Extensions to the Exmouth water supply borefield

Water Corporation

Report and recommendations of the Environmental Protection Authority

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Summary

This report is to provide Environmental Protection Authority (EPA) advice, to the Minister for the Environment, on the environmental factors relevant to the proposal to extend the existing Exmouth water supply borefield.

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

(a) stygofauna;

(b) terrestrial fauna;

(c) vegetation and flora; and

(d) groundwater.

The conditions and procedures, in the EPA's opinion, to which the proposal should be subject to if implemented are in summary:

(a) the proponent's commitments should be made enforceable;

(b) the proponent should be required to implement an environmental management plan detailing a stygofauna and aquifer monitoring programme; and

(c) the proponent should be required to implement an environmental management system.

The EPA submits the following recommendations:

Recommendation 1

That the Minister for the Environment note the relevant environmental factors and Environmental Protection Authority's objectives set for each factor (Section 3).

Recommendation 2

That subject to the satisfactory implementation of the EPA's recommended conditions and procedures (Section 4), including the proponent's environmental management commitments, the proposal can be modified and managed to meet the EPA's objectives.

Recommendation 3

That the Minister for the Environment imposes the conditions and procedures set out in this report.

Recommendation 4

That the Minister for the Environment notes that there has been a number of previous planning and scientific studies which have recommended extension of the Cape Range National Park. The EPA recommends that the Government give priority to consideration of the proposals in these various reports to extend the Cape Range National Park and to consider other extensions which may be relevant in light of additional information particularly covering the coastal plains and foothills.

Recommendation 5

That the Minister for the Environment notes the EPA's views on the need for an integrated approach to planning and environment for the Cape Range peninsula presented in Section 5 of this report and takes appropriate action to address the EPA's proposals regarding this.

Recommendation 6

That the Minister for the Environment notes that the EPA intends to develop an environmental policy on development within the Exmouth—Cape Range area to assist in the management of the area and the assessment of development proposals.

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1. Introduction

This report is to provide Environmental Protection Authority (EPA) advice and recommendations to the Minister for the Environment on the environmental factors relevant to the proposal to extend the existing Exmouth water supply borefield.

The proposal by the Water Corporation to increase the supply of potable water was referred to the EPA in November 1994. A level of assessment of Consultative Environmental Review was set on the proposal. The CER report (Muir Environmental, 1995) hereafter called the CER, was available for public review between 2 August and 30 August 1995.

An Addendum was prepared to the CER in July 1996 (Water Corporation, 1996).

Further details on the proposal are given in Section 2 of the report. Section 3 discusses environmental factors relevant to the proposal.

Conditions and procedures to which the proposal should be subject if the Minister determines that it may be implemented are set out in Section 4. Section 5 presents the EPA's recommendations to the Minister.

Appendix 1 provides maps relevant to the proposal. A list of people and organisations that made submissions is included in Appendix 2 and published information is listed in Appendix 3.

2. The proposal

The proposal to extend the Exmouth water supply borefield (Appendix 1: Figures 1 and 2), as detailed in the CER and Addendum, includes:

- extending the existing borefield, to the west (equipping existing bores) and to the south (drilling and equipping new bores);
- increasing the long term supply capacity from approximately 760 million litres per year (ML/yr) to 1,025ML/yr;
- constructing four dedicated stygofauna monitoring bores (two within the proposed borefield extension and two to the south of Shothole Canyon Road, which has been identified as future National Park) and two nests of dedicated saltwater interface monitoring (SWIM) bores. These will be used for long term monitoring;
- constructing seventeen water level monitoring bores, which will also be monitored for stygofauna;
- upgrading the infrastructure by:
  - (i) extending power supply to existing western bores;
  - (ii) redrilling and equipping replacement bores for 14 old bores in the existing borefield; and
  - (iii) equipping existing but unequipped production bores, and new production bores with new pumps. These bores will be connected to the current pipe network by means of 150mm and smaller polythene pipes laid on the ground surface. Where the pipes cross drainage lines, these will be laid on the surface and will not inhibit or redirect surface runoff. Where the collector main crosses Mowbowra Creek, it will be suspended about 3m above the creek in a steel cradle supported on each bank by concrete stanchions.

The proposal is not within any proposed extension to the Cape Range National Park. The proposal will be undertaken by the Water Corporation and is intended to have an indefinite life.

3. Environmental Factors

3.1 Relevant Environmental Factors

In the EPA's opinion, based on the submissions and material listed in Appendices 2 and 3, the following are the factors relevant to the proposal:

(a) stygofauna;
(b) terrestrial surface fauna;
(c) vegetation and flora; and
(c) groundwater.

These relevant factors are discussed in the following sections 3.2-3.5.

3.2 Stygofauna

Aspects of stygofauna

Stygofauna is a relevant environmental factor because of its species richness, evolutionary history and adaptations, and evidence it provides of continental drift. It also makes a significant contribution to the biodiversity in Australia.

The Cape Range Peninsula contains a great diversity of aquatic animals that are specially adapted to the subterranean life. The subterranean aquatic fauna (stygofauna) is endemic to the Cape Range peninsula and inhabits the groundwaters of the fringing coastal plain (Humphreys, 1993). The fauna contains classes, orders, genera and species not otherwise represented in the southern hemisphere (Humphreys, 1995).

The stygofauna is also unrelated to that of other karst regions of Australia, and its closest relatives are found in some islands in the North Atlantic. The fauna is believed to have a common origin dating from the Tethys Ocean that formed between the northern and southern landmasses with the breakup of the supercontinent Pangea (Humphreys, 1994).

The aquatic fauna comprises at least 11 species which include two fish, two shrimps, a thermosbaenacean, an ostracod, a cirolanid isopod, at least two melitod isopods, and a recently described member of the class Remipedia (Yager and Humphreys 1996). It includes three genera and one class unknown elsewhere in the southern hemisphere . Part of the fauna occurs on Barrow Island, but the two fish, the remipede, one shrimp and the ostracod occur only on the Cape Range Peninsula (Knott 1993, Humphreys 1994, Yager and Humphreys, 1996).

There are five stygofauna (aquatic) species declared as Specially Protected (Threatened) Fauna under the *Wildlife Conservation Act 1950* . Species declared Specially Protected (Threatened) cannot be taken without authorisation.

Concern was expressed in pubic submissions about the potential impact of groundwater abstraction on stygofauna and the aquifer of the Cape Range.

Assessment

The area considered for assessment of this relevant environmental factor is the Cape Range Peninsula. This is the land north of a line between Ningaloo homestead on the west coast and the base of the Bay of Rest on the eastern side, including Cape Range and Rough Range, an

area of approximately 2,200 km^2 (Appendix 1: Figure 1). This area is approximately north of latitude 22°30'S.

The EPA's objective in regard to this environmental factor is to:

- ensure that stygofauna are adequately protected, consistent with the *Wildlife Conservation Act 1950;*
- maintain the abundance, diversity, and geographical distribution of stygofauna; and
- improve our understanding of stygofauna through appropriate research including sampling, identification, documentation.

As part of the meeting this objective, the EPA expects that:

(i) information is obtained through research and development on the species of stygofauna in the area, and

(ii) measures are implemented where practicable to maintain the stygofauna habitats and populations.

In assessing the impact of this proposal on stygofauna, the stygofauna loss which will result from this proposal must be considered in relation to the presence and extent of stygofauna within the groundwaters of the Cape Range peninsula.

In comparative terms, the Water Corporation has indicated that from entrainment tests conducted, the loss of stygofauna would be an average of 240, 000 individuals per year and that the proportion of the aquifer and stygofauna habitat and population impacted by pumping will be less than 1% per year of the total (Water Corporation, 1996).

The Water Corporation indicated that the storage of water per kilometre of aquifer is about 20,000,000 kL per kilometre, with the annual average recharge estimated at 160,000 kL/km. Extraction is confined to 100,000kL/km per year, so 60,000kL/km/yr flows on downstream of the Corporation's borefield towards the sea. Therefore there should be no reduction in aquifer water storage, as the annual water abstraction is less than the annual average recharge.

The annual water volume removed by the pumps (100,000kL/km/year) represents 1% of the freshwater storage volume of the aquifer, or 1% of the brackish water volume, or 0.5% of the combined fresh and brackish aquifer volumes and 99.5% of the aquifer volume will be unaffected by pumping.

The Water Corporation also comment that even if 1.0% were removed each year from the fresh aquifer, it would be unrealistic be to assume that the remaining 99.5% of the population in the total aquifer would be unable to replace these because:

- the remaining population will reproduce to replace the stock lost;
- the area of impact can be considered as remote from the majority of the stygofauna population which is distributed throughout the total aquifer; and
- there has been no reduction has been observed in species or in species density after 30 years of operation of the existing wellfield.

The Department of Environmental Protection expressed concerns about the adequacy of the Water Corporation's analysis of the predicted impacts on stygofauna population, due to the simplified model and assumptions adopted. The Department accepted, however, that an adequate monitoring programme could be put in place to monitor actual impacts, and that pumping could be reviewed if unacceptable impacts were determined.

The Water Corporation (1996) has also indicated that the bulk of the dissolved organic carbon is biologically inaccessible which means that any abstraction will have a negligible impact on the

effective carbon energy balance of the aquifer because the available carbon is 'fixed' in living biomass and detritus.

The source of carbon to the aquifer is important because if it is primarily gained from the surface, removal of water by pumping may significantly deplete the energy reserves of the subterranean ecosystem. However, if the energy is generated internally by bacterial processes, pumping is unlikely to influence the aquifer carbon balance (Water Corporation, 1996).

The EPA notes that the W.A Museum (Humphreys, 1996) suggests that as the pumped water will be drawn along paths of least resistance, it will barely sample the boundary layers in which most of the fauna is known to reside. Consequently, the numerical loss of fauna through entrainment is expected to be some small fraction of the total fauna.

Humphreys (1994) also indicates that most fauna is capable of adapting to quite varied conditions and that the freshwater lens beneath Cape Range appears to be afaunate not because it is unaccessible to the stygofauna, but because the stygofauna cannot utilise extremely freshwater. The bulk of the stygofauna mostly occupy the zone of the aquifer below the level of pumping, that is brackish to saline zone.

The EPA notes that Hamilton-Smith, et al (draft, 1996) indicate that the extension of the borefield to the south should present few problems to the karst and its inhabitants.

The EPA notes that the proponent has committed to finalising a detailed stygofauna and aquifer monitoring programme (in consultation with, and to the requirements of, the DEP, CALM, Water and Rivers Commission and the WA Museum), to protect and maintain stygofauna populations in the aquifer and to submit data on stygofauna species composition and numbers and implement actions to protect stygofauna populations and habitat. This detailed monitoring programme will be developed by the Water Corporation The Corporation has committed to developing a statistical database with regards to stygofauna presence, absence and abundance in order to detect variation with time of the stygofauna population within the bores.

Having particular regard to:

(a) the proponent's commitments to implement a detailed stygofauna and aquifer monitoring programme and to implement contingency actions if unacceptable impacts are detected; and

(b) the advice from the W.A Museum that the loss of fauna through entrainment in bores is expected to be a small portion of the total fauna;

it is the EPA's opinion that the loss of stygofauna from abstraction is unlikely to compromise the EPA's objective. The EPA is therefore of the opinion that stygofauna populations can be maintained and that the Water Corporation's ongoing research into the aquifer behaviour and stygofauna should continue. This monitoring programme will provide a scientifically sound means for ongoing review and management of the impacts of the wellfield on stygofauna populations in the aquifer.

In addition to the above, the EPA intends to develop a policy on development within the Exmouth-Cape Range area to assist in the management of the area and the assessment of development proposal. The policy will also provide environmental guidance for proponents of development proposals in the Cape Range region.

As part of this policy on development, the EPA considers that a regional strategy should be developed in order to gain a better understanding of subterranean fauna and their distribution in the Cape Range karst system. Hence, it is recommended that a Working Group comprising the Water Corporation, DEP, CALM, WA Museum and other relevant groups, develop and implement a programme to improve knowledge of subterranean fauna in Cape Range. This programme will assist developers and government when making planning decisions.

3.3 Terrestrial fauna

Aspects of terrestrial fauna

The terrestrial fauna of Cape Range is a relevant environmental factor because of the regions geomorphological and adaphic diversity (Humphreys, 1995).

Kendrick (1993) cited in the CER indicated that there are 30 mammals, 84 reptiles, 5 amphibians and 200 birds known from the Cape Range peninsula either as living species or from fossils. A habitat evaluation was carried out by Muir Environmental at several locations for a number of key environmental features which were known to be related to certain groups of fauna or to specific fauna requirements. This is described in the CER.

In relation to fauna protection, the Black-footed Rock wallaby (*Petrogale lateralis*) and the Pebble-mound Mouse (*Pseudomys chapman)* are listed in Schedule 1 of the Wildlife Conservation (Specifically Protected Fauna) Notice 1996.

The CER indicated that the Black-footed Rock-wallaby has been recorded in the gorges on the western side of the Cape Range National Park, however, there are no similar suitable habitats in the borefield area.

With regard to the Pebble-mound Mouse, the CER indicated that nests were found in the borefield, although it was uncertain as to how long they had been there. It was noted that although several nests were well away from areas of impact, two were observed where old access tracks had damaged nests. A detailed search for places where the proposed works might come into contact with nests was conducted, and in one location the pipe route was altered to avoid a nest.

The Lesser Sticknest rat (*Leporillus apicalis*) and the Peregrine Falcon (*Falco peregrinus*) are listed under Schedule 2 and Schedule 4 of the Wildlife Conservation (Specifically Protected Fauna) Notice 1996 respectively, however no evidence was found of recent occupation or that the area has any particular significance for the species.

The CER indicated that other species that could be present in the project area include a skink lizard (*Lerista allochira)*, which is an endemic vertebrate of the Cape Range Peninsula and a frog (*Pseudophyrne douglas*i).

Assessment

The area considered for assessment of this relevant environmental factor is Water Reserve 34055 on the Cape Range Peninsula (Appendix 1: Figure 1) as this is the area over which terrestrial fauna could be affected by the proposal.

The EPA's objective is "to protect terrestrial Threatened Fauna and Priority fauna species, and their habitats in accordance with the provisions of the Wildlife *Conservation Act 1950".*

The proponent has made a commitment to ensure that any Pebble-mound mouse nests found are not disturbed and that it will remove the pump and rising column from all decommissioned bores, and fit locked vandal-resistant and fauna-resistant caps.

Having particular regard to the commitments made by the proponent in relation to protecting Pebble-mound nests from disturbance and the fact that the project area contains habitat that is represented elsewhere on the Cape Range Peninsula, it is the EPA's opinion that terrestrial fauna having significant conservation value are unlikely to be affected by the proposal.

3.4 Vegetation and flora

Aspects of vegetation and flora

The flora of the Cape Range Peninsula is a relevant environmental factor because of the geomorphological diversity and aridness of the area.

A description of flora and vegetation within the project area is included in the CER. No gazetted rare plant species are recorded from the Exmouth and Cape Range area. The CER also identifies a number of scarcer and endemic species, known to the Cape Range Peninsula as identified by Keighery and Gibson (1993). These plants were specifically searched for in the field and the only one recorded was *Brachychiton obtusilobus* .

The CER indicated that this plant species was identified in the field as common and widespread preferring the upper and mid slopes of the valleys. The plant species has a "Priority" taxa, as defined by the Department of Conservation and Land Management (CALM), of 4. This means that the taxa is considered to have been adequately surveyed and which whilst being rare, is not currently threatened by any identifiable factor.

With regard to the presence of phreatophytic vegetation within the borefield, the Water Corporation (1996) has concluded that there has been no water stress-induced mortality of vegetation in the vicinity of existing production wells over the 30 year history of the borefield. In addition, the top of the watertable is within karst limestone overlain by 40 to 100 metres of relatively dense rock and unlike the shallow Jandakot and Gnangara aquifers, plant roots have not penetrated the watertable. Evidence of this can be seen as fragments of plant roots have not been found in deeper sections of cores from recent drilling done at Exmouth.

Assessment

The area considered for assessment of this relevant environmental factor is Water Reserve 34055 on the Cape Range Peninsula (Appendix 1: Figure 1) as this is the area over which vegetation and flora could be affected by the proposal.

The EPA's objective is "to protect Declared Rare Flora and Priority flora, in accordance with the *Wildlife Conservation Act 1950*, and to maintain the abundance, diversity, geographical distribution, and productivity of vegetation communities".

No declared rare flora species have been identified within the project area. One plant species found was identified as a Priority 4 species. Little additional clearing of vegetation will be required. Only access tracks and areas immediately surrounding each base would be maintained in a cleared state.

Having particular regard to:

(a) the fact that the only significant flora found within the project area is widespread and that pipes and access tracks, by nature of the topography, will follow ridge crests; and

(b) the fact that the vegetation in the area is not likely to be dependent on the groundwater;

it is the EPA's opinion that the extension to the water supply borefield is unlikely to compromise its objective to protect flora of significant conservation value.

3.5 Groundwater

Aspects of groundwater

Groundwater is a relevant environmental factor because it is a critically important resource to the subterranean fauna of the Cape Range Peninsula, and the continued existence of human settlement in the area.

The aquifer on Cape Range resembles that found on many islands, in that it has a relatively thin freshwater layer overlying intruding seawater, with a mixed zone between the two. In essence a wedge of saltwater pushes under the fresh water contained in the limestone (Appendix 1: Figure 3) (Water Corporation, 1996).

The water table lies a couple of metres above present sea level near the coast, rising to 15m altitude towards the inland part of the borefield. At Cape Range, the freshwater - saltwater transition is at about 5km from the coast and the zone of diffusion is approximately 20-30 metres thick (Martin, 1990). The aquifer is recharged both directly by rainfall and indirectly through the beds of ephemeral streams which carry storm runoff from the Range. The upper part of the aquifer is karst and has high permeability (Water Corporation, 1996).

The current and proposed annual abstraction levels are 100ML per kilometre per year (60% of estimated annual throughflow) or 1% of available storage per year. This target per kilometre of borefield equates to 1% of available fresh water in karst storage or 0.5% if the mixing zone is included (Water Corporation, 1996).

In the northern sector of the borefield, some salinisation has occurred due to the combined impact of public and private abstraction (Water Corporation, 1996).

Assessment

The area considered for assessment of this relevant factor is Water Reserve 34055 on the Cape Range Peninsula (Appendix 1: Figure 1). The Water and Rivers Commission (WRC) has designated this Water Reserve as a Priority 1 Groundwater supply area.

The EPA's objective is "to ensure that the quantity of groundwater is maintained to agreed watertable levels, and that quality is maintained consistent with the draft Western Australian Water Quality Guidelines for Fresh and Marine Waters (EPA Bulletin 711)".

The EPA in assessing the proposal recognises that the Water Corporation's extraction from the aquifer is subject to licensing by the WRC and the *Rights in Water and Irrigation Act, 1914* .

The EPA also notes that the Water Corporation has designed and operated the existing borefield to abstract water at very low rates so as to avoid upconing of saline water to maintain the fresh-saltwater equilibrium and to abstract less than the sustainable yield of the aquifer. It is also noted, however, that the northern sector of the borefield has been overpumped resulting in increasing salinity of the freshwater lens in the northern kilometre of the borefield. The northern sector of the borefield, however, will be decommissioned and replaced by development of the borefield to the south (Water Corporation, 1996).

The EPA notes that the volume of freshwater within the karst zone is approximately 10,000ML/km and that the current (and proposed) annual abstraction target per kilometre of borefield is 100ML. This equates to 1% of available fresh water in karst storage or 0.5% if the mixing zone is included, and in terms of storage depletion, is accepted to be low. Hence, there is a buffering capacity within the aquifer to cater for annual variations in recharge (Water Corporation, 1996).

The proponent has committed to protect and maintain water levels and the quality of the fresh water in the karst aquifer by finalising a detailed aquifer monitoring programme in consultation with the DEP and Water and Rivers Commission. If this monitoring programme detects salinity of production or monitoring bores is increasing, the Water Corporation has committed to:

(i) reduce the rate of pumping from the bores;
(ii) reduce the total production of water from the group of bores in the area; and
(iii) cease groundwater production from the bores involved, if the above measures do not improve salinity levels.

The EPA notes that the Water Corporation has indicated that the salinity of water supplied to the consumers of Exmouth must not exceed 1000mg/L and meet other key health and aesthetic standards under the Corporation's Operating Licence granted by the Office of Water Regulation. The Corporation has a target to supply water to its customers at a salinity of 800mg/L or less, and meets this by blending water from more saline wells with water from fresher wells. It is expected that salinity limits will be further defined in the Environmental Management Programme for the aquifer and stygofauna monitoring.

Having particular regard to:

(a) the commitments made by the proponent in relation to protecting the aquifer quality and quantity;

(b) the requirements for licensing abstraction under the *Rights in Water and Irrigation Act;*

it is the EPA's opinion that the abstraction of groundwater is unlikely to compromise the EPA's objective to protect the nominated beneficial uses of the groundwater. Furthermore, the EPA believes that the Water Corporation's ongoing research and monitoring of the aquifer should continue.

4. Conditions and procedures

In the EPA's opinion, the proposal should be subject to the following conditions and procedures if implemented.

4.1 Proponent's Commitments

The proponent's commitments made in the CER and Addendum (Water Corporation 1996) and summarised in Table 1, should be made enforceable conditions.

4.2 Environmental Management Programme

(i) The proponent should be required to implement the plan of research, investigation and monitoring detailed in the supplementary investigation prepared by the proponent in July 1996 (Water Corporation, 1996).

(ii) the proponent should be required to report on progress and performance of the EMP annually to the EPA.

(iii) the proponent should be required to provide resources for independent expert reviews of the findings and conclusions of research investigations, to the satisfaction of the EPA.

4.3 Environmental Management System

The proponent shall prepare and implement an environmental management plan and environmental management procedures in order to implement the proposal and manage the

relevant environmental factors to ensure the EPA's objectives (Section 3) are met. The plan should adopt quality assurance principles (such as those adopted in Australian Standards ISO 9000) series and environmental management principles (such as those adopted in the voluntary Australian Standards ISO 14000 [draft] series), with appropriate monitoring and auditing to ensure compliance with this condition.

5. Other advice

5.1 Integrated approach to management of the Cape Range peninsula

The Cape Range peninsula is an area of special environmental importance for a number of reasons, and its management requires an integrated approach. In this regard, the following reports and features of the area need to be taken into account the:-

(a) Gascoyne Coast Regional Strategy;
(b) Government statement setting out New Horizons in Marine Management;
(c) Legislative Council's Select Committee's First Report on Cape Range National Park;
(d) Symposium on the Biogeography of Cape Range;
(e) draft report on Karst Management Considerations for the Cape Range Karst Province;
(f) Structure Plan for the Exmouth/Learmonth area being developed by the WA Planning Commission;
(g) Cape Range National Park, and proposals for its extension;
(h) Ningaloo Marine Park;
(i) presence of the Exmouth Water Reserve; and
(j) the array of activities either being undertaken or proposed in the multiple use areas, such as town, tourism, mining, oil and gas exploration, aquaculture and fishing.

The integrated management approach needs to be based on environmental regions such as watersheds even though they are small by most standards, and include the adjacent waters especially the Ningaloo reef. The important environmental factors of the area should be of prime consideration and be given attention in the planning process.

One of the most important factors of the Cape Range peninsula is its karst landscape (small voids through to caves, ranging in size from millimetres to metres) formed primarily as a result of selective chemical dissolution of limestone by natural waters. These voids are the habitat for an array of very small, mostly invertebrate, subterranean animals which have an ancient set of taxonomic relationships, and thus the landscape has high scientific value. Some of the animals live in the air voids in the ground above the water table and others live in the voids filled with water.

The voids within the limestone landscape of the area are thought to be randomly distributed, and thus it is not possible either through borehole drilling or geophysical mapping to understand the extent or nature of the habitat. Also, it is not known whether the various species are widely distributed or whether they are restricted to very small areas. Accordingly, there will be uncertainty associated with each proposal which has the potential either to physically remove part of the landscapes (limestone quarrying, urban development, harbour development, etc) or to affect the water balance (water extraction).

Further research, undertaken over time, will gradually add to our understanding of the distribution of the animals living in the karst landscape, but this can not be done quickly for a variety of reasons, including the random distribution of the voids and the small number of researchers, both field and taxonomic, available in this specialised area. In the meantime, projects, if developed, are likely to result in the taking of some of these subterranean animals of scientific importance.

The challenge before us as a society is for all of those with an interest in the karst nature of the Cape Range peninsula – government officers, planners, developers, researchers and community groups – to recognise the scientific importance of the array of animals in the karst landscape, as small as they might be as individuals, and to progress research and management in a manner which provides for continuous understanding of the subject and continuous improvement in the management strategies. As set out by the International Union for the Conservation of Nature and Natural Resources in one of its guidelines for cave and karst protection, "effective planning for karst regions demands a balanced consideration of economic, scientific and human values, within the local cultural and political context and in a way which is congruent with that context."

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

The EPA proposes that the Government takes action to:

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

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

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

(d) apply the principles and goals in the National Strategy for Biodiversity to sustainable development, planning and appropriate management of the area;

(e) require projects and operators within the Cape Range area to develop and implement environmental management plans and systems approaching or equal to or better than the requirements of Standards Australia ISO14000 (draft) series. To complement these standards, memoranda of understanding and codes of practice may be developed;

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

(g) pursue the management of the Cape Range peninsular as a whole-of-government approach with a view to all interested parties – government officers, planners, developers, industry, researchers and community groups – recognising the importance of the area and the need for an integrated approach to environmental management of the highest standard. This should include the development and implementation of consistent, integrated environmental management programmes by all land managers and developers across the peninsular. The Exmouth Coastal Strategy provides a good example of integrated management, and these principles should be extended across the peninsular.

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

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

If established, the Groups could review and report on on-going performance of the EMP for the Whitecrest mine, if it is implement.

5.2 Proposed environmental policy

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

6. Recommendations

Recommendation 1

That the Minister for the Environment note the relevant environmental factors and environmental objectives set for each factor (Section 3).

Recommendation 2

That subject to the satisfactory implementation of the EPA's recommended conditions and procedures (Section 4), including the proponent's environmental management commitments, the proposal can be modified and managed to meet the EPA's objectives.

Recommendation 3

That the Minister for the Environment imposes the conditions and procedures set out in this report. The implementation of the Minister's conditions and procedures are to be audited by the Department of Environmental Protection.

Recommendation 4

That the Minister for the Environment notes that there has been a number of previous planning and scientific studies which have recommended extension of the Cape Range National Park. The EPA recommends that the Government give priority to consideration of the proposals in these various reports to extend the Cape Range National Park and to consider other extensions which may be relevant in light of additional information particularly covering the coastal plains and foothills.

Recommendation 5

That the Minister for the Environment notes the EPA's views on the need for an integrated approach to planning and environment for the Cape Range peninsula presented in Section 5 of the report, and takes appropriate action to address the EPA's proposals regarding this.

Recommendation 6

That the Minister for the Environment notes that the EPA intends to develop an environmental policy on development within the Exmouth—Cape Range area to assist in the management of the area and the assessment of development proposals.

Table 1. Summary of Environmental Protection Authority recommendations

Relevant Factors	Environmental Objective	The proposal	Proponent's Commitment	EPA Opinion
Stygofauna.	To ensure that stygofauna are adequately protected, consistent with the *Wildlife Conservation Act 1950; to* maintain the abundance, diversity and geographical distribution of stygofauna; and to improve our understanding of stygofauna through appropriate sampling, identification and documentation. As part of the meeting this objective, the EPA expects that: (i) information is obtained through research and development on the species of stygofauna in the area, and (ii) measures are implemented where practicable to protect all stygofauna habitats and populations.	Groundwater abstraction is predicted to cause the direct loss of a maximum of 1% of the stygofauna occupying the fresh water zone of the aquifer.	Finalise a detailed stygofauna and aquifer monitoring programme. Submission of data on stygofauna species composition and numbers. Implement actions to protect stygofauna populations and habitat.	Given the nature of the proponent's commitments, and the view of the WA Museum that the numerical loss of fauna through abstraction from pumping is expected to be a small fraction of the total fauna, the EPA believes impacts can be managed so that subterranean fauna are not significantly affected.
Terrestrial fauna.	To protect terrestrial Threatened Fauna and Priority fauna species, and their habitats in accordance with the provisions of the Wildlife *Conservation Act 1950".*	Direct disturbance (clearing) associated with construction of access tracks to allow drilling equipment access to bore locations.	To ensure that any pebble mound mouse nests found are not disturbed, and that all access tracks remain stable. The Water Corporation will remove the pump and rising column from all decommissioned bores, and fit locked, vandal-resistant and fauna-resistant caps.	Terrestrial surface fauna is represented in similar areas on Cape Range, which are not subject to development pressure. The proponent's commitments are considered adequate.

Vegetation and flora	To protect Declared Rare Flora and Priority flora, in accordance with the *Wildlife Conservation Act 1950*, and to maintain the abundance, diversity, geographical distribution, and productivity of vegetation communities	Direct disturbance (clearing) associated with construction of access tracks to allow drilling equipment access to bore locations.	Rehabilitation action will be initiated if problems arise. To ensure that all excavations and creek crossings remain stable and implement rehabilitation actions if problems arise	Flora is represented in similar areas on Cape Range, which are not subject to development pressure. The proponent's commitments are considered adequate.
Groundwater	To ensure that the quantity of groundwater is maintained to agreed watertable levels, and that quality is maintained consistent with the draft Western Australian Water Quality Guidelines for Fresh and Marine Waters (EPA Bulletin 711)	The borefield draws water from the region where the overlying lens of freshwater coincides with the highly transmissive karst features.	If monitoring reveals that salinity of production or monitoring wells is increasing, the Water Corporation will: • immediately reduce the rate of pumping from the bore(s) • reduce the total production of water from the group of bores in the area • if the above measures do not improve salinity levels, cease groundwater production from the bores involved.	Given the commitments by the proponent, the EPA believes impacts can be managed so that groundwater quality is maintained for its beneficial uses.

Appendix 1

Maps relevant to the proposal

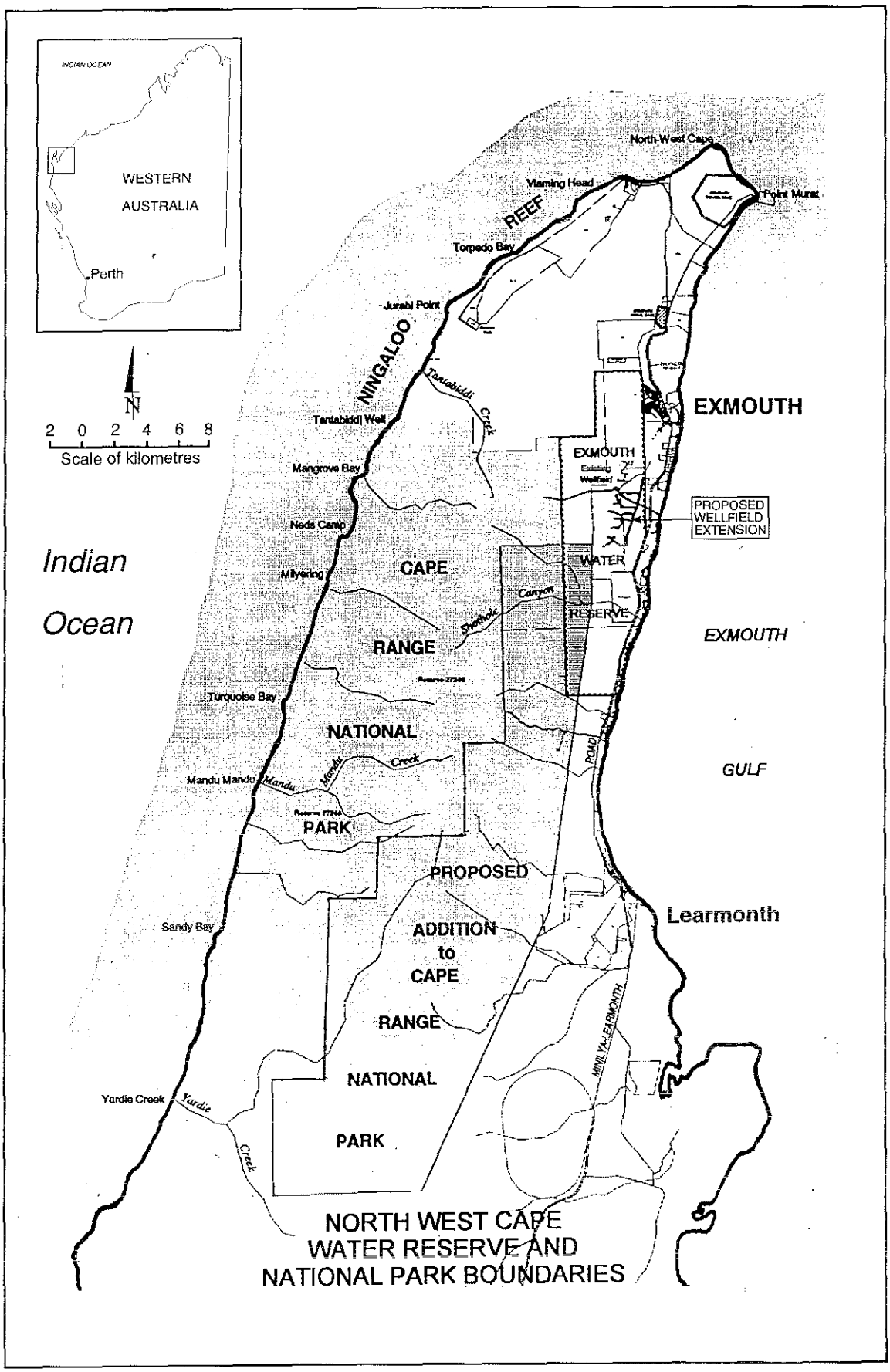

Figure 1. Project location.

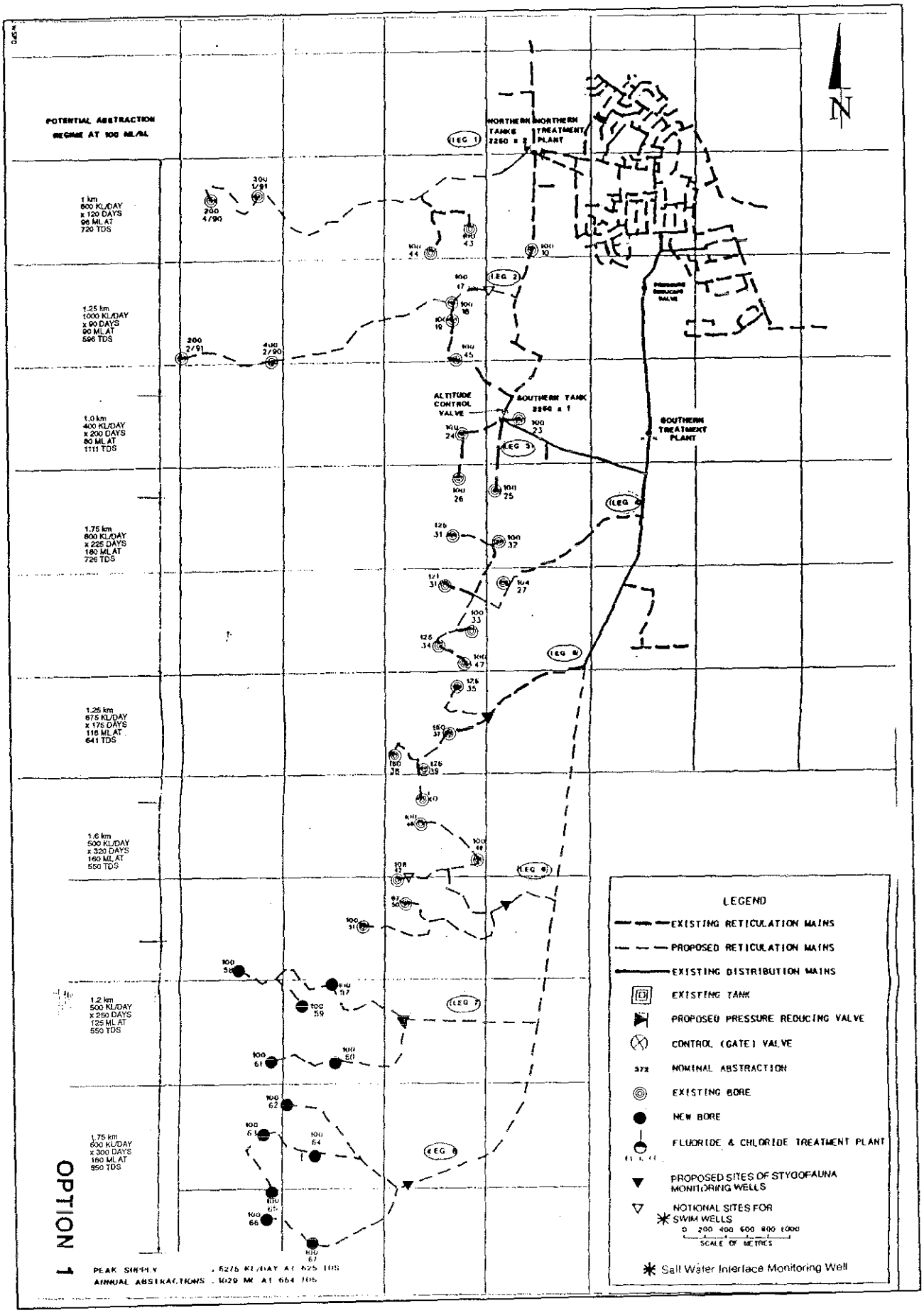

Figure 2. Proposed extension.

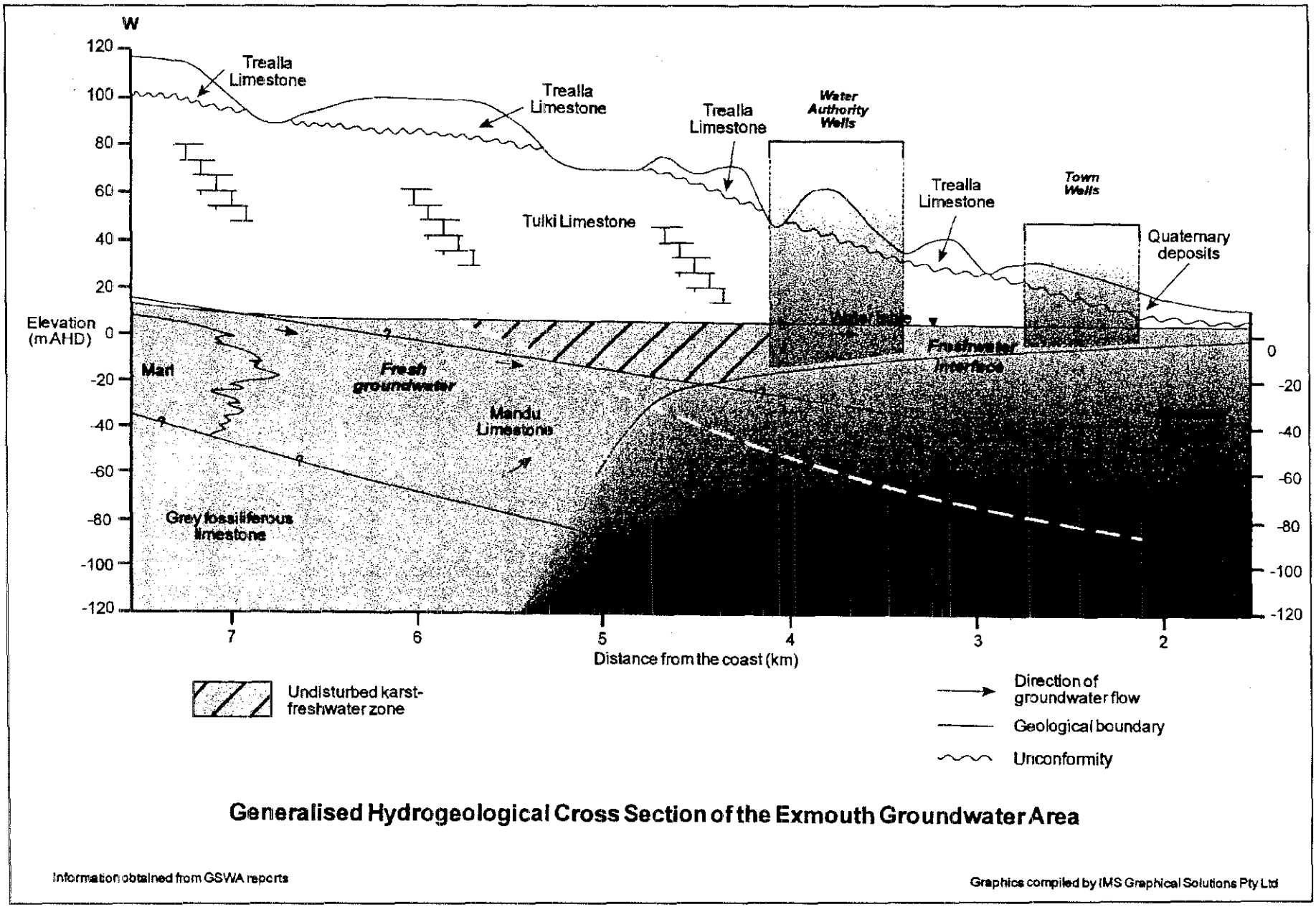

Figure 3. Hydrological cross section of the Exmouth Groundwater Area (Water Corporation, 1995).

Appendix 2

List of submitters

State and local government agencies

Department of Conservation and Land Management

Western Australian Museum

Shire of Exmouth

Organisations

Conservation Council of Western Australia

Appendix 3

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