Desalination and Seawater Supplies Project, Burrup Peninsula

Water Corporation

Report and Recommendations of the Environmental Protection Authority

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1. Introduction

This report provides the advice and recommendations of the Environmental Protection Authority (EPA) to the Minister for the Environment and Heritage on the environmental factors relevant to a proposal by the Water Corporation to construct and operate a seawater supply and desalination system on the Burrup Peninsula.

The EPA was advised of the proposal in November 2000. Based on the information provided, the EPA considered that while the proposal had the potential to have an effect on the environment, the proposal could be readily managed to meet the EPA's environmental objectives. Consequently, it was notified in *The West Australian* newspaper on 11 December 2000 that, subject to the preparation of a suitable Environmental Protection Statement (EPS) document, the EPA intended to set the level of assessment at Proponent-initiated Environmental Protection Statement.

The proponent has prepared an EPS document that accompanies this report and describes the project, its environmental impacts and the proposed approach to their management in greater detail. This document is available through the Department of Environmental Protection (DEP) library in Perth and the regional office in Karratha. The EPA considers that the proposal described can be managed in an acceptable manner subject to the commitments to the proposal being legally binding.

The EPA has determined under Section 40 (1) of the *Environmental Protection Act 1986* that the level of assessment for the proposal be Proponent-initiated Environmental Protection Statement, and this report provides the EPA advice and recommendations in accordance with Section 44 (1).

Any person who disagrees with the EPA's decision on the level of assessment may lodge an appeal with the Minister for the Environment within 14 days of the date of the decision being placed in the public record.

A separate right of appeal exists for any person who disagrees with the content of, or any recommendations in this report, also within 14 days of release of the report.

2. The proposal

The proposal is described in detail in Section 3 of the proponent's "Burrup Peninsula Desalinated Water and Seawater Supplies Project" EPS document (Burns and Roe Worley, April 2001). The proposal involves the construction and operation of a seawater supply and desalination system on the Burrup Peninsula (Figures 1 and 2) to service the requirements of new industrial developments.

The capacity of the current potable water supply (Millstream borefield and Harding Dam) is insufficient to meet the requirements of new industries, including the Syntroleum gas to liquids project (HLA - Envirosciences Pty Limited (1999a). This proposal provides an alternative source of high quality process water that meets Syntroleum's requirements (6.5 ML/day), as well as providing up to 62 ML/day of seawater for use by future projects. The desalination plant is to be constructed on the Syntroleum site, utilising waste process heat from the Syntroleum plant.

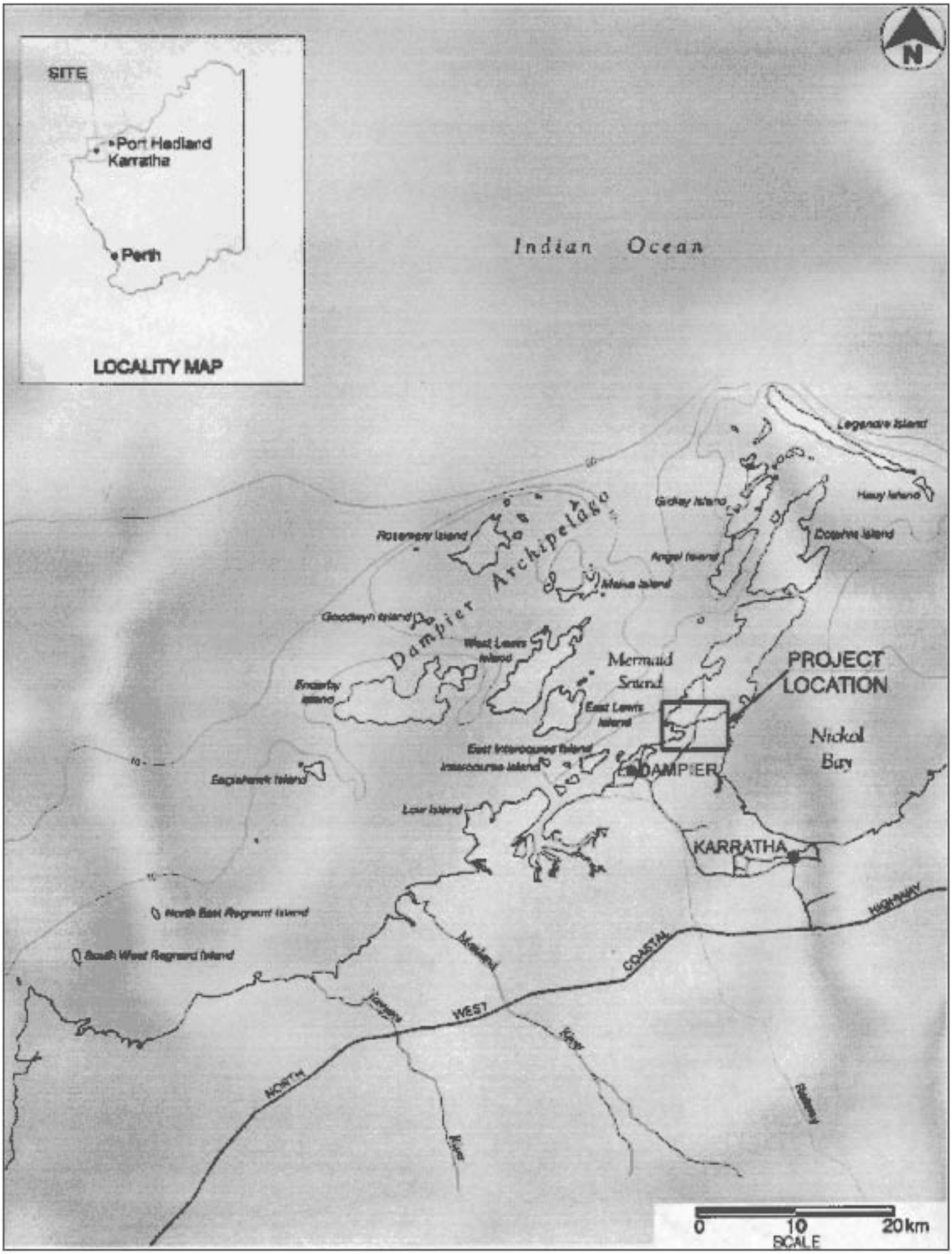

Figure 1. Location of proposal.

Figure 2. Pipeline route.

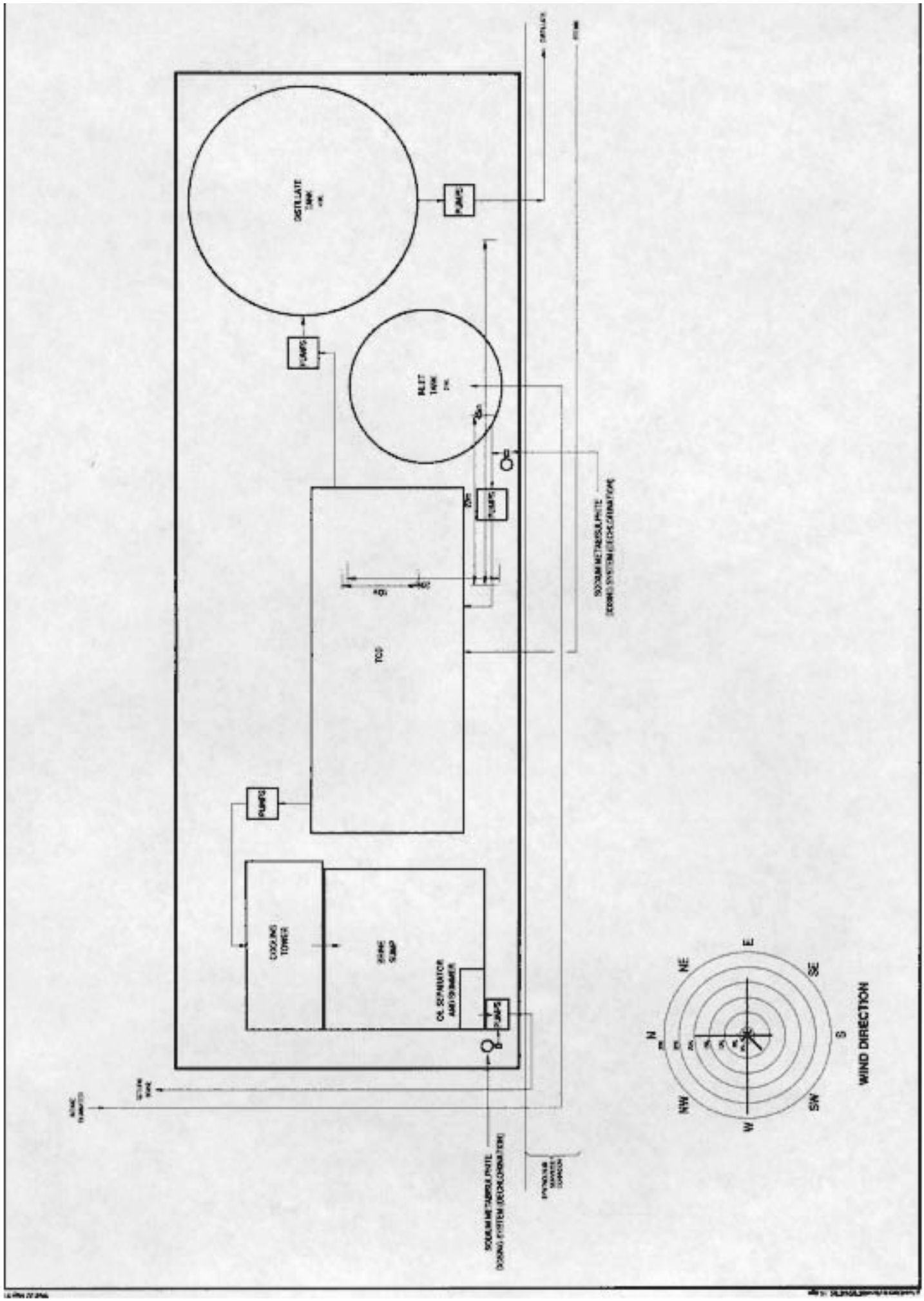

Figure 3. Desalination Plant General Arrangement

The general arrangement of the desalination plant is shown in Figure 3. The proposal allows for the extraction of up to 100 ML/day of seawater from King Bay and the return of a brine stream at a maximum rate of 77 ML/day.

The key components of the proposal are:

- Seawater intake structure, including pump station, onshore screening and electrolytic chlorination;
- Thermo Compression Distillation Plant (6.5 ML/day capacity);
- Cooling tower, water storage facilities and brine pump at the Syntroleum site;
- Seawater supply pipeline to the Syntroleum site (4.6 km);
- Brine discharge pipeline to King Bay (4.6 km); and
- Brine outfall and diffusers.

The main characteristics of the proposal are summarised in Table 1 below.

Table 1. Key Project Characteristics

Element	Description
Project Purpose	To provide high quality water to the Syntroleum project and seawater for cooling purposes to other proposed industries on the Burrup Peninsula.
Project Life	25 + years.
Major Project Components	1. Seawater intake pump system. 2. Nominal 6.5 megalitres/day thermal desalination plant. 3. Brine cooling tower and water storage facilities. 4. Seawater supply pipeline (approximately 4.6 km long). 5. Brine discharge pipeline (approximately 4.6 km long). 6. Brine outfall and diffusers.
Project Location	Seawater intake pump system – within the Mermaid Marine harbour development. Desalination plant and cooling tower – within the Syntroleum site, King Bay-Hearson Cove Industrial Area. Pipelines – within easements on the eastern side of Burrup Road, northern side of King Bay Road and western side of the Mermaid Marine access road and property. Brine outfall and diffuser – extending approximately 500m from the Mermaid Marine groyne to a point midway between the Mermaid Marine and Woodside shipping channels at 2.5m Chart Datum.
Plant Operation	Continuous – up to 24 hours per day, 365 days per year.
Plant Storage Capacities	Approximately 2 megalitres (1.5 hours) seawater storage. Approximately 4 megalitres (15 hours) distilled water storage.
Inputs: - Seawater - Power Supply	 Initially – approximately 18 megalitres/day (winter) to approximately 38 megalitres/day (summer). Finally - up to 100 megalitres/day. Approximately 1MW to 1.5MW, supplied from Syntroleum.
Discharges: - Brine - Antiscalant	 Initially - up to 38 megalitres/day at 52,500 milligrams/litre total dissolved solids. Typically at 2°C above ambient seawater temperature. Finally - up to 77 megalitres/day at 55,500 milligrams/litre total dissolved solids. Typically at 2°C above ambient seawater temperature. Approximately 100 kilograms/day

Element	Description
- Biocide - Sulphamic Acid	Normally, nil; decomposed by addition of sodium metabisulphite. Nil to discharge.
Noise: - Construction: - Operation:	 Less than 30 dB(A) at the nearest permanent residence (Dampier) Seawater intake system: Less than 70 dB(A) at 1m from pump well. Desalination plant: Less than 30 dB(A) at the nearest permanent residence (Dampier).
Construction Period	Approximately 15 months.
Construction Workforce	Peak 50 persons.
Operational Workforce	Estimated 6 persons.

3. Consultation

The proponent has consulted extensively with stakeholders including government agencies, commercial and community organisations and the local community throughout the project.

The principal stakeholders and community groups identified are shown in Table 2.

Table 2 Identified Stakeholders

Government and Commercial Organisations	Community Groups
Dampier Port Authority	Dampier Archipelago Preservation Association
Department of Conservation and Land Management	Dampier Archipelago Residential Dwellers Association
Department of Environmental Protection	Dampier Skindiving Club
Department of Resource Development	Friends of the Burrup
Environmental Protection Authority	Hampton Harbour Boat and Sailing Club
Hamersley Iron Associates *	Karratha Dive School
Mermaid Marine Pty Ltd *	King Bay Game Fishing Club
Shire of Roebourne	Naval Reserve Cadets
Water and Rivers Commission	Nickol Bay Naturalists (Inc)
Woodside Energy Limited *	

* Organisations were directly briefed on the project.

Consultation with stakeholders has occurred through meetings, newspaper briefings, radio, internet and press releases. Letters were also sent to identified stakeholders including community groups, outlining the project and inviting comments on the proposal. An initial round of consultation meetings were held in Karratha during 24 - 25 January 2001.

Although there was general support for the proposal in relation to the perceived benefits of desalination, a number of concerns were raised by various stakeholders. The issues raised by the stakeholders are recorded in the proponent's EPS document (Table 10.2). The main issues include:

- Need for further hydrodynamic modelling to determine the effects of pumping on turbidity;
- More information needed on the distillation process;
- Concerns regarding weed control management;
- Impact of brine on local coral communities near outlet;
- Need to address Aboriginal heritage requirements; and
- The future use of the pipeline in relation to the wastewater disposal via the pipeline.

A second round of consultation meetings was held with the stakeholders during 8 - 9 March 2001 to feed back requested information and gather additional comments. The stakeholder comments and proponent responses are summarised in Table 10.3 of the proponent's document. The proponent has addressed the issues raised by the stakeholders within the EPS document, including:

- Conduct further hydrodynamic modelling (far-field modelling) to predict impacts from the brine discharge on marine flora and fauna;
- A commitment to a weed management plan;
- A commitment to a heritage management plan; and
- Confirmation that approval is sought for brine and cooling water disposal only.

The specific details of the distillation process were not included in the EPS due to its complexity, but the process was discussed at length and in detail with the relevant stakeholders.

The stakeholder comments during the second round of consultation indicated general widespread support for the project. The proponent will continue to keep stakeholders informed of the progress of the project development and provide written responses to concerns raised by organisations and individuals. In addition, DEP concerns in relation to risk management compatibility with the Syntroleum plant have been addressed by the proponent committing to make the desalination plant compliant with Syntroleum's safety and hazard management requirements.

4. Relevant environmental factors

The summary of all of the environmental factors and their management is outlined in Table A of the EPS (pages 6-13, *Burrup Peninsula Desalinated Water and Seawater Supplies Project, Burns and Roe Worley Pty Ltd, 2001*).

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

a) Terrestrial flora – vegetation clearing and weed invasion from construction activities;

b) Marine flora and fauna – subsea trench construction and brine discharge; and

c) Visual amenity – visual impact of seawater intake and brine discharge pipelines.

Terrestrial flora

The EPA's environmental objectives for this factor are to:

1. Protect Declared Rare and Priority Flora consistent with the provisions of the *Wildlife Conservation Act, 1950* and the Commonwealth's *Endangered Species Protection Act 1992;* and
2. Maintain the abundance, species diversity, geographical distribution and productivity of vegetation communities.

The desalination plant and associated equipment will be located within the confines of Syntroleum's natural gas to synthetic hydrocarbons plant. The land required for the desalination plant is relatively small (0.6 hectares) and will be cleared prior to construction of the Syntroleum plant. The environmental impacts from clearing have been reported by the EPA in the assessment of the Syntroleum proposal (EPA, 2000) and its consolidated document of changes, dated 26 April 2001.

The construction of the intake and discharge pipelines will disturb a 20m corridor of vegetation along the length of the pipeline route (4.6 km). The selected route for the pipelines has been based on the use of road reserves, existing easements and service corridors proposed by the Department of Resources Development. A total of about 13 hectares of vegetation will be cleared or trampled during construction. An area of only about 3 hectares of undisturbed grassland will be affected, approximately 10 hectares having been cleared previously. The section of pipeline in the undisturbed area will be located above ground, minimising impacts on the vegetation.

The construction of the pipeline infrastructure may affect vegetation communities and Declared Rare and Priority Flora as a result of the following:

- Flora will be removed from the pipeline corridor;
- Priority species will be disturbed;
- Sensitive habitats and significant vegetation communities may be removed; and
- Exotic weeds may be introduced and spread.

No Declared Rare Plants as listed for Western Australia under the *Wildlife Conservation Act, 1950* or plants listed under the Commonwealth's *Endangered Species Protection Act 1992* were found in the surveyed area. The priority flora identified along the proposed route included:

- *Terminalia supranitifolia* (Priority 1); and
- *Eriachne tenuiculmis* (Priority 3)

The proponent has committed to conducting a more detailed vegetation survey in the appropriate season, prior to construction. Any identified rare and priority species along the proposed route will be tagged with a view to avoiding disturbance where practicable. Where impacts upon priority flora cannot be avoided, the proponent will relocate or replace all of the specimens affected.

Weed spread is highly likely as a result of construction activities unless adequate controls are in place. A total of five weeds (*Aerva javanica, Cenchrus ciliaris, Stylosanthes hamata, Passiflora foetida* and *Pennisetum setaceum)* were identified during the vegetation survey. A further two species (*Rumex vesciarius* and *Euphorbia hirsute*) have previously been identified along the proposed pipeline route. The proponent will develop and enforce a weed management plan approved by the Department of Conservation and Land Management (CALM). Included in the plan will be the removal of all weed species along the pipeline route and the establishment of a vehicle wash down facility.

Construction and laydown areas will be rehabilitated and monitored over a 15 year period. However, complete rehabilitation in which species richness and cover is indistinguishable from undisturbed countryside is not expected.

The EPA concludes that based on the management plans and commitments made by the proponent, the proposal would not compromise the EPA's environmental objectives for this factor.

Marine flora and fauna

The proposal has the potential to impact on the marine flora and fauna during:

- Construction of the proposed seawater intake and brine outfall facilities; and
- Operation of the seawater supply and brine outlet systems.

The EPA's environmental objective for this factor is to maintain the ecological function, abundance, species diversity and geographic distribution of marine flora (seagrass and macro-algae) and marine fauna.

Construction of inlet and outlet facilities

A benthic mapping survey (IRC Environment, February 2001) was conducted to document corals and benthic macrophytes in the vicinity of the seawater inlet and brine outlet facilities. The seabed was found to be mainly sand, mud and coarse shell. Marine habitats and biota in the area was relatively sparse and typical of habitats widely distributed in the Dampier region. Burrowing worms and crustaceans were found to be the predominant fauna. Information available to date indicates that no coral communities or extensive seagrass beds exist within the confines of King Bay. None of the marine biota observed in the area are listed as especially protected, endangered, vulnerable or threatened under the *Commonwealth Environmental Protection and Biodiversity Conservation Act* or the *Western Australian Wildlife Protection Act.*

The marine flora and fauna in the vicinity of the proposed offshore seawater supply and brine disposal facilities will be disturbed during the excavation of the 500m subsea trench and subsequent pipeline installation and stabilisation. The area of disturbance is expected to be about 1 hectare (approximately 1%) of the King Bay seabed.

The seawater in King Bay is naturally turbid throughout the year due to the nature of the seabed, the wind and the high tide variation. However, construction activities will lead to a short term (several weeks) increase in turbidity. It is considered that this increase in turbidity will be minimal when compared with the recent large scale dredging operation within the bay. The proponent will employ best available dredging construction methods and techniques. A dredging and spoil disposal plan will be developed that includes the monitoring of dissolved oxygen and turbidity and activities will be stopped if values exceed acceptable levels at the periphery of an accepted disturbance zone. Sub-sea excavation will be avoided during the periods when corals are spawning. Sediment sampling indicates low levels of heavy metal and that the sediment has a low potential for re-suspension (Astron Engineering, 1998). Any redistribution of sediments in King Bay as a result of construction activities is therefore not expected to make a significant difference to the environment.

As only local infauna (animals inhabiting the sediments) will be affected, the EPA considers the impacts due to construction of the pipeline will not be significant.

Operation of seawater supply and brine discharge system

The proponent will operate and manage the desalination plant and seawater supply and brine discharge system. The brine discharge stream (77 ML/day) will essentially be seawater with an elevated salinity (approximately 38% above ambient) and temperature (typically 2 ^{0}C above ambient). It will also contain an anti-scalant (sodium salt of a polycarboxylic acid) and low concentrations of biocides (typically chlorine) and byproducts. Although a cleaning agent (sulphamic acid) will occasionally be used to remove scale from the desalination system, it will be collected and disposed of appropriately.

A hydrodynamic assessment (Worley, March 2001) was undertaken to predict the environmental impacts associated with the ongoing withdrawal of seawater from, and the release of the brine discharge to the natural environment. Near-field modelling (CORMIX v.3.2) of the saline plume (55,000 mg/L) predicted that the ANZECC environmental quality criteria (EQC) (ANZECC, October 2000) for salinity (<5 % variation) would be met, apart from within a 40m mixing zone at the outfall. Near-field modelling for thermal dispersion was based on a high, worst case discharge temperature of 5^0 C above ambient seawater temperature. The model predicted that within 7m and110m of the outfall the temperature elevation would be less than 2^0 C and 0.25^0 C above ambient, respectively.

Both the DEP and CALM have reviewed the hydrodynamic modelling and found the methodology used and the predicted impacts acceptable. However, on the basis of available information, the corals in the region are near the threshold of their thermal tolerance during the summer months. The EPA considers that the thermal load from this project should be minimised as low as reasonably practicable, in addition to meeting acceptable environmental quality criteria. The proponent has made the following commitments to ensure impacts from thermal pollution are negligible:

- A cooling tower will be installed that is designed to cool the brine to within 3^0 C of the wet bulb temperature. (A comparison of seawater temperatures with meteorological data indicate that on average the brine discharge is expected to be cooled to within 2^0 C of the ambient seawater temperature);
- The daily variation between seawater inlet and brine outfall temperatures will be monitored and recorded; and
- Operations will be manage to ensure that the brine discharge (end of pipe) temperature:
    - is less than 2^0 C above ambient seawater temperature for 80% of the time; and
    - does not exceed 5^0 C above ambient seawater temperature.

    unless otherwise agreed by the DEP.

The potential impact of the brine discharge on flora and fauna in King Bay and Mermaid Sound was predicted using a far field 3 dimensional model called Environmental Fluid Dynamics Code (EFDC). The far field effects of salinity, temperature and any accumulation of other contaminants were determined. The model predicted that the EQC salinity guidelines would not be exceeded outside the near field mixing zone (40m), although the dense plume will cause some stratification to occur in the dredged basins and channels.

The seawater temperature in the vicinity of the proposed outfall was found to vary due to natural causes by as much as 2^0 C over a tidal cycle and by up to 5^0 C in a month. The temperature variation is caused by the large area of shallow water in King Bay and the large tides in the region. Far field modelling predicted the temperature increase to be less than 0.1^0 C above ambient within a few hundred metres of the discharge. The EPA considers the predicted temperature increase to be acceptable, given that the nearest coral communities are approximately 500m away. The proponent has committed to a coral management plan which would include appropriate monitoring programs to ensure no adverse impacts to the local coral communities. The data can also be used to verify the dispersion modelling results.

Low levels of heavy metals may be present in the brine discharge from corrosion or other sources. However, numerical modelling indicates that King Bay is well flushed and no accumulation of contaminants is expected. In addition, the proponent has committed to undertaking a program of sampling the seawater and sediments in the vicinity of the outfall to confirm that the level of heavy metals are within established limits.

Acute toxicity tests indicate that the antiscalant will not be harmful to the marine biota at the anticipated dose rate (typically less than 2 mg/L in the brine discharge). The proponent has committed to conducting chronic toxicity tests or obtaining chronic toxicity data prior to commissioning. The residual biocide (chlorine) in the brine discharge will be continuously monitored and dechlorinated by the controlled addition of sodium metabisulphite to produce

ions naturally present in seawater. A second on-line chlorine monitoring system will be installed to confirm that the chlorine concentration has been reduced to below detectable limits (< 0.1 mg/L).

Continuous on-line monitoring of brine turbidity will be used to determine long term trends and establish whether additional controls are required. As the seawater in the region is naturally turbid and subject to disturbance from vessel movements, any minor increase in turbidity due to the brine discharge is not expected to affect the marine flora and fauna.

The proponent has committed to undertaking a brine, seawater, sediment and biota monitoring program. The program will establish baseline data, validate modelling results and determine long term effects on the biota. Heavy metals and process chemicals will be monitored. A thorough screening analysis will be conducted periodically on the brine to verify that it does not contain any environmentally damaging constituents. If monitoring identifies any unacceptable impacts, modifications will be made to mitigate adverse effects.

The water velocity at the screen surface of the seawater discharge pumps will not exceed 0.15 m/s to reduce scouring of the seabed and prevent entrapment of marine fauna against the screen.

The EPA concludes that based on the results of the near and far field modelling and the commitments made by the proponent, the seawater supply and brine discharge can be managed to meet the EPA's objective for this factor.

Visual Amenity

The Burrup Peninsula has outstanding scenic values and is therefore a popular tourist and recreational destination. However, the area is also strategically placed for industrial development and a number of large industrial developments are being proposed within areas that have been zoned industrial. The EPA accepts that the visual amenity of the region will be reduced as a result of industrial development. The EPA's objective is to ensure that the proponent considers aesthetic values, and that measures are put in place to reduce the visual impact of the developments on the surrounding countryside as low as reasonably practicable.

The project has the potential to reduce the visual amenity of the Burrup as it includes the installation of large diameter (0.45m to 0.9m) seawater supply and brine discharge pipelines. For approximately half of the route the pipelines will be buried, however they will be located above ground on the hard, rocky areas, where burial is considered to be impractical. The exposed section of the pipelines will extend for approximately 2 kms following alongside Burrup and King Bay Roads. The proponent has committed to reducing the visual impact from Burrup Road by:

1. Using excess rock and soil to screen the pipelines; and
2. Painting the pipelines in a colour that blends in with the environment.

Access will be required to sections of the pipelines, but only a four wheel drive track is envisaged. The proponent will not construct a vehicle access road without DEP approval.

The pipelines alongside King Bay Road will be highly visible, but given the existing development in King Bay and the fact that, this area is of lesser importance from a tourism and recreational perspective, the EPA considers that the visual impact is acceptable.

The main plant includes a thermal desalination unit, seawater and desalinated water storage tanks and a cooling tower which are to be located on the Syntroleum site, next to major process items for the synthetic hydrocarbons plant. The visual impact of these additional items is considered to be insignificant in the context of the Syntroleum plant. Construction and laydown areas will be rehabilitated to ensure there is no long-term reduction in visual amenity as a result of clearing activities.

The EPA considers that the visual impact of the project will be consistent with the development that is being considered for the region. The proponent has made commitments that will reduce visual impacts from Burrup Road. The EPA notes that the desalination plant will not be visible

from the popular recreational beach at Hearson Cove. It concludes that the proposal can be managed to meet the EPA's objective for this factor.

5. Conclusions

Section 44 of the Environmental Protection Act 1986 requires the EPA to report to the Minister for the Environment on the environmental factors relevant to the proposal and on the conditions and procedures to which the proposal should be subject, if implemented. In addition, the EPA may make recommendations as it sees fit.

The EPA concludes that the factor of terrestrial flora can be managed to meet the EPA's objective to:

1. Protect Declared Rare and Priority Flora consistent with the provisions of the *Wildlife Conservation Act, 1950* and the Commonwealth's *Endangered Species Protection Act 1992;* and
2. Maintain the abundance, species diversity, geographical distribution and productivity of vegetation communities.

Only 3 hectares of undisturbed grassland will be affected and the proponent has made commitments that are expected to reduce impacts on the vegetation, preserve priority flora and prevent the spread of weeds during construction.

The EPA concludes that the factor of marine flora and fauna can be managed to meet the EPA's objective to maintain the ecological function, abundance, species diversity and geographic distribution of marine flora (seagrass and macro-algae) and marine fauna. Modelling indicates that the EQC guidelines will be met apart from within a 40m mixing zone at the outfall. The predicted increase in seawater temperature near the outfall is considered to be acceptable. Impacts will be limited to local infauna, while nearby coral reef systems are not predicted to be affected. The proponent will undertake a brine, seawater, sediment and biota monitoring program to establish baseline data and test for any long term effects on the biota.

The EPA concludes that the factor of visual amenity can be managed to meet the EPA's objective of ensuring that the visual amenity of the area adjacent to the project is not unduly affected by the proposal.

6. Recommendations

The EPA considers that the proponent has demonstrated, in its EPS document, that the proposal can be managed in an environmentally acceptable manner and that concerns raised in stakeholder consultation have been taken into account. The EPA provides the following recommendations to the Minister for the Environment:

1. That the Minister notes that the proposal being assessed is for the Desalination and Seawater Supplies Project, Burrup Peninsula.
2. That the Minister notes that this report follows a decision by the EPA to set a level of assessment as Proponent-initiated Environmental Protection Statement because:
    - The potential impacts can be managed through enforceable conditions, so that impacts are not significant, thus more comprehensive assessment under Part IV of the *Environmental Protection Act 1986* is not warranted.
    - The proponent's commitments in relation to the environmental factors identified need to be made legally binding through the Environmental Conditions set in accordance with Part IV of the *Environmental Protection Act 1986.*
3. That the Minister considers the report on the relevant environmental factors as set out in Section 4.

4. That the Minister notes that the EPA has concluded that it is unlikely that the EPA's objectives would be compromised, provided there is satisfactory implementation by the proponent of the recommended conditions and proponent commitments as set out in Appendix 2, including the provision for implementation of an environmental management system.

5. That the Minister imposes the conditions and procedures recommended in Appendix 2 of this report.

Appendix 1
References

ANZECC, October 2000. *Australian and New Zealand Guidelines for Fresh and Marine Water Quality – National Water Quality Management Strategy. Australian and New Zealand Environment and Conservation Council Agriculture and Resource Management Council of Australia.*

Astron Engineering, 1998. *Investigative Sampling at King Bay*.

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HLA - Envirosciences Pty Limited (1999a). *Syntroleum Proposed Gas to Synthetic Hydrocarbons Plant, Burrup Peninsula, Western Australia. Consultative Environmental Review*.

IRC Environment, February 2001. *Water Corporation Dampier Marine Environmental Survey*.

Worley, March 2001. *Burrup Peninsula Desalination Plant Hydrodynamic Assessment*.

Appendix 2

Recommended Environmental Conditions and Proponent's Consolidated Commitments

Schedule 2

Proponent's Consolidated Commitments – Desalinated and Seawater Supplies Project, Burrup Peninsula (Ass. No. 1378)

No	Topic	Action	Objective	Timing	Advice
1	Terrestrial Flora	1) Prepare a weed management plan. 2) Implement the weed management plan.	To prevent the introduction of new weeds. To control existing weeds.	Pre-construction Construction	CALM Agwest (for noxious weeds)
2	Terrestrial Flora	Conduct a detailed vegetation survey along the pipeline route, in the appropriate season.	To identify and protect sensitive flora.	Pre-construction	CALM
3	Terrestrial Flora	1) Prepare a flora and vegetation plan: • to quantify area of vegetation to be disturbed and the values that would be lost. 2) Implement the flora and vegetation plan.	To protect significant, rare and endangered flora. To protect significant vegetation assemblages.	Pre-construction Construction	CALM
4	Terrestrial Flora	1) Prepare a rehabilitation management plan for the construction and laydown areas: • to monitor vegetation assemblages. 2) Implement the rehabilitation management plan.	To measure and report on rehabilitation success.	Construction Annually for 5 years, then biannually for a further 10 years.	CALM
5	Terrestrial Fauna	Construct suitable fauna passages beneath the above ground sections of the pipelines.	To protect significant fauna habitats and their access. To protect rare and endangered fauna.	Construction	CALM
6	Marine Flora and Fauna	1) Prepare a dredging and spoil disposal plan that incorporates the best practically available dredging construction methods and techniques: • to minimise generation of turbidity; • to minimise redistribution of contaminants; • to minimise visual impacts; and • to ensure seawater oxygen levels are not depleted.	To protect benthic flora and fauna. To minimise the extent of disturbance of benthic flora and fauna.	Pre-construction	

		2) Implement the dredging and spoil disposal plan.		Construction	
7	Marine Flora and Fauna	1) Prepare a brine discharge quality plan to monitor and control emissions: • Continuous on-line monitoring shall include flow rate, temperature, conductivity, oxidation-reduction potential and turbidity. • Appropriate additional monitoring shall be conducted to control discharge levels of any process additives and other environmental contaminants (such as heavy metals) as required by the DEP. • Brine discharge temperature to be less than 2^0 C* above the inlet seawater temperature for 80% of the time and not exceeding a maximum limit of 5^0 C above, unless otherwise agreed with the DEP. • The concentration of oxidising biocide in the brine discharge to be less than 0.1 mg/L. • The concentration of antiscalant in the brine discharge to be less than 2 mg/L, unless otherwise agreed with the DEP. • The proponent will design and operate the plant to minimize thermal loads to the marine environment as low as reasonable practicable. 2) Implement the brine discharge quality plan. 3) If monitoring identifies unacceptable impacts, modifications will be made to mitigate adverse effects.	To protect sessile flora and fauna.	Pre-commissioning Operation On-going	

8	Marine Flora and Fauna	1) Conduct a research program to determine the chronic toxicity of antiscalant on appropriate marine biota. 2) Implement the findings.	To protect sessile flora and fauna.	Pre-commissioning Operation	
9	Marine Flora and Fauna	Chemical additives described in the EPS will not be changed without prior approval.	To protect sessile flora and fauna.	On-going	
10	Marine Flora and Fauna	1) Prepare a plan to monitor contaminants in the seawater, sediment and biota. 2) Implement the plan. 3) If monitoring identifies unacceptable impacts, modifications will be made to mitigate adverse effects.	To establish baseline data for the concentrations of heavy metals, process chemicals and other relevant contaminants. To identify long term effects on biota. To protect sessile flora and fauna.	Pre-commissioning Operation On-going	
11	Marine Flora and Fauna	1) Prepare a water quality monitoring plan that includes the monitoring of caged "sentinel" organisms around the brine outfall. 2) Implement the water quality monitoring plan. 3) If monitoring identifies unacceptable impacts, modifications will be made to mitigate adverse effects.	To establish baseline data. To identify effects on biota. To protect marine flora and fauna. To protect mangrove communities.	Pre-construction For a minimum of 18 months after commissioning. On-going	
12	Marine Flora and Fauna	1) Prepare a coral management plan to ensure no adverse impacts on coral communities particularly the nearest corals to the discharge diffuser. The plan will include intensive monitoring of temperature at the intake and outfall, at appropriate locations between the outfall and the nearest coral community and at appropriate reference locations, over the months of December to April, following commissioning of the plant.	To protect local coral communities. To verify the dispersion modelling results. To interpret the results of any coral monitoring program.	Pre-commissioning Operation	CALM

		2) Implement the plan. 3) If monitoring identifies unacceptable impacts from the project, modifications will be made to mitigate adverse effects. Unacceptability of impacts will be in consultation with the DEP.		On-going	
13	Visual Amenity	1) Prepare a visual amenity plan that includes: • Mounding of excess soil and rock to form a visual screen where practicable; • Painting pipelines in colours that blend with the environment; and • No construction of a pipeline maintenance access road, unless otherwise agreed with the DEP. 2) Implement the plan.	To provide a visual screen of the pipelines from Burrup Road. To prevent unacceptable visual impacts.	Pre-construction Construction	
14	Aboriginal Heritage	1) Prepare an Aboriginal heritage plan to: • identify all sites of cultural significance; • provide guidelines for avoidance of and behaviour around sites; and • provide guidelines if artifacts are found. 2) Implement the Aboriginal heritage plan.	To minimise disturbance to sites of cultural significance.	Pre-construction Construction	
15	Risk	Plant design and operation to be compliant with Syntroleum's Safely Report and Emergency Plan (as required by the Worksafe National Standard for the Control of Major Hazard Facilities).	To ensure safe operation in proximity to a major hazard facility.	Design compliance - pre-construction. Operation compliance – prior to operation of Syntroleum plant.	DME

*The difference between the 24 hour average seawater intake temperature and the brine discharge temperature.
Agwest = Agriculture Western Australia
CALM = Conservation and Land Management
DEP = Department of Environmental Protection
DME = Department of Minerals and Energy