CARRIED BY THE LICENSEE OR AUTHORISED AGENT AT ALL TIMES FOR THE PURPOSE OF PROVING THEIR AUTHORITY TO TAKE FAUNA WHEN QUESTIONED AS TO THEIR RIGHT TO DO SO BY A WILDLIFE OFFICER, ANY OTHER STATE OR LOCAL GOVERNMENT EMPLOYEE OR ANY MEMBER OF THE PUBLIC.

7 LICENCEE AUTHORISED TO TAKE THREATENED STYGOFAUNA.

8 FURTHER CONDITIONS (NUMBERED TO) ARE ATTACHED.

PURPOSE
DRILLING EXPLORATION (MELANIE-1 EXPLORATION WELL).

WILDLIFE CONSERVATION ACT 1950
WILDLIFE CONSERVATION REGULATIONS

Regulation 17:- Licence to Take Fauna For Scientific Purposes

FURTHER CONDITIONS (OF LICENCE NUMBER SF2111)

1. The licensee shall ensure that all due care is taken in the capture and handling of fauna to prevent injury or mortality resulting from that capture or handling. Where traps or other mechanical means or devices are used to capture fauna these shall be inspected at regular intervals throughout each day of their use. At the conclusion of research all markers and signs erected by the licensee and all traps shall be removed, all pitfalls shall be refilled and the study area returned to the condition it was in prior to the research/capture program. During any break in research, cage traps should be removed and pitfalls either removed or filled with sand.

2. No collecting is to be undertaken in areas where it would impinge on pre-existing scientific research programs.

3. Any inadvertently captured specimens of fauna which is declared as likely to become extinct, rare or otherwise in need of special protection is to be released immediately at the point of capture. Where such a specimen is injured or deceased, the licensee shall contact CALM licensing staff at Como (09 334 0434) for advice on disposal. Records are to be kept of any fauna so captured and details included in the report required under further condition 6 below.

4. Prior to any renewal of this research licence the licensee shall submit a summary report outlining work conducted under this licence and work proposed for the next research period.

5. Within one month of the expiration of this licence (or at such other time or times as the Executive Director may determine) the holder shall furnish to the Executive Director [ATTENTION: WILDLIFE CLERK] a return setting out in full detail the number of each species of fauna taken during the currency of the licence, the localities where the species was/were taken and the method of handling of such fauna and disposal of specimens. A copy of any paper or report resulting from this research should be lodged in due course with the Executive Director. In the case of consultants, a list of the fauna handled, the localities involved and a copy of the interpretive data prepared should be lodged.

6. As a general rule not more that ten specimens of any one protected species shall be permanently taken from any location less than 20 km apart. Where exceptional circumstances make it necessary to take large series in order to obtain adequate statistical data the collector will proceed with circumspection and justify their actions to the Executive Director in advance.

7. No fauna, whether dead or alive, may be taken out of Western Australia without the necessary export permit issued under the *Wildlife Conservation Act 1950*. It should be noted that the permit will not be issued unless the State to which the fauna is going has approved that fauna entering that State. In addition to the requirements of the Australian States, the Commonwealth controls exports overseas through Commonwealth legislation administered by the Australian Nature Conservation Agency.

8. All holotypes and syntypes and a half share of paratypes of species or subspecies permitted to be permanently taken under this licence shall be donated to the Western Australian Museum. Duplicates (one pair in each case) of any species collected which represents a significant extension of geographic range shall be donated on request to the Western Australian Museum.

9. To prevent any unnecessary collecting in this State, all specimens and material collected under the authority of this license shall, on request, be loaned to the Western Australian Museum. Also, the unused portion or portions of any specimen collected under the authority of this license shall be offered for donation to the Western Australian Museum or made available to other scientific workers if so required.

APPENDIX J

DRAFT ENVIRONMENTAL MANAGEMENT PLAN

A draft Environmental Management Plan has been prepared for the Melanie-1 exploration well. This Plan addresses all aspects relating to safety, operations, environmental impact and management, and contingency. Concerns raised during the public consultation programme have also been incorporated into the Plan. It is expected that this Environmental Management Plan will be revised once approval is received to drill the Melanie-1 exploration well and that it will be used as an operational guide.

The Environmental Management Plan consists of a table listing:

- Subject area or issue.
- Brief description of the task.
- Person responsible for attending to specific tasks and who confirms by signing that the tasks have been completed.
- Project senior person to countersign that the task was completed satisfactorily.

All tasks are to be undertaken as specified, unless non-conformance has been approved by the Operations Manager of Sun Resources NL. Any non-conformance is to be included in a non-conformance report.

Issue	Tasks	Responsible person	Initials and date	Checked by Operations Manager Initials/date
J.1 Public Information	i. Copies of this document have been forwarded to: • North West Cape Planning Study. • Shire of Exmouth. • Gascoyne Development Commission. • Exmouth District High School.	Wolf Martinick		
	ii. A notice board has been prepared for display in a prominent location in the town of Exmouth.	Company representative		
J.2 Environmental Induction	i. An Environmental Induction Booklet has been produced, providing information on the significance of the flora, fauna and landscapes of Cape Range Peninsula and outlining environmental rules and procedures to ensure that potentially adverse environmental impacts are avoided or minimised.	Environmental Officer		
	ii. All workers engaged in the Project Area have signed an agreement that they have read and agreed to observe the requirements of the Environmental Induction Booklet.	Company Representative		
	iii. Penalties have been imposed on workers and contract companies who have disregarded the requirements of the Environmental Induction Booklet.	Company Representative		
J.3 Safety	i. A Drilling Operations Manual and a Health, Safety and Emergency Response Manual has been made available to all workers in the Project Area.	Company Representative		
	ii. All workers in the Project Area are observing the requirements of Sun Resources NL's Drilling Operations Manual and the Health, Safety and Environment and Emergency Response Manuals.	Company Representative		
	iii. Workers and contract companies who disregarded the requirements of Sun Resources NL's Drilling Operations Manual and the Health, Safety and Environment and Emergency Response Manual have been dealt with appropriately.	Company Representative		

Issue	Tasks	Responsible person	Initials and date	Checked by Operations Manager Initials/date
	iv. A meeting was undertaken immediately prior to the spudding of the well to re-emphasise details of the Emergency Response Manual.	Company Representative		
	v. The drilling crew are undertaking the daily Blow-Out-Preventer (BOP) drill, after setting surface casing.	Company Representative		
J.4 Site Preparation and Layout	i. Prior to the layout of facilities on the Project Area a series of photographs were taken from locations marked by starpickets. Photographs were taken from specific starpickets towards other specific starpickets. The starpickets have been retained for the purpose of taking photos from identical sites and identical views on decommissioning and subsequently on a needs basis.	Environmental Officer		
	ii. The layout of the facilities within the Project Area was undertaken on the basis of a site specific assessment. Terrain features were considered in the layout, thereby avoiding or minimising the need for soil and terrain disturbances (ie. sump in low lying area, avoiding or limiting the need to excavate).	Environmental Officer		
	iii. Vegetation clearing was avoided wherever practically possible, and strictly confined to within the Project Area.	Environmental Officer		
	iv. Where possible, stands of vegetation within the Project Area were retained.	Environmental Officer		
	v. Where possible, vegetation within the Project Area was pruned rather than cleared.	?		
	vi. Where possible, vegetation within the Project Area was flattened rather than cleared.	Environmental Officer		

Issue	Tasks	Responsible person	Initials and date	Checked by Operations Manager Initials/date
	vii. Only limestone gravel free of weeds was brought to the Project Area	Environmental Officer		
	viii. Limestone gravel was spread only on surfaces where its need is essential, ie, pads, sump and walkways.	Environmental Officer		
	ix. Duckboards have been placed along walkways.			
	x. A 3 metre wide fire break has been established around the flare pit.			
	xi. Mesh fencing has been constructed around the sump to prevent local fauna becoming trapped in the mud.	Company Representative		
J.5 Weed Control	i. Contractors were advised by letter that all machinery and equipment must be brought to the Project Area in a clean condition. It must be free of soil, vegetation and seeds, especially Double-gee weeds.	Company Representative		
	ii. The contractor advised in writing that prior to machinery and vehicles departing for the Project Area they were thoroughly cleaned and the tyres were inspected for Double-gee seed. All footwear of the contractors workforce was equally inspected. All Double-gee seed was removed.	Company Representative		
	iii. All vehicles on their first arrival on the Project Area were in a clean condition.	Company Representative		
	iv. On the initial first arrival on the Project Area the tyres of all vehicles were inspected for the presence of Double-gee weeds.	Company Representative		

Issue	Tasks	Responsible person	Initials and date	Checked by Operations Manager Initials/date
	v. On initial first arrival on site the footwear of all workers was inspected at random for the presence of Double-gee seeds.	Company Representative		
	vi. All Double-gee seeds found on tyres and footwear were removed and destroyed by burning.	Company Representative		
	vii. All machinery and equipment on this first arrival was inspected prior to entering into the Project Area, to confirm that it was in a clean condition.	Company Representative		
	viii. The quarry from which limestone gravel was obtained was inspected for the presence of weeds prior to the removal of limestone gravel.	Environmental Officer		
	ix. Only limestone gravel free of weeds was transported to the Project Area.	Environmental Officer		
	x. Following the first major rains after decommissioning the Project Area was inspected for the presence of weeds. All weeds, if present (including Buffel grass) were sprayed with the herbicide Round-up.	Environmental Officer		
J.6 Pollution Control	i. All fluid and solid waste from the drilling operation is being deposited into a plastic lined sump.	Company Representative		
	ii. Any spillages of lubrication oil, diesel fuel, drilling fluids or production oil was removed immediately. The contaminated soil was removed to a drum, truck or the plastic lined sump for disposal at an approved site.	Company Representative		
	iii. All production oil was flared.	Company Representative		

Issue	Tasks	Responsible person	Initials and date	Checked by Operations Manager Initials/date
	iv. A transportable chemical toilet has been established on the Project Area.	Company Representative		
	v. All domestic rubbish and similar waste is being promptly disposed of according to the requirements of the Shire of Exmouth.	Company Representative		
J.7 Fuel and Oil	i. All fuel in the Project Area is being kept in a bunded area which meets with requirements of the Department of Minerals and Energy.	Company Representative		
	ii. All waste lubrication oil is being disposed of according to the requirements of the Shire of Exmouth.	Company Representative		
J.8 Public Access	Public access is controlled with notices in appropriate places stating "No Access to Unauthorised Personnel".	Company Representative		
J.9 Fire Safety	i. No open fires are being permitted.	Company Representative		
	ii. The vegetation of the Project Area has been sufficiently flattened or pruned and, where appropriate, covered with limestone gravel not to be a fire risk.	Company Representative		
	iii. Smoking in the Project Area is restricted to one safe area only.	Company Representative		
	iv. Fire fighting facilities are present and in an operational condition in the Project Area, including an adequate supply of water to extinguish an accidental bushfire before it burns out of control.	Company Representative		
	v. Recommendations of the local bush fire brigades were obtained and implemented prior to the spudding of the well.	Company Representative		

Issue	Tasks	Responsible person	Initials and date	Checked by Operations Manager Initials/date
J.10 Imminent Cyclone	i. Upon receiving a cyclone warning, the need to bund the sump and cellar has been determined by a site inspection.	Company Representative		
	ii. If a bund is required, it has been constructed using appropriate material.	Company Representative		
	iii. Dr Chris Henderson and/or Mr John Blinkhorn of the Cape Conservation Group have been invited to inspect the emergency bunding before the onset of a cyclone.	Company Representative		
J.11 Decommissioning	i. The drilling waste and water has been retained in the sump until all of the waste was precipitated, with the water having a total suspended solids content of 20 ppm or less. This water was then released into the bore adjacent to the well.	Environmental Officer		
	ii. The solid wastes in the sump were dried sufficiently to permit them to be excavated and transported to a waste disposal site approved by the Shire of Exmouth.	Company Representative		
	iii. All solid wastes and mud has been excavated and disposed of at the waste disposal site approved by the Shire of Exmouth.	Company Representative		
	iv. All waste, rubbish and other materials have been removed and disposed of as approved by the Shire of Exmouth.	Company Representative		
	v. As far as is practically possible, all introduced limestone gravel has been removed from the Project Area and returned to the quarry from which it was obtained, or it has been returned to a site requested by the Shire or someone else.	Environmental Officer		

Issue	Tasks	Responsible person	Initials and date	Checked by Operations Manager Initials/date
	vi. The stripping of the introduced limestone gravel has been undertaken carefully to ensure minimal disturbance to the underlying soil surface, and it has exposed, wherever practically feasible, the native vegetation with minimal disturbance having been caused to the root systems.	Environmental Officer		
	vii. Soil surfaces which were very compacted by the operations were ripped on a needs basis, with care having been taken to avoid causing more damage than good by disturbances to root systems.	Environmental Officer		
	viii. Where topsoil was removed within the Project Area it has been respread over the affected area(s).	Environmental Officer		
	ix. Photographs from identical positions and of identical views to those taken of the Project Area prior to commencement of operations have been taken as a record of before and after views.	Environmental Officer		
	x. After the first significant rains in the area after decommissioning, an environmental report has been prepared to report on the revegetation and make recommendations for further improvement in the restoration of the site.	Environmental Officer		
J.12 Weapons	Firearms, projectile weapons, or other similarly dangerous materials have not been permitted in the Project Area. This has been strictly enforced and person(s) suspected of contravening this ban have been dealt with.	Company Representative		
J.13 Pets	i. No pet animals were permitted in the Project Area.	Company Representative		
	ii. Feeding of local fauna is not permitted and food scraps are being promptly disposed of.	Company Representative		

Issue	Tasks	Responsible person	Initials and date	Checked by Operations Manager Initials/date
J.14 Dust	Dust is being suppressed on a needs basis by applications of fresh water.	Company Representative		
J.15 Cave Fauna (aquatic and dry)	i. Case the section through the limestone formation as soon as drilling through this section is completed.	Company Representative		
	ii. On decommissioning, case, seal and lock the bore so that it can be used as a sampling site for cave fauna. Discuss this casing, sealing and locking with Dr Bill Humphreys.	Company Representative		
	iii. Case and seal Melanie-1 exploration well as required by the Department of Minerals and Energy.	Company Representative		