Port Mandurah Canal Estate Stage 2

Esplanade (Mandurah) Pty Ltd

Report and recommendations
of the Environmental Protection Authority

Environmental Protection Authority
Perth, Western Australia
Bulletin 790
September 1995

THE PURPOSE OF THIS REPORT

This report contains the Environmental Protection Authority's environmental assessment and recommendations to the Minister for the Environment on the environmental acceptability of the proposal.

Immediately following the release of the report there is a 14-day period when anyone may appeal to the Minister against the Environmental Protection Authority's report.

After the appeal period, and determination of any appeals, the Minister consults with the other relevant ministers and agencies and then issues his decision about whether the proposal may or may not proceed. The Minister also announces the legally binding Environmental Conditions which might apply to any approval.

APPEALS

If you disagree with any of the contents of the assessment report or recommendations you may appeal in writing to the Minister for the Environment outlining the environmental reasons for your concern and enclosing the appeal fee of $10.

It is important that you clearly indicate the part of the report you disagree with and the reasons for your concern so that the grounds of your appeal can be properly considered by the Minister for the Environment.

ADDRESS

Hon Minister for the Environment
12th Floor, Dumas House
2 Havelock Street
WEST PERTH WA 6005

CLOSING DATE

Your appeal (with the $10 fee) must reach the Minister's office no later than 5.00 pm on 6 October 1995.

Environmental Impact Assessment (EIA)

Process Timelines in weeks

Date	Timeline commences from receipt of full details of proposal by proponent	Time (weeks)
10/4/95	Proponent Document Released for Public Comment	-
2/6/95	Public Comment Period Closed	8
12/6/95	Issues Raised During Public Comment Period Summarised by EPA and Forwarded to the Proponent	2
22/8/95	Proponent response to the issues raised received	11
20/9/95	EPA reported to the Minister for the Environment	4

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Summary and recommendations

Following the completion of development of Stage 1 of the Port Mandurah Canal Estate, a canal and residential development project situated on the entrance to the Peel Inlet, the EPA has now evaluated Stage 2 as proposed by Esplanade (Mandurah) Pty Ltd.

This development would see the completion of the canal system and associated residential development first proposed in 1982. Stage 1 of the Port Mandurah Canal Estate was constructed during 1990, having undergone a formal environmental assessment process with Environmental Conditions being set on 15 August 1989.

For Stage 2 the Environmental Protection Authority identified the main environmental topics requiring detailed consideration as:

- implications to wetlands and System 6 Recommendation C.50;
- the Conservation and Foreshore Management Plan;
- maintenance of acceptable water quality in the canals system (existing and new)
- effect of the canal development on groundwater; and
- noise and dust impacts during construction.

Only a small portion of the site contains wetlands. However their location adjacent to the Mandurah Channel and the Peel-Harvey Inlet, with its known waterbird conservation value, and the System 6 Recommendation C. 50 covering the foreshore portion of the site, has meant that this is a significant topic. Esplanade (Mandurah) Pty Ltd has undertaken fauna research on the site to assign conservation values to the site and has then used that information to design the project to protect the areas of high and moderate value. The System 6 area will be reserved and ceded to the Crown for conservation purposes.

The operational performance of the existing Stage 1 canal estate has been used by the proponent and the EPA to determine whether acceptable water quality would also be achieved within the Stage 2 development as well as Stage 1. Water quality in Stage 1 has proven to be acceptable and the design and management prescription for Stage 2 should ensure that continues for the whole development.

Development of the canal estate will affect groundwater conditions beneath and close to the site. However, Esplanade (Mandurah) Pty Ltd has made necessary commitments to ensure that adequate monitoring is undertaken and remedial action would be taken should problems arise.

Construction on the site could lead to dust and noise impacts, temporarily reducing the amenity of the area. The City of Mandurah will have primary responsibility for managing these issues, while Esplanade (Mandurah) Pty Ltd has made commitments to comply with relevant guidelines.

Conclusion

The Environmental Protection Authority has evaluated the Port Mandurah Canal Estate Stage 2 development and has concluded that the proposal is environmentally acceptable. Approval of the proposal should be subject to the proponent's commitments.

Recom-mendation Number	Summary of EPA recommendation
1	Port Mandurah Canal Estate Stage 2 is environmentally acceptable subject to the proponent's commitments.

1. Introduction and background

1.1 Purpose of this report

This report and recommendations provides the Environmental Protection Authority's advice to the Minister for the Environment on the environmental acceptability of the proposed Port Mandurah Canal Estate Stage 2.

1.2 Background

In 1982, the Environmental Protection Authority reviewed a canal development (called Halls Head Waterways) proposed by Parry's (Esplanade) Pty Ltd. That development, which covered all of the area that now comprises Stages 1 and 2 of the Port Mandurah Canal Estate, was found to be environmentally acceptable (EPA 1982).

Subsequently, in 1989, Esplanade (Mandurah) Pty Ltd referred to the EPA a new canal development which would be constructed over several stages. Environmental approval was then sought by Esplanade (Mandurah) Pty Ltd for only Stage 1 of the Port Mandurah Canal Estate. The EPA, reporting on that proposal in Bulletin 378, concluded that the Stage 1 project Figure 1) could proceed (EPA 1989).

Development of the first stage of the Port Mandurah Canal Estate (Stage 1) was undertaken during 1990. At the time that this Stage was being considered by approval agencies, including the EPA, it was indicated that several subsequent stages of the canal estate would be proposed at a later time.

In accordance with the provisions of the *Environmental Protection Act* 1986-1994, Esplanade (Mandurah) Pty Ltd (a subsidiary of Cedar Woods Properties Ltd) referred the proposal to develop the next (and final) stage of the canal estate to the Environmental Protection Authority in May 1992. Because of the potential impacts of the wetland and foreshore area, the Environmental Protection Authority determined that the appropriate level of assessment for the canal estate proposal was a Public Environmental Review. The Public Environmental Review document was released for public comment for a period of eight weeks from 10 April to 2 June 1995.

1.3 Structure of the report

This document has been divided into 7 Sections.

Section 1 describes the historical background to the proposal and its assessment, and describes the structure of this report. Section 2 briefly describes the proposal (more detail is provided in the proponent's Public Environmental Review). Section 3 explains the method of assessment and provides an analysis of public submissions.

Section 4 sets out the evaluation of the key environmental topics associated with the proposal. In each sub section, the objectives of the assessment is defined, the likely effect of the proposal, the advice to Environmental Protection Authority from submissions, the proponent's response to submissions. Then the adequacy of the response by the proponent is considered in terms of project modifications and environmental management commitments in achieving an acceptable outcome. The Environmental Protection Authority analysis and recommendations with respect to identified issues are contained in this section.

Section 5 summarises the conclusions and recommendations. Section 6 describes the recommended environmental conditions. References cited in this report are provided in Section 7.

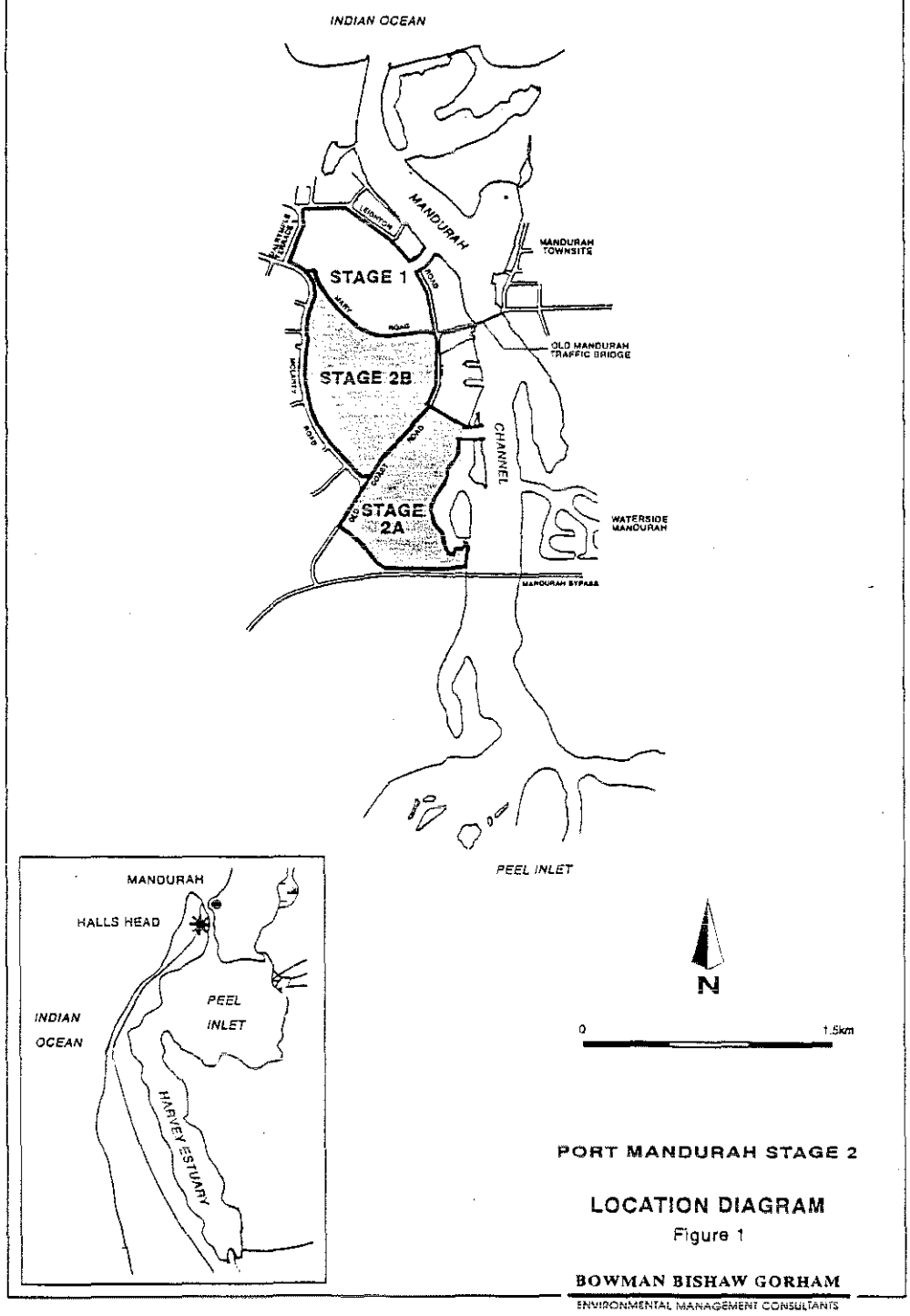


Figure 1. General location of Port Mandurah Canal Estate (source: Bowman Bishaw Gorham 1995)

2. The proposal

The Port Mandurah Canal Estate Stage 2 site is located adjacent to the Mandurah Estuary Channel, between the Old Mandurah Traffic Bridge and the Mandurah Bypass Traffic Bridge. Its northern boundary is defined by Mary Street while McLarty Road and Old Coast Road indicate the site's western limit (Figures 1 and 2)

Esplanade (Mandurah) Pty Ltd, which is a subsidiary of Cedar Woods Properties Ltd, owns all of the land included in the Stage 2 development except for Lot 2 and an adjoining Road Closure, which are located in Stage 2A and are owned or controlled by the City of Mandurah.

The proposal, as outlined in the Public Environmental Review, would be developed in four phases over a period of five to eight years. The main components of the proposal, as shown in Figure 2, are:

- a Conservation and Foreshore Reserve of approximately 23.9ha along the Mandurah Channel frontage of the development site;
- approximately 500 single residential waterside lots (R 15 and R20) established along the margins of 33ha of canal waterways, which will be linked with the existing canal system within the Port Mandurah Stage 1 development and the Mandurah Channel;
- two areas of communal (group) housing development (R 40) covering 2.7ha and providing 110 residences;
- a heritage precinct of 1.4ha comprising the Old Sutton Farm buildings and associated heritage features;
- 5.2ha of Public Open Space, to include a historical graveyard and two sites of Aboriginal cultural heritage; and
- new bridges where the main canal system passes under Mary Road and Old Coast Road, along with other smaller bridges within the canal development (Bowman Bishaw Gorham 1995).

The land currently has several town planning zones under the City of Mandurah Town Planning Scheme No. 1A, namely 'Tourist and Municipal Purpose' over Stage 2A and 'Residential 1' over the remainder of the Stage 2 site. The City of Mandurah is proceeding with Town Planning Scheme No. 3 which would change the zone to 'Canal' apart from the Sutton heritage precinct, which would have a 'Tourist' zone. In view of the time necessary to finalise TPS No. 3, an Outline Development Plan has been prepared for and submitted to the City of Mandurah by the proponent to allow Stage 2 to commence in the interim.

3. Environmental impact assessment method

3.1 Steps in the procedure of assessment

The purpose of the environmental impact assessment is to determine whether a proposal is environmentally acceptable or under what conditions it could be environmentally acceptable.

A set of administrative procedures has been defined (refer to flow chart in Appendix 1) in order to implement this method of assessment.

The first step in the method is to identify the environmental topics to be considered. A list of topics (or possible issues) is identified by the Environmental Protection Authority through the preparation of guidelines which are referred to relevant agencies for comment prior to being finalised.

In the next main step these topics are considered by the proponent in the Public Environmental Review both in terms of identifying potential impacts as well as making project modifications or devising environmental management strategies.

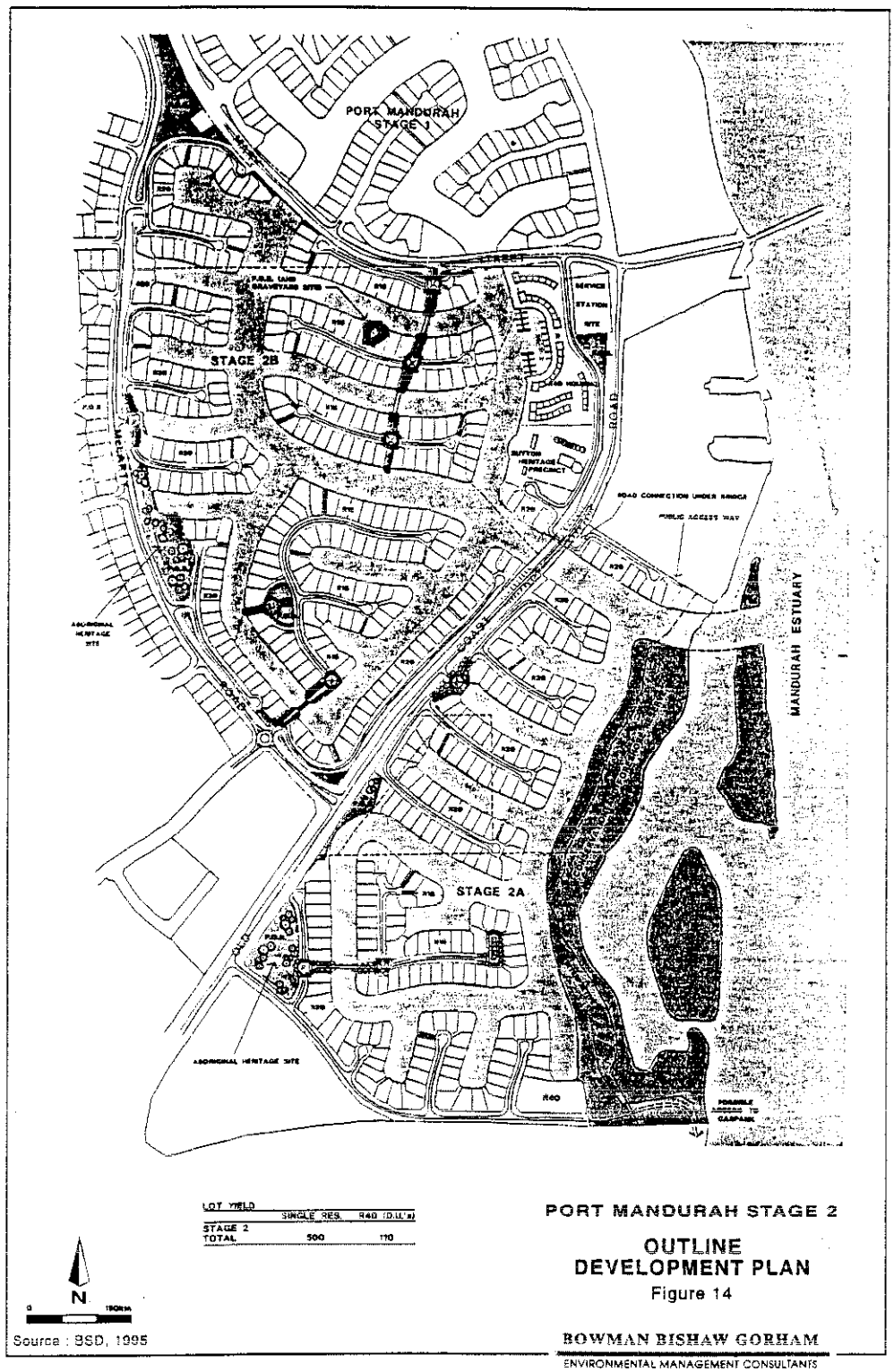


Figure 2. Layout of proposed canal estate

The Public Environmental Review is checked to ensure that each topic has been discussed in sufficient detail by the proponent prior to release for government agency and public comment. The submissions received are summarised by the Department of Environmental Protection on behalf of the Environmental Protection Authority and this process can add environmental issues which need to be evaluated in terms of the acceptability of potential environmental impact.

Proponents are invited to respond to the issues raised in submissions. Appendix 2 contains a summary of the issues raised in submissions and the proponent's response to those issues. A list of submitters appears as Appendix 3. Eight submissions were received, of which five were from government agencies and three from members of the public and conservation groups. One further submission was received after the closing date for public comments from a Government agency.

The proponent's revised commitments following their response appears in Appendix 4.

This information, namely the Guidelines, the proponent's Public Environmental Review, the submissions and the proponent's response, is then subjected to analysis for environmental acceptability. For each environmental issue, an objective is defined and where appropriate an evaluation framework identified.

The expected impact of the proposal, with due consideration to the proponent's commitments to environmental management, is then evaluated against the assessment objective. The Environmental Protection Authority then determines the acceptability of the impact. Where the proposal, as defined by the proponent, has unacceptable environmental impacts the Environmental Protection Authority can either advise the Minister for the Environment against the proposal proceeding or make recommendations to ensure the environmental acceptability of the proposal.

Limitation

This evaluation has been undertaken using information currently available. The information has been provided by the proponent through preparation of the Public Environmental Review document (in response to guidelines issued by the Environmental Protection Authority), by Department of Environmental Protection officers utilising their own expertise and reference material, by utilising expertise and information from other State government agencies, information provided by members of the public, and by contributions from Environmental Protection Authority members.

The Environmental Protection Authority recognises that further studies and research may affect the conclusions. Accordingly, the Environmental Protection Authority considers that if the proposal has not been substantially commenced within five years of the date of this report, then such approval should lapse. After that time, further consideration of the proposal should occur only following a new referral to the Environmental Protection Authority.

3.2 Public submissions

Comments were sought on the proposal from the public, community groups, as well as local and State government agencies. During the public submission period of 10 April to 2 June 1995, eight submissions were received. A summary of these submissions was forwarded to the Esplanade (Mandurah) Pty Ltd for response. Esplanade (Mandurah) Pty Ltd received copies of the full submissions from each State Government agency. Submissions received by the Environmental Protection Authority were within the following categories:

- 1 from a member of the public;
- 2 from groups and organisations; and
- 5 from State and other government agencies (plus one more after the close of submissions).

One further letter providing comment on the proposal was received from the Commonwealth Australian Nature Conservation Authority some considerable time after the close of the public

review period and after the proponent had completed its response to submissions. Because of the late submission the proponent has not been asked to respond and its comments have not been included in this section of the report but are referred to in Section 4.1.

The principal topics of concern raised in public submissions included (in summary):

Biophysical impacts

- impacts on the wetland area between the Old Coast Road and the Mandurah Channel;
- impacts on foreshore stability near the canal entrance;
- Conservation and Foreshore Reserve and Management Plan;
- impacts on groundwater hydrology;

Pollution issues

- impacts on water quality within the canals and Mandurah Channel from dredging and stormwater drainage;
- impacts of dust;
- impacts on groundwater quality;

Social surrounds

- Suitability of this site for this development;
- Outline Development Plan;

Other issues

- Justification for canal development; and
- Type of structures required in development;

The Environmental Protection Authority has considered the submissions received and the proponent's response as part of the assessment of the proposal.

3.3 Synopsis of public submissions

Submissions received by the Environmental Protection Authority were primarily concerned with the following topics.

Impacts on wetlands

The potential impacts of the development on the wetlands and foreshore area between the Old Coast Road and the Mandurah Channel were raised.

Concern was expressed about bias towards waterbirds and the dismissal of terrestrial fauna values. It was also noted in a submission that the conservation values assigned to waterbird habitats were misleading, particularly those areas assigned lower values. The mapping of the vegetation was also considered to be inadequate.

Two submissions considered the benefit of removing mosquito habitat was over- exaggerated compared to the loss of the bird or vegetation habitat. It was noted that the areas where mosquitos breed and grow are also generally good bird habitat.

The Environmental Protection Authority's evaluation of the impacts of the canal estate on wetland values and the System 6 area is contained in Section 4.1.

Impacts on foreshore stability

It was suggested in a submission that Area 2A stands alone as representative of its type of shoreline both in the Peel Harvey Estuary and in the State. It also contains the most southerly examples of the "Rockingham type" sea level curves (relict shorelines) in South Western Australia. An additional comment in a submission was that the PER presents insufficient detail to allow for an evaluation of surface stability of the reserve as there appears to be the potential for erosion, including 'gullying', wave induced erosion or scour by currents.

The Environmental Protection Authority's evaluation of the impacts of the canal estate on the foreshore area is contained in Section 4.1.

Conservation and Foreshore Reserve and Management Plan

It was indicated in submissions that the foreshore reserve should be based on an ecological boundary rather than an arbitrary width. In relation to this reserve, a submission expressed the view that the overall design of the proposed reserve should ensure that any loss of value to waterbirds is entirely compensated for by the creation of new habitats, rehabilitation of habitats and improved management arrangements.

A submission raised the issue of a contingent fund for unpredicted liabilities, such as erosion and accretion. It was suggested that the proponent establish a bank guarantee in favour of the Minister for the Environment, for adequate funds to address any such contingent liability and that this be held for a medium term period (10 years).

The submission from the Peel Inlet Management Authority (PIMA) advised that details of the proposed low profile, permeable bund of limestone boulders, and assessment of the potential impact of flushing of the conservation areas should be submitted to PIMA for approval.

The Environmental Protection Authority's evaluation of the proposed Conservation and Foreshore Reserve and Management Plan is contained in Section 4.1.

Impacts on groundwater hydrology

One submission considered that the hydrology of the southern portion of area 2A and the entire portion of 2B, which contain the most sensitive conservation areas and are prone to degradation during dewatering, could not be understood from the data derived from a single transect across the site.

In relation to construction impacts, submissions suggested that the proponent should include a commitment to ensure that dewatering activities will not affect the existing vegetation, and specifically include provision to restrict approximately 80% of dewatering to winter to avoid stressing remnant vegetation. In addition, a submission recommended that the details of dewatering and dredging activities should be submitted to PIMA for approval and licensing prior to construction activities commencing.

The Environmental Protection Authority's evaluation of the impacts of construction of the canal estate on groundwater is contained in Section 4.3.

Impact on canal water quality

A submission noted that Stage 2A is located within the Peel-Harvey Coastal Plain Catchment, and is therefore subject to the provisions of the Ministry of Planning Statement of Planning Policy No. 2, especially the requirements related to the retention of stormwater drainage on-site. The developer was encouraged in a submission to apply the Water Sensitive Urban (Residential) Design Guidelines. Related to this was the identification in a submission of the need for a contingency plan for emergency spills and pollution events during construction.

In relation to monitoring, submissions pointed to the requirement to obtain the approval of PIMA on the final water quality monitoring programme. Comment was also made that the water quality monitoring programme should be designed to be consistent with the previous monitoring programme for Stage 1.

The Environmental Protection Authority's evaluation of the management of water quality within the canal estate and Mandurah Channel is contained in Section 4.2.

Impact of dust during and following construction

A submission suggested that the proponent should undertake to only use fresh water for dust suppression during construction.

The impact of dust and also noise emissions upon residential premises is considered by the Environmental Protection Authority in Section 4.4.

Site suitability and development options

Options for developing this land which did not include a canal estate were suggested in several submissions. One option was for the development of Stage 2B as a medium to high density urban land use with the present System 6 boundary extended, perhaps to the Old Coast Road, as a trade-off. Another alternative was for the development of canals on area 2B, retaining the wetland portions of 2A whilst developing low density housing on the highland portions of 2A.

A further alternative mentioned in a submission was for area 2A to be purchased by the Local Authority or a Government Department for municipal or conservation purposes.

A submission indicated that there was concern that this development would lead to subsequent loss of public access to the area.

Esplanade (Mandurah) Pty Ltd has provided an outline of its reasons for proposing a canal estate development in its response to submissions (Appendix 2, Issue 1.1). The EPA's discussion in Section 5 is pertinent to the applicability of this issue.

Outline Development Plan

The Outline Development Plan prepared for the City of Mandurah was criticised because there is no clear identification of the existing System 6 and conservation/ foreshore resources, as distinct from the 6 ha of land which the proponent proposes to cede for conservation/ foreshore reserve purposes and the existing dry or partially inundated land as distinct from submerged shoals needs to be identified. Subsequently a plan has been prepared to show the System 6 area within the Outline Development Plan (Appendix 4).

The EPA discusses the implications of the development on System 6 Recommendation C. 50 in Section 4.1 of this report.

Structures

The submission from PIMA advised that there is a need for the proponent's to discuss the provision of houseboat mooring facilities and other structures associated with marine vessels, their use and upkeep, rather than it becoming a foreshore management issue later in time.

This is a matter of detail that is appropriate for PIMA to deal with and can be adequately addressed by that agency. In its response to submissions Esplanade (Mandurah) Pty Ltd has indicated that house boats are unlikely to meet the design for the canal system and the canal design does not allow for the provision of public mooring facilities (Appendix 2, Issue 15). The Environmental Protection Authority concludes that this is not a significant environmental issue, but considers that the proponent and PIMA should enter into discussions to ensure that problems do not emerge.

4. Evaluation of key environmental topics

The Environmental Protection Authority has considered the topics raised during the environmental impact assessment process including matters identified in public submissions. Table 1 summarises the topics raised, the characteristics of the proposal and the comments received in order to identify issues warranting evaluation. The Environmental Protection Authority has evaluated the following key environmental topics arising from this proposal, based on existing information and advice from other Government agencies:

- implications to wetlands and System 6 Recommendation C.50;
- the Conservation and Foreshore Management Plan;
- maintenance of acceptable water quality in the canals system (existing and new)
- effect of the canal development on groundwater; and
- noise and dust impacts during construction.

The issue of alternative development options for this site warrants further consideration if the present proposal is found to be environmentally unacceptable.

The EPA considers that other topics raised during the environmental impact assessment process can either be appropriately managed by the proponent in accordance with their environmental management commitments (Appendix 4), or are issues which should be dealt with by the proponent in concert with other agencies.

In giving advice regarding the environmental acceptability and management requirements for the Port Mandurah Canal Estate Stage 2, the Environmental Protection Authority will assess the above key environmental issues in relation to proposal outlined by Esplanade (Mandurah) Pty Ltd.

Relevant to the evaluation of this proposal is the performance of Stage 1 of the Port Mandurah Canal Estate. There has been an extensive series of monitoring programmes in place since 1990 for Stage 1. This has included the following:

- groundwater monitoring programme;
- canal water quality monitoring programme
- sediment monitoring programme;
- fish monitoring programme; and
- canal and Mandurah Channel bathymetry monitoring programme.

The results of these programmes have been incorporated into the project design and commitments for Stage 2 by Esplanade (Mandurah) Pty Ltd and have been considered by the EPA in this assessment.

Table 2 outlines the impacts anticipated by the proponent and the management response which the proponent intends to apply to minimise their consequences.

4.1 Effects on wetlands and System 6 Recommendation C.50

4.1.1 Objective

The Environmental Protection Authority's objective is to ensure that key wetland functions on the site are retained or enhanced as a result of the canal estate development.

4.1.2 Evaluation framework

Existing policy framework

Ramsar Convention

Australia has signed and ratified an agreement known as the '*Convention on Wetlands of International Importance*'(the Ramsar Convention). This agreement provides for the nomination and protection of wetlands of international significance in terms of their ecology, botany, limnology or hydrology and, in the first instance, of international importance to waterfowl. Its fundamental thrust is to protect the value of wetlands as habitat, especially to waterfowl.

Table 1: Identification of issues requiring EPA evaluation

Topics	Proposal Characteristics	Government Agency Comments	Public Comments	Identification of Issues
Biophysical				
Effects on wetlands and System 6 Recommendation C. 50	The System 6 area will be protected and some wetland will be developed.	CALM considers that the overall design should ensure that any loss of waterbird habitat is entirely compensated for by the creation of new habitats, rehabilitation of habitats and improved management arrangements. The consultant's report does not substantiate the claim that the loss of less valuable habitat elsewhere in the development will be mitigated. PIMA considers that the foreshore area (Area 2A) should be purchased for municipal and conservation purposes.	The conservation values of the portion of Area 2A (southern foreshore) to be cleared have been understated. By increasing the density of development in Stage 2B, there is no need to develop Stage 2A. System 6 is presently being updated and Recommendation C. 50 could be expanded as a result of this review.	Protection of wetland values within proposal and specifically protection of relevant portion of System 6 Recommendation C. 50 area requires evaluation by the EPA.
Impacts on Foreshore Stability	Canal entrance will cut through foreshore.	The DEP notes that the topography of the site indicates that significant areas of the Conservation and Foreshore Reserve will be periodically inundated. There is the potential for erosion of this area which needs to be better quantified and managed through the Conservation and Foreshore Reserve Management Plan.	Foreshore stability, adjacent to the new entrance channel, should be monitored with strategies in place for the management of any accretion or erosion.	Maintenance of foreshore stability can be managed by DEP, PIMA and CALM through the Conservation and Foreshore Reserve Management Plan.
Conservation and Foreshore Reserve Management Plan	Develop and implement a management plan, including facilities, for the proposed foreshore reserve.	CALM advises that vesting of the foreshore reserve in the National Parks and Nature Conservation Authority is appropriate.	Adequate funding should be provided in trust to cover the cost of ongoing management.	Requires EPA evaluation to ensure that proposed management of the reserve meets environmental objectives.
Effect on Groundwater hydrology	Dewatering and canal construction will change groundwater conditions.	PIMA is concerned that the groundwater study was based on one transect over the site and is specifically concerned that this will permit adequate understanding of the potential impacts from dewatering on the southern portion of the site.	The location of monitoring bores does not give adequate groundwater information in Stage 2A.	Requires EPA evaluation to ensure that impacts are managed.

Table 1: Identification of issues requiring EPA evaluation (cont'd)

Topics	Proposal Characteristics	Government Agency Comments	Public Comments	Identification of Issues
Pollution				
Maintenance of Acceptable Water Quality in the Canals	Flushing of Stage 2 should be at least as good as Stage 1, which has acceptable quality.	PIMA considered that its advice should be sought regarding approval of the water quality monitoring programme and reports should be submitted to PIMA. Further, the monitoring programme should be consistent with that implemented for Stage 1. DEP considers that, given the strong tidal currents through the Mandurah Channel, water exchange with the canals can be expected to be adequate.	The need for an emergency contingency plan was identified.	Requires EPA evaluation to ensure that management of canal water quality meets environmental objectives.
Effect on Groundwater Quality	Dewatering and canal construction will change groundwater conditions.	Discharge of dewatering fluids and dredge waters should be submitted to PIMA for licencing.		Requires EPA evaluation to ensure that impacts are managed.
Impacts arising from Noise and Dust	Dust and noise will be managed during construction.		Only fresh water should be used for dust suppression.	Requires EPA evaluation to ensure that management of noise and dust during construction meets environmental objectives.
Social				
Alternative Development Options	A canal estate comprising all but the highest and moderate value wetlands and several heritage areas.	Where development is not supported for area 2A, it should be purchased by the Local Authority or a Government Department for municipal or conservation purposes.	Suggested alternatives are: • developing only Stage 2B as a medium to high density urban land use; or • developing canals on area 2B, retaining the wetland portions of 2A whilst developing low density housing on the highland portions of 2A.	Requires EPA evaluation if Stage 2 canal estate development proposal is environmentally unacceptable.
Additional Structures	The design is for a residential canal development.	PIMA advise that there is a need for the proponents to discuss (either to provide a commitment for or an argument against) the provision of houseboat mooring facilities and other structures associated with marine vessels, their use and upkeep, rather than it becoming a foreshore management issue later in time.		Should be resolved through discussion between proponent and relevant agencies.

Table 2: Summary of Predicted Impacts and Potential Management (source: Bowman Bishaw Gorham 1995)

Table A

Summary of Impacts and Management - Port Mandurah Stage 2

PREDICTED IMPACT	PROPOSED MANAGEMENT
Construction Phase	
Impacts to waterbird habitat	- The proposal will conserve all areas having high waterbird habitat value and all areas of samphire with moderate habitat value. The project design will create new waterbird habitat which is expected to increase the total number of waterbirds using the site. The proponent will prepare and implement a Conservation and Foreshore Management Plan. The Conservation and Foreshore Reserve will be ceded to the NPNCA for vesting as an "A" Class Reserve.
Loss of vegetation and habitat	
- Loss of sedgeland which is possibly of moderate significance to a limited number of waterbird species but is a potential highly significant seasonal mosquito breeding habitat	- Removal of significant mosquito breeding area and replacement of sedge habitat in proposed Conservation and Foreshore reserve.
- Loss of degraded dry land samphire which is of very low significance to waterbirds and of very high, year-round significance for mosquito breeding	- Removal of highly significant mosquito breeding area and enhancement of other habitats of higher waterbird usage.
- Loss of some tree overstorey which has low to moderate value for bushbirds and waterbird roosting.	- Retention of the majority of the tree overstorey habitat in POS
Localised temporary drawdown of shallow aquifer during dewatering	
- Temporary impacts to a limited number of domestic bores	- Conduct most dewatering in winter to minimise impact. Pay for affected owners to connect to mains water supply.
- Potential stress to phreatophytic vegetation and heritage trees.	- Conduct most dewatering in winter to minimise impact. Monitor trees on site and irrigate if required.
Discharge of dewatering fluids into the estuary.	- Discharge procedures to follow PIMA Dewatering Policy WS 4.2, including use of stilling basin and appropriate detention time to allow turbidity in the water to settle prior to discharge of clear water to the estuary.
Dredging of the entrance channel	
- Potential for increased turbidity in Mandurah Channel	- Dredging procedures to follow PIMA Dredging Policy WS 4.1. Turbidity from dredging will be short term and be unlikely to exceed naturally occurring fluctuations.
- Dissection of the northernmost end of the tidal shoal	- Loss of habitat will be small and mitigated by the creation of new tidal flats within the proposed Conservation and Foreshore Reserve.
- Possible temporary disturbance to waterbird activities.	- Disturbance, if any, will be minimal and short-term, and will not impact longer-term use of the habitat. No management required.
Potential disturbance to waterbirds habitat and other conservation areas during construction	- Preparation of Conservation and Foreshore Management Plan prior to construction. - Environmental specifications in construction contract to protect waterbird habitat and other conservation areas.
Low level noise during construction	- Construction activities confined to daylight hours. Noise expected to be masked by background traffic noise.
Residual dust problems during estate construction.	- Construction will mostly be conducted during winter. Dust levels will be monitored and dust-suppression procedures applied if required.

Table 2: Summary of Predicted Impacts and Potential Management (source: Bowman Bishaw Gorham 1995) (Cont'd)

Table A
(Cont'd)

PREDICTED IMPACT	PROPOSED MANAGEMENT
Operations Phase	
Disruption of traffic during bridge construction.	- Bridge construction will be undertaken in "the dry" to minimise construction time. Traffic will be diverted by temporary detours constructed on land owned by the proponent to a standard acceptable to the City of Mandurah.
Canal and estuarine water and sediment quality impacts	
- Potential deterioration of water quality due to inadequate flushing	- Canal design is based on Port Mandurah Stage 1, which has a high level of flushing performance. This will be enhanced by water through flow following connection with Stage 1.
- Contaminant inputs from residential land use	- Nutrient and drainage management design, including spoon drains, soakwells and silt and grease traps, will ensure that nutrients and other contaminant inputs will be minimal. The proponent will provide an environmental awareness brochure which will include ways to minimise fertiliser application and encourage the use of suitable native plant species for gardens.
- Contaminant inputs from vessels	- Use of tributyl tin oxide (TBT) antifouling on vessels less than 25m is prohibited in WA. Discharge of sewage, hydrocarbons and litter from vessels into public waterways is also illegal.
	- Preparation and implementation of Water and Sediment Quality Monitoring Program to the satisfaction of PIMA
Potential interference with hydrodynamic processes	
- Impacts upon shoreline stability.	- The development is not expected to influence shoreline stability. The entrance channel will be rock-walled to prevent boat wash and sediment disturbance. Design of boundary canal revetment in the proposed Conservation and Foreshore Reserve will minimise any risk of erosion from the Reserve.
- Potential for sediment scour from tidal currents through the canal waterways following connection of Stage 2 with Stage 1.	- Provision of adequate scour protection.
Movement of the saltwater interface to the west, with a potential to impact a small number of domestic bores.	- Abstraction management advice and/or compensation for affected bore owners
Restriction of public access to existing foreshore reserve.	- Proposal to specifically exclude public to the majority of the proposed Conservation and Foreshore Reserve, however public access controlled to allow enhanced appreciation of waterbird habitat by the provision of environmental education facilities and viewing platforms.
	- Vessel access into the Reserve from the estuary will be specifically discouraged by the placing of limestone boulders in the tidal channel between the offshore samphire flat and the sub-tidal shoal.
Increased population and recreation pressure	
- Additional pressure on commercial fishing	- Regional impact of increased tourism and recreation. managed under the Fisheries Act
- Waterbird disturbance by boating activity	- Previous data indicates that high boat activity causes very little disturbance to waterbirds. managed by PIMA, CALM and Department of Transport.

In meeting part of its obligations to this international treaty, Australia has nominated a number of wetlands as Internationally Important. In Western Australia the Department of Conservation and Land Management has submitted a list of wetlands which have been entered onto the list of Internationally Important wetlands (Department of Conservation and Land Management, 1990). The Peel - Harvey Estuary is one such wetland, listed as the Peel-Yalgorup System Wetland of International Importance. In relation to this development, the Mandurah Channel south of the Old Mandurah Traffic Bridge is part of this listing.

JAMBA and CAMBA Agreement

The JAMBA Agreement (JAMBA 1981) and the CAMBA Agreement (1988) place obligations on each of the national signatories to cooperate in the protection of migratory birds and their environment, including prohibiting the taking of eggs, sale or hunting of birds, research on migratory birds and encouraging the conservation of migratory birds. Each party is encouraged to protect species of migratory birds through the establishment of sanctuaries and the preservation and enhancement of the environment of migratory birds. Specific species of migratory birds are listed in an Annex to each agreement.

System 6

The EPA's System 6 Recommendation C. 50 covers all of the Peel Inlet and a portion is included within the Port Mandurah Stage 2 development site. This portion, which essentially encompasses the lagoon and Channel foreshore immediately to the north of the Mandurah Bypass Bridge, is shown in Figures 3 and 4.

In its System 6 report, the EPA made the following comment relevant to this site:

" The most important areas as water-bird habitats are the extensive shallows around the southern and eastern shores and the tidal flats and shallows around Channel and Creery Islands. The shore areas in the north of Peel Inlet and bordering the main channel contain samphire flats and marshes important for eastern curlews and whimbrels, and this is one of the few places in the South West where they can always be seen." (DCE, p. 98)

Figure 4, which is taken from the response to submissions (Appendix 2), more clearly delineates the boundary of the System 6 Recommendation C. 50 area. It comprises a range of habitats mapped by Ninox Wildlife Consulting and E Gobble-Garratt and Associates (Appendix F to the PER), including Habitat Type 2 (Open Shallows), Habitat Type 3 (Tidal Flats), Habitat Type 4 (Bare Shorelines), Habitat Type 5 (Perches), Habitat Type 6 (Tidal Lagoon), and a portion of Habitat Type 10 (Seasonal Swamps). This portion of the System 6 Recommendation C. 50 covers an area of approximately 15 ha.

Technical information

The principal conservation value of the Peel - Harvey Estuary is as habitat for waterbirds.

Two main potential impacts upon these waterbird populations may arise from this proposal. Firstly there is the direct loss of habitat arising from the development of the canal estate. Secondly, there is the potential for disturbance of breeding and nesting activities.

Appendix F of the Public Environmental Review outlines 11 waterbird habitats on the site, within which 36 species of waterbirds have been identified during sampling and a further 16 species would also be expected to use this site. Fourteen of these species are covered by the JAMBA and CAMBA Agreements (Bowman Bishaw Gorham 1995)

Comments from key Government agencies

The Department of Conservation and Land Management pointed out in its submission that the overall design of the proposed reserve should ensure that any loss of value to waterbirds is entirely compensated for by the creation of new habitats, rehabilitation of habitats and improved management arrangements (eg fences).

Vesting of the proposed foreshore reserve in the National Parks and Nature Conservation Authority is supported by CALM.

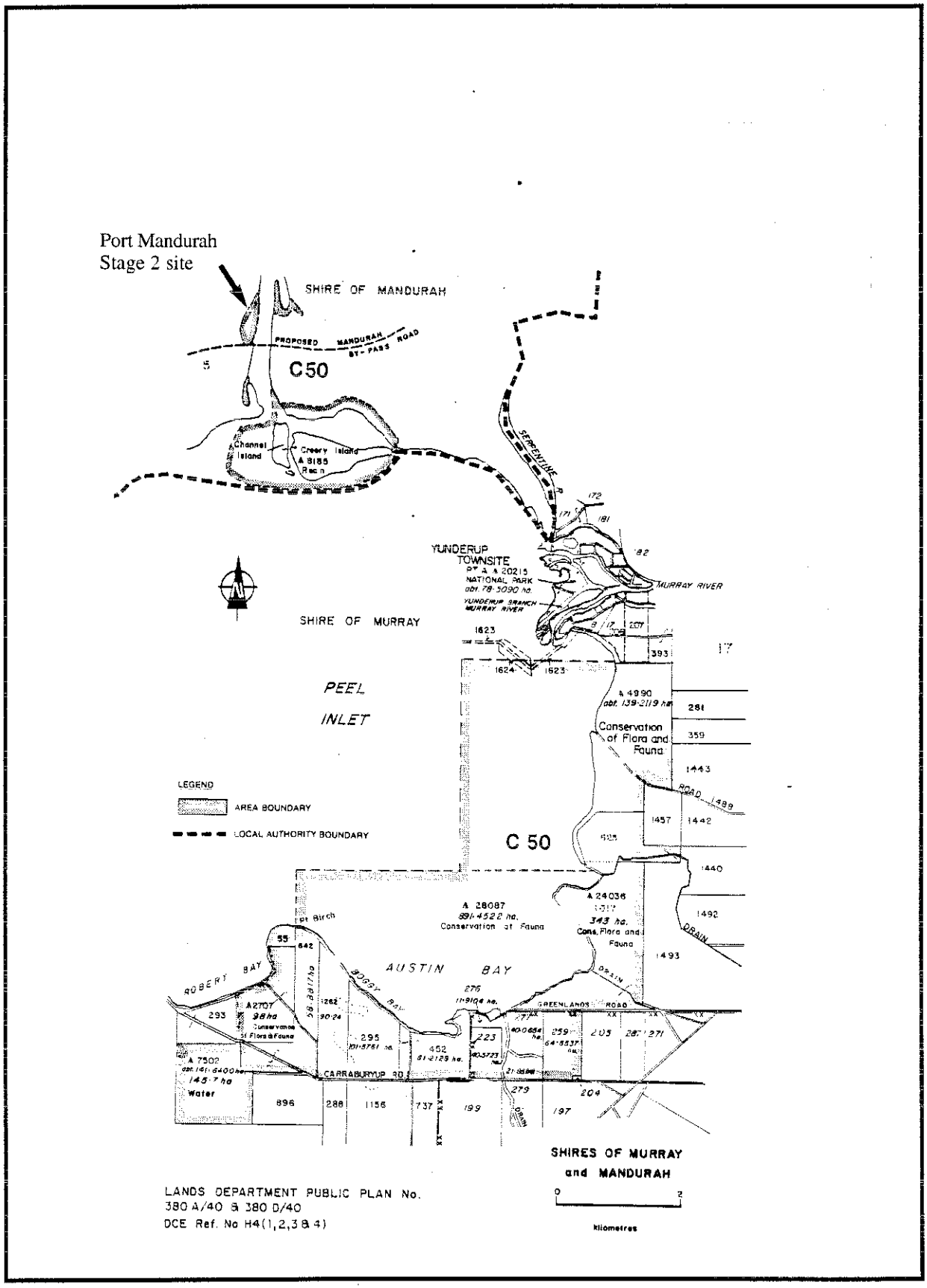


Figure 3. System 6 Recommendation C. 50 map (source: Department of Conservation and Environment 1983)

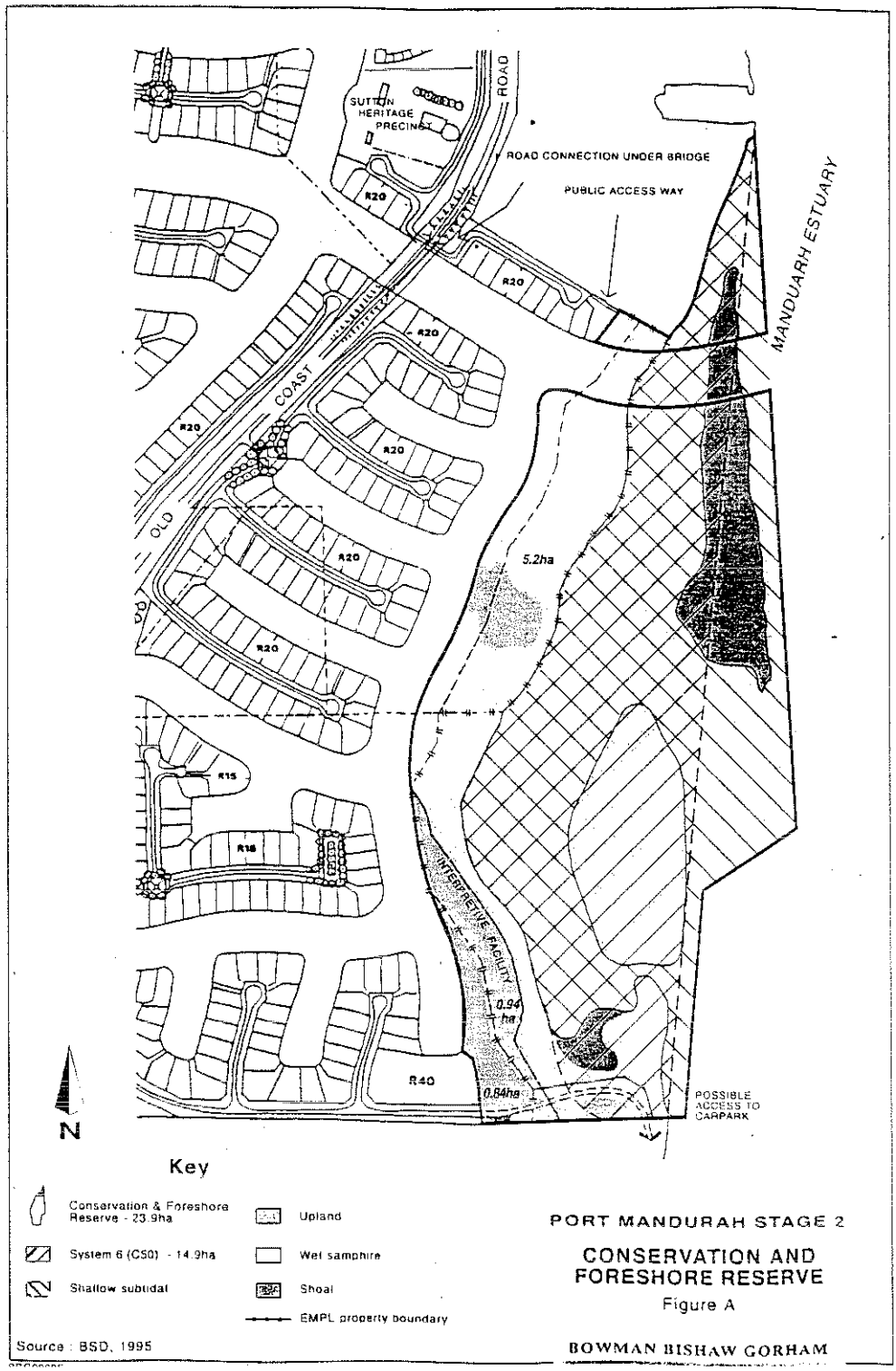


Figure 4. Conservation and Foreshore Reserve (source: Bowman Bishaw Gorham)

The Peel Inlet Management Authority advised that it had no objection to the canal entrance from the Mandurah Channel to Stage 2B, and that it supports the creation of the foreshore reserve.

The Department of Environmental Protection expressed concern about the stability of the Conservation and Foreshore Reserve. The PER presents insufficient detail to allow for an evaluation of surface stability of the reserve. The potential for erosion, including 'gullying', wave-induced erosion or scour by currents, and the physical characteristics of the likely vegetation cover, would assist in evaluating surface stability of the Conservation and Foreshore Reserve.

The late comments from the Australian Nature Conservation Authority (ANCA) advised that, in the view of the ANCA, the project site adjoins the Peel-Yalgorup System Ramsar site. As a consequence of the potential affect of development as a source of disturbance to waterbirds using the foreshore reserve area, ANCA has recommended that a 200m buffer be established between the landward edge for the foreshore reserve and the development.

4.1.3 Public submissions

A number of submissions from the public encouraged alternative forms of development on the Port Mandurah Canal Estate site which would permit all or most of the Stage 2A area to be retained as wetland.

Two submissions considered that the benefit of removing mosquito habitat was over-exaggerated compared to the loss of the bird or vegetation habitat. It was noted that the areas where mosquitos breed and grow are also generally good bird habitat.

4.1.4 Response from the proponent

Esplanade (Mandurah) Pty Ltd has acknowledged in the Public Environmental Review and its response to submissions that there are important species of waterbirds using the portion of the site between the Old Coast Road and the Mandurah Channel.

Specifically, the proponent's response to comments in submissions about the value of the wetland portion of the site indicates that:

- the Conservation and Foreshore Reserve will enable the protection all wetland areas identified as having a high waterbird habitat value and all of the wet samphire areas with a moderate habitat value;
- the only habitat not replaced or rehabilitated will be the seasonally inundated samphire area, which has high mosquito breeding potential and has been identified to have low significance to waterbirds; and
- a number of commitments (namely 3, 4, 5, 6, 16 and 17) have been given to ensure protection and management of the important waterbird habitats (Appendix 2, Issue 3.2).

In relation to the long term stability of the foreshore reserve, Esplanade (Mandurah) Pty Ltd points out that, while erosion is not expected to be problem, the final design of foreshore protection for the reserve will be defined in consultation with CALM, PIMA and DEP prior to construction. Commitment 6 reflects this position (Appendix 2, Issue 16.1).

4.1.5 Evaluation

Not all of the wetland area within Stage 2A will be protected. Those areas mapped in Appendix F of the PER and which would be lost through development include the major portion of Habitat 7 (Regularly Inundated Samphire), Habitat 8 (Rarely Inundated Habitat), Habitat 9 (Open Woodland) and Habitat 10 (Seasonal Swamp). While the degree to which some of these areas have been disturbed through grazing and other factors mentioned in the PER may be subject to some debate, the mapping broadly agrees with that undertaken by M Trudgeon for the Department of Planning and Urban Development (1991).Approximately 60 per cent of the area of wetland east of the Old Coast Road would be subject to the canal development.

Based on the data referred to in Appendix F of the PER, the proponent has appropriately identified those portions of the site with significant value to waterbirds using the site. Apart from the canal entrance (approximately 1ha), which will cut through some of the Habitat 3 (Tidal Flats), Habitat 5 (Perches) and Habitat 6 (Tidal Lagoon) areas, all of the System 6 Recommendation C. 50 area on this site will be protected (involving approximately 15ha).

The late comments from ANCA recommend that a 200m buffer be established between the foreshore reserve and the development. This is based on a recent report by CALM on "Guidelines for Design of Effective Buffers for Wetland on the Swan Coastal Plain". The EPA understands that this report does not deal with extensive estuarine wetlands, as is the case for the wetlands fringing the Peel-Harvey Estuary. In its response to submissions, Esplanade (Mandurah) Pty Ltd pointed out that the project design provided "... for an enhanced waterbird habitat and an ecologically functional interface between the canal estate and the Conservation and Foreshore Reserve, through provision of an additional 25m buffer zone along the eastern development boundary. The proposed Foreshore Reserve is generally 75-100m wide along its entire length." (Appendix 2, p. 9). CALM's submission on the proposal did not suggest any additional buffer for this area.

Those wetland and habitat areas which would be lost through development constitute a portion of the conservation value of the Peel Inlet. However, these habitat are present elsewhere within the Peel-Harvey region. Unlike the lagoon and foreshore area proposed to be reserved, and based on the information presented in Appendix F of the PER, the western portion of Stage 2A does not constitute an area of conservation value of such significance that it warrants preservation.

Commitment 3 provides for the creation of the Conservation and Foreshore Reserve to meet the following objectives:

- inclusion within the proposed reserve of all areas identified as having high or very high waterbird habitat value and all samphire areas with moderate waterbird habitat value;
- protection of areas of high habitat value during project construction;
- separation of the proposed reserve from the residential development by a canal, with a further landscaped buffer between the protected high value areas and the canal;
- provision of an Interpretive Facility and formal pathways, viewing platforms and car parking by Esplanade (Mandurah) Pty Ltd on the south east portion of the proposed reserve; and
- construction of a vermin proof fence around the southern boundary of the proposed reserve ((Bowman Bishaw Gorham, Section 4.2.1)

Management of this proposed Conservation and Foreshore Reserve is subject to several commitments by Esplanade (Mandurah) Pty Ltd. The primary commitment is Commitment 6 (see Appendix 4). The Conservation and Foreshore Reserve Management Plan to be prepared under that commitment will include:

"• methods and design of foreshore protection;
- landscape and rehabilitation design and implementation;
- public access and information facilities;
- waterbird monitoring;
- mosquito management; and
- management responsibility" (Bowman Bishaw Gorham, p. 90)

This management plan would be prepared in consultation with the Department of Environmental Protection, Department of Conservation and Land Management and Peel Inlet Management Authority.

The ceding of the foreshore area to the Crown for subsequent vesting with the National Parks and Nature Conservation Authority as a Conservation Reserve is supported by the EPA. This would occur after preparation of the Conservation and Foreshore Reserve Management Plan.

The commitment to prepare a management plan which incorporated these elements is endorsed by the EPA.

One point raised in the submission by the Department of Conservation and Land Management is that whether the proponent develops the facilities or the funds are paid into a trust managed specifically for interpretive facilities by the vested authority, should remain optional. CALM recommended that this issue be further explored during development of the reserve management plan. The EPA agrees that co-ordination of educational and interpretive facilities in the Peel Inlet should be improved and supports CALM's view that this should be considered further.

The issue of public access to the site was raised in a submission. In its response to submissions, Esplanade (Mandurah) Pty Ltd has pointed out that there is currently no authorised access to the portion of the site in private ownership, and that access to the foreshore area is also restricted (Appendix 2, Issue 1.2). As mentioned above, the Conservation and Foreshore Reserve Management Plan would include provision for controlled public access to the proposed reserve.

The Environmental Protection Authority noted that a portion of the Stage 2A area is owned or under the control of the City of Mandurah and is therefore not presently available for this development. It is the EPA's understanding that the City of Mandurah will put Lot 2, fronting Old Coast Road, out to tender as it no longer wishes to retain ownership.

4.2 Maintenance of acceptable water quality

4.2.1 Objective

The Environmental Protection Authority's objective is to ensure that water quality within the existing and proposed canal system remains consistent with that in the Mandurah Channel through the long term.

4.2.2 Evaluation framework

Existing policy framework

The Western Australian Planning Commission's Policy DC 1.8 - Procedures for Approval of Artificial Waterways and Canal Estates, outlines minimum provisions within canal estates for a range of topics including water quality.

Several specific policies have been developed by the Peel Inlet Management Authority to manage potential sources of water quality problems during construction. PIMA Dredging Policy WS 4.1 deals with dredging impacts while PIMA Dewatering Policy WS 4.2 considers the discharge of dewatered fluids.

Comments from key Government agencies

The Peel Inlet Management Authority suggested that the water and sediment monitoring programme should be designed to be consistent with the previous monitoring programme for Stage 1. It also advised that the general water quality and sediment monitoring parameters as stated in the PER were considered satisfactory. However, the final sampling regime including the parameters, their measurement in a spatial and temporal sense, and historical compatibility with other canal data needs to be discussed with appropriate input from Department of Environmental Protection, Department of Transport (DOT), Office of Catchment Management and PIMA/ Waterways Commission. Additional parameters such as pH, salinity and copper should also be included. Annual reports should be submitted to PIMA, for review and comment. Where significant changes in water quality are detected PIMA should be notified immediately.

PIMA also recommended that breaching of the entrance channel during the construction phase should occur on an ebb tide.

The Department of Fisheries indicated that the proponent should agree to make any necessary changes to the canal system if unacceptable monitoring results or inadequate flushing are demonstrated.

DEP indicated that the management and monitoring programme for water quality should be designed with attention to the water quality in the 'end points' of the canals.

4.2.3 Public submissions

A need for a contingency plan for emergency spills and pollution events during construction was identified. The stormwater drainage system does not seem to take into account the provision of facilities to control accidental spills that may enter the system.

4.2.4 Response from the proponent

Monitoring of the Stage 1 canal development has shown that flushing occurs on a daily tidal cycle. It is predicted that the development of Stage 2 and its linking to the Stage 1 canal system would be at least at efficient as the existing development (Bowman Bishaw Gorham, p. 80).

Management of drainage and stormwater would include the following:

- roof runoff would be discharged directly into the canals;
- runoff from landscaped and paved portions of residential lots would be directed to soak wells; and
- road drainage would pass through silt traps prior to discharge to the canals (Bowman Bishaw Gorham, p. 82).

These are consistent with the drainage management system for the existing Stage 1 canal estate and are subject to Commitment 11, related to environmental design described in the PER (see Appendix 4).

Esplanade (Mandurah) Pty Ltd has reaffirmed its commitments to undertake construction of the canal system and then to monitor it for the first five years to confirm that water quality performance is as anticipated, based on performance for Stage 1. Commitments 13 and 28 are most relevant (see Appendix 4).

The risk to the estuary resulting from an accidental spill during construction is expected to be minimal, as all dewatering from the site would be initially stored in a detention pond prior to discharge to the estuary. Should a spill occur, dewatering operations would cease during cleanup (Appendix 2, Issue 12.4)

4.2.5 Evaluation

Since their construction, the canals within the Stage 1 Port Mandurah Canal Estate have maintained acceptable water quality. This has resulted from a range of factors including the satisfactory water flushing characteristics of the canal system and the management of water within the estate through storm water system design and control.

The expansion of the development with Stage 2 is intended to be undertaken with similar design features and provides an additional canal connection with the Mandurah Channel, which will assist through flushing.

Even with the progressive development of Stage 2, consultants to Esplanade (Mandurah) Pty Ltd are predicting that the Stage 2A can be developed and achieve acceptable water quality (PER Appendix E)

Management responsibility for the canal system for the initial five years would be with Esplanade (Mandurah) Pty Ltd. After that period, the City of Mandurah would have

Waterways Manager responsibility. Commitments 1 and 2 provide the mechanism under which this transfer of responsibility would take place.

Assessment of the canal design indicates that flushing will be adequate for the Stage 2 canal estate. Allied with the experience from the stormwater management arrangement for Stage 1, the implementation of a similar arrangement should maintain water quality within the canal estate which matches that in the source waters of the Mandurah Channel.

On the basis of satisfactory compliance with the proponent's commitments, the known performance of the existing canal system with the Stage 1 development and the flushing improvement that an additional canal link with the Mandurah Channel would create, the EPA considers that satisfactory water quality can be maintained within the current Stage 1 and proposed Stage 2 canal system.

4.3 Effect on groundwater

4.3.1 Objective

The Environmental Protection Authority's objective is to ensure that construction of the canal estate does not adversely affect existing groundwater users, including phreatophytic vegetation.

4.3.2 Evaluation framework

Existing policy framework

The Water Authority of Western Australia has primary responsibility for the management of water resources in Western Australia. Where adverse effects on groundwater have arisen as a consequence of dewatering or other construction activities, the WAWA has become involved in resolving the problem.

Another agency involved in groundwater impacts is PIMA, which has a Dewatering Policy (WS 2) dealing with the containment and discharge of dewatering fluids generated during construction.

Comments from key Government agencies

The PIMA advised that the details of dewatering and dredging activities should be submitted to PIMA for approval and licensing prior to construction activities commencing. In addition, the discharge of water into the estuary from the dewatering operation should be monitored in accordance with the Swan River Trust Guidelines, and reports submitted to PIMA on a regular basis for its information.

PIMA also recommended that the proponent should include a commitment to ensure that dewatering activities will not affect the existing vegetation, and specifically include provision to restrict approximately 80% of dewatering to winter to avoid stressing remnant vegetation.

4.3.3 Public submissions

A number of public submissions indicated concern about the adequacy of groundwater related data. In particular, concern was expressed about the ability to make accurate predictions from a single transect as the basis for the groundwater hydrology study over the Stage 2 site. In addition, it was claimed that the location of monitoring bores does not give adequate information on groundwater flows in Stage 2A, where most of the conservation value of the site is located.

4.3.4 Response from the proponent

Esplanade (Mandurah) Pty Ltd points out in its responses that it is aware of and would comply with the requirements of PIMA in relation to dredging and dewatering activities (Appendix 2,

Issue 11). Commitment 21 deals with protecting vegetation within the Stage 2 area from adverse dewatering effects (Appendix 4).

Additional commitments have been given to reduce the effects of dewatering operations on other groundwater users. Commitments 20 and 25 provide for the deepening of bores or alternative water supply arrangements for existing bore owners should development of the canal estate cause a reduction in the suitability of the groundwater supply (Appendix 4).

4.3.5 Evaluation

The Environmental Protection Authority is aware that construction of the Stage 1 canal estate caused some problems in relation to groundwater changes for existing users. This knowledge has been applied by Esplanade (Mandurah) Pty Ltd to its proposed Stage 2 development. In particular, appropriate commitments have been given to ensure that existing groundwater users and areas of vulnerable vegetation on the site would be protected from adverse impacts.

Maintenance of acceptable quality for liquids leaving the site through dredging and dewatering operations are adequately addressed through commitments made by Esplanade (Mandurah) Pty Ltd to comply with PIMA requirements.

The EPA considers that groundwater impacts arising from the development can be satisfactorily managed through the implementation of the proponent's commitments.

4.4 Impacts arising from noise and dust

4.4.1 Objective

The Environmental Protection Authority's objective is to ensure that construction of the canal estate does not adversely affect the amenity of the area.

4.4.2 Evaluation framework

Existing policy framework

The EPA published "Guidelines for Assessment and Control of Dust and Windborne Material From Land Development Sites" in 1990. In recent times these guidelines have been reviewed to ensure their continued effectiveness, and to establish guidelines for other environmental matters relating to land development sites.

New draft guidelines have been prepared by the DEP which address dust management as well as disposal of cleared vegetation and control of drainage (DEP 1995).

Construction on the site would need to comply with the existing Neighbourhood Annoyance Regulations under the Environmental Protection Act.

4.4.3 Public submissions

A submission encouraged the proponent to only use fresh water for dust suppression during construction, to reduce long term effects arising from salt in the soil.

4.4.4 Response from the proponent

The proponent has made several commitments to protect the amenity of the site and its surroundings during development. These include Commitment 18, which is to manage and monitor dust emissions in compliance with the EPA's Dust Guidelines (EPA 1990) and to reduce noise nuisance by restricting construction activities to daylight hours and adopting other relevant practices such as noise suppression devices (Commitment 19).

In relation to the water used for dust suppression, Esplanade (Mandurah) Pty Ltd has indicated in its response to submissions that water would be drawn from the dewatering settlement pond to avoid saline water (Appendix 2, Issue 7). This water is expected to be fresh or slightly brackish.

The development programme currently proposes excavation of the canals during winter 1996, which would reduce requirements for dust control.

4.4.5 Evaluation

The Environmental Protection Authority considers that these issues can be adequately addressed through compliance with the proponent's commitments, compliance with appropriate dust and noise control guidelines and in accordance with requirements applied by the City of Mandurah under its development controls.

5. Conclusions

The Environmental Protection Authority concludes that the proposal by Esplanade (Mandurah) Pty Ltd to construct the Port Mandurah Canal Estate Stage 2 development is environmentally acceptable subject to the proponent's commitments and the Environmental Protection Authority's recommendation.

In reaching this conclusion the Environmental Protection Authority identified the main environmental topics requiring consideration as:

- implications to wetlands and System 6 Recommendation C.50;
- the Conservation and Foreshore Management Plan;
- maintenance of acceptable water quality in the canals system (existing and new)
- effect of the canal development on groundwater; and
- noise and dust impacts during construction.

The Environmental Protection Authority believes that these topics are adequately addressed by the commitments made by the proponent, the proponent's response to the issues raised in public submissions, and the Environmental Protection Authority's recommendations in this report. Table 3 provides a summary of the EPA's position on these key topics.

Some submissions raised the possibility of alternate forms of development on the Stage 2 site, primarily to protect the wetland area within Stage 2A. These other development options do not need to be considered because the EPA considers that the project is environmentally acceptable.

The proponent has made a number of environmental management commitments to ameliorate the impacts arising from this proposal. These commitments are included in Appendix 4. The Environmental Protection Authority considers that while the proponent should be required to implement all of the commitments, compliance with commitment numbers 1, 3, 5, 6, 11-14, 16, 17, 21, 23, and 26-28 should be audited by the Department of Environmental Protection.

The Environmental Protection Authority is satisfied that, using information currently available, the following recommendation may be made to the Minister for the Environment.

Recommendation 1

The Environmental Protection Authority recommends that the Port Mandurah Canal Estate Stage 2 is environmentally acceptable subject to the proponent's commitments.

Table 3: Summary of Environmental Protection Authority recommendations.

Issues	Environmental Objective	Evaluation Framework	Proponent's Commitment	EPA Recommendation
Biophysical impacts				
Effects on wetlands and System 6 Recommendation C. 50	To ensure that the key wetland functions on the site are retained or enhanced.	Comply with System 6 Recommendation C. 50 and establish adequate management.	Setting aside and ceding of a Conservation and Foreshore Reserve, comprising a minimum foreshore reserve width of 50m plus a 25m buffer zone, under the control of CALM. Esplanade (Mandurah) Pty Ltd (EMPL) will provide detailed design specifications to ensure that the through flow of canal water will not result in unacceptable scouring of the canal sides. For the first 5 years EMPL will monitor the shoreline and nearshore shoaling in the vicinity of the Stage 2 entrance channel. See commitments 3, 4, 5, 6, 11, 12, 13, 14, 15, 16, 17, 27.	Not considered necessary as proponent's commitments are adequate.
Preparation of Conservation and Foreshore Management Plan	To ensure that proposed management of the reserve meets environmental objectives.	Protection of the habitat value, provision of an adequate buffer and provision of funding for implementation.	A management plan for this reserve will be prepared and facilities outlined in the proposal will be constructed by the proponent (EMPL). See commitments 3, 4, 5, 6, 14, 17.	Not considered necessary as proponent's commitments are adequate.
Effect on Groundwater	To ensure that canal construction does not adversely affect existing groundwater users, including the environment.	Minimise groundwater effects and provide other arrangements where impact arises on existing uses.	EMPL will monitor the impacts of the canals on groundwater abstracted at nearby residences and provide alternative water supplies if required. The effects of dewatering operations upon nearby trees will be monitored and watering will occur if necessary. See commitments 20, 21, 22, 25.	Not considered necessary as proponent's commitments are adequate.

Table 3: Summary of Environmental Protection Authority recommendations

Issues	Environmental Objective	Evaluation Framework	Proponent's Commitment	EPA Recommendation
Pollution				
Maintenance of Acceptable Water Quality in the Canals	To ensure that water quality in the existing and proposed canal system is acceptable over the long term.	Water quality should be protected through design and long term management.	The canals will be ceded to the Crown and vested in the City of Mandurah. Management for the first 5 years will be EMPL's responsibility, and then the City of Mandurah. EMPL will prepare and implement a water and sediment quality monitoring programme for the canals. See commitments 1, 2, 10, 11, 12, 13, 15, 22, 23, 24, 26, 27, 28.	Not considered necessary as proponent's commitments are adequate.
Impacts arising from Noise and Dust	To minimise adverse affect on the amenity of the area during development of the site.	Dust and noise generated from the development should be managed.	Dust emissions during construction will be managed and monitored in accordance with DEP requirements. Noise nuisance will be suppressed and construction will be restricted to daylight hours. See commitment 18, 19.	Not considered necessary as proponent's commitments are adequate.

6. Recommended environmental conditions

Based on the assessment of this proposal and recommendations in this report, the Environmental Protection Authority considers that the following Recommended Environmental Conditions are appropriate.

PROPOSAL: PORT MANDURAH CANAL ESTATE STAGE 2

CURRENT PROPONENT: ESPLANADE (MANDURAH) PTY LTD

This proposal to construct the Port Mandurah Canal Estate Stage 2 at Mandurah may be implemented subject to the following conditions:

1 Proponent Commitments

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

1-1 In implementing the proposal, the proponent shall fulfil the commitments made in the Public Environmental Review and in response to public submissions, provided that the commitments and environmental management measures are not inconsistent with the conditions or procedures contained in this statement.

A schedule of environmental management commitments to be audited by the Department of Environmental Protection was published in Environmental Protection Authority Bulletin 790 and a copy is attached.

2 Implementation

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

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

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

3 Proponent

These conditions legally apply to the nominated proponent.

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

4 Time Limit on Approval

The environmental approval for the proposal is limited.

4-1 If the proponent has not substantially commenced the project within five years of the date of this statement, then the approval to implement the proposal as granted in this statement shall lapse and be void. The Minister for the Environment shall determine any question as to whether the project has been substantially commenced.

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

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

5 Compliance Auditing

To help determine environmental performance, periodic reports on progress in implementation of the proposal are required.

5-1 The proponent shall submit periodic Progress and Compliance Reports, in accordance with an audit programme prepared by the Department of Environmental Protection in consultation with the proponent.

Procedure

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

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

7. References

Bowman Bishaw Gorham (1995). Port Mandurah Canal Estate Stage 2. Public Environmental Review. Report No: R14240. Esplanade (Mandurah) Pty Ltd. Western Australia.

CAMBA (1988). Agreement Between the Government of Australia and the Government of the People's Republic of China for the Protection of Migratory Birds and their Environment.

Department of Conservation and Environment (1983). Conservation Reserves for Western Australia as recommended by the Environmental Protection Authority. The Darling System - System 6. Part II: Recommendations for Specific Localities. Report 13. Department of Conservation and Environment. Perth, Western Australia.

Department of Conservation and Land Management (1990). Wetlands, Nominated by the Government of Western Australia, Australia, for inclusion on the 'List of Wetlands of International Importance'. Ramsar Convention. Department of Conservation and Land Management.

Department of Environmental Protection (1995). Land Development Sites - A Guideline for the Prevention of Pollution from Land Development Sites in Western Australia. Department of Environmental Protection (WA). Perth, Western Australia.

Department of Planning and Urban Development (1991). A Flora and Vegetation Survey of the Coast of the City of Mandurah. Department of Planning and Urban Development. Perth, Western Australia.

Environmental Protection Authority (1982). Halls Head Waterways Project, Parry Corp Pty Ltd. Report and Recommendations of the Environmental Protection Authority. Bulletin 129. Environmental Protection Authority. Perth, Western Australia.

Environmental Protection Authority (1989). Port Mandurah Development, Esplanade (Mandurah) Pty Ltd. Report and Recommendations of the Environmental Protection Authority. Bulletin 378. Environmental Protection Authority (WA). Perth, Western Australia.

Environmental Protection Authority (1990). Guidelines for Assessment and Control of Duct and Windborne Material From Land Development Sites. Environmental Protection Authority. Perth, Western Australia.

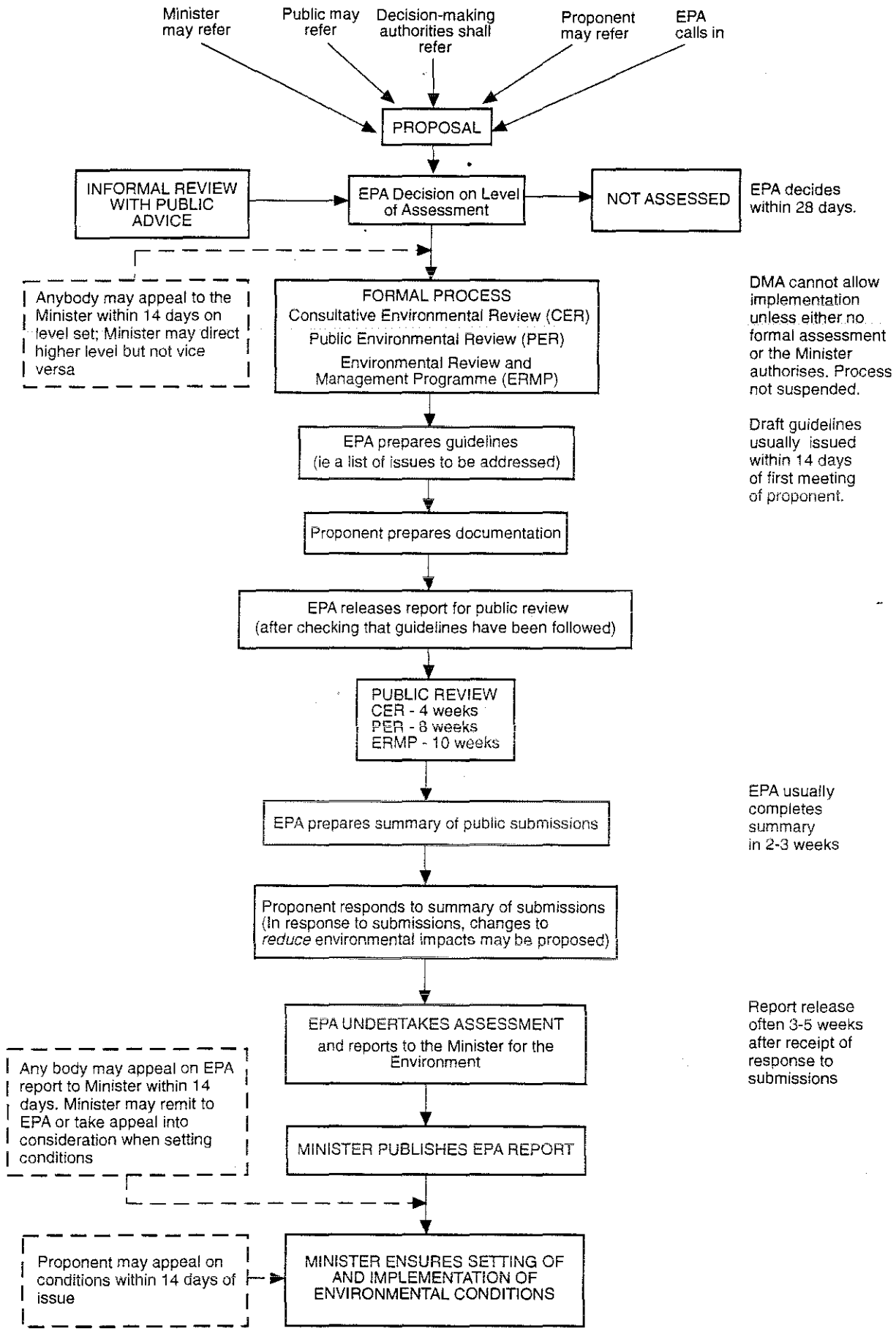
JAMBA (1981). Agreement Between the Government of Japan and the Government of Australia for the Protection of Migratory Birds and Birds in Danger of Extinction and their Environment

Waterways Commission (1992). Peel Inlet Management Programme. Waterways Commission. Perth, Western Australia.

Appendix 1

Environmental impact assessment flow chart

EIA PROCESS FLOW CHART



Appendix 2

Summary of public submissions and the proponent's response

PROPONENT'S RESPONSE

PORT MANDURAH STAGE 2
- PUBLIC ENVIRONMENTAL REVIEW -

RESPONSE TO ISSUES RAISED IN PUBLIC SUBMISSIONS

This document forms Esplanade (Mandurah) Pty Ltd's (EMPL's) principal responses to submissions upon the Public Environmental Review (PER) for the proposed Port Mandurah Stage 2 Canal Estate.

The responses are to the issues and comments within public submissions to the PER, summarised in the Department of Environmental Protection's (DEP) correspondence to the proponent dated 19 June, 1995. For ease of reference, the comments and responses are numbered in accordance with the DEP correspondence.

1. JUSTIFICATION FOR DEVELOPMENT

1.1. The projection of a strong demand for medium to hi-density housing close to the city centre as a basis for advocating a canal estate as the preferred type of development, was not felt to be adequate justification, particularly given the conservation value of the area. This issue was raised in a number of submissions.

Response:

The projected demand for medium to high density housing close to the city centre was only one of many compounding reasons provided to justify the development of a canal estate. Reasons which justify canal estate development over the area include the following:

- The proposal is a continuation of an existing canal estate development. The EPA has previously supported the staged development of the Port Mandurah Project.

- There has been a continuous high demand for residential canal lots since the inception of canal estates within the City of Mandurah and Shire of Murray fifteen years ago and there continues to be a strong demand for waterfront lots within the City of Mandurah. That demand is demonstrated by increasing sales and steadily rising values in waterfront lots.

- The statutory authorities requested that the planning and engineering design of the Port Mandurah Stage 1 development should allow for future extensions of the canal system to the south, to cater for future waterfront lot demand in anticipation of the above trend and within the limited available land suitable for the purpose.

- There was a clear majority elector support for proceeding with Stage 2 of the Port Mandurah Canal Estate, as determined by the ratepayer referendum conducted by Mandurah City Council in November, 1990.

- The Port Mandurah Stage 2 site is ideally located both environmentally and demographically for a canal estate development. In accordance with State Planning Commission Policy DC1.8, land most suitable for a canal estate development is limited to 'channel' areas which ensure close proximity to the ocean and adequate tidal circulation and flushing regimes.

- The site has been extensively used for sheep and cattle grazing, marl extraction, and has had levy banks constructed for the control of surface waters. These previous land uses and modifications have resulted in substantial land degradation and associated loss of most of the previous conservation value. The use of degraded land of low conservation value close to the city centre for medium density housing development is considered to be environmentally sound planning.

- The layout of the canals, and the engineering structures proposed, have been specifically designed for the protection and enhancement of the System 6 waterbird habitat, including the provision of a canal buffer zone to isolate areas of high conservation significance from public access and feral animals.

Sections 2.5.1, 2.5.2, 2.5.3 and 2.5.4 of the PER evaluate alternatives to the proposed development, with strong justification in support of the canal proposal.

With respect to the conservation value of the area, the first step in project planning for Port Mandurah Stage 2 was the identification and delineation of areas within the site which contain significant value for conservation. This task was undertaken prior to the development of any concept plans for the area and allowed for an ecological boundary to be proposed as a limit to development. The work was based on independent assessments by fauna and vegetation specialists who offer highly respected relevant expertise. Ecologists from CALM and PIMA were also consulted. The areas that were identified as worthy of conservation, including 6ha of the proponent's landholdings, have been incorporated into the proposal as a Conservation and Foreshore Reserve totalling 23.9ha adjacent to the Mandurah Estuary (Figure A).

The proponent will therefore finance the development and implementation of a management plan for the protection of the entire area of System 6 Recommendation C50 (14.9ha) adjacent to the property, plus an additional 9ha of surrounding land which was also identified as warranting conservation reservation.

The conservation value of the site and surrounding area has therefore been carefully addressed, with appropriate management being proposed to ensure the long-term preservation of areas with conservation significance.

The heritage values of historical buildings and Aboriginal sites were also clearly demonstrated in Section 2.2 of the PER and will similarly be conserved.Please also see Response 2.3.

1.2. There was general opposition to the canal style of development and subsequent loss of public access to the area.

Response:

The general opposition to the canal style of development is questioned. There was majority support in the November, 1990 Council ratepayers referendum with respect to developing Stage 2 of the Port Mandurah project. There is a strong demand by purchasers for waterfront lots in Mandurah. Only eight submissions were received on the PER

during the eight week public review period, five of which were from Government. Only five submissions were received from the public on the rezoning advertising, and three of these supported the rezoning. These results do not support a statement of any "general opposition" to canal development.

The history of canal development at Mandurah has enabled the impacts of canal construction and operation on the natural and social environment to be confidently predicted and the aesthetic appeal of Port Mandurah Stage 1 is widely accepted by the community. In fact, there is strong support for the style of development at Port Mandurah Stage 1 as evidenced by the high demand for lots, and the same construction specification and detail will be utilised (and improved where possible) in Port Mandurah Stage 2.

There is currently no public access to the area of the proponents land, which is in private ownership. The land is used for grazing and is surrounded by rural fences on all boundaries.

Public access is also currently excluded from the existing NPNCA foreshore reserve on the estuary foreshore adjacent to the southern part of the property. The primary 'beneficial use' for this area and the proposed Conservation and Foreshore Reserve is the protection of waterbird habitat, not public recreation, hence this exclusion is desirable and appropriate. Moreover, the creation of the public open space and the environmental interpretive facility will allow public access to the area which was non-existent previously. Public access will be controlled and confined to properly constructed pathways, boardwalks and bird hide areas, to afford maximum protection and minimum disturbance to the high value conservation area.

2. SUITABILITY OF SITE FOR DEVELOPMENT

2.1. It was strongly felt that alternatives to canal style residential development were not adequately represented. The Peel Regional Strategy land use plan shows Stage 2B area as 'urban development' and Stage 2A area as 'urban with regional development space'. It was considered that alternative forms of development presented in the PER could better reflect this.

Suggested alternatives are:

- **developing Stage 2B as a medium to hi-density urban land use with the present System 6 boundary extended, perhaps to the Old Coast Road, as a trade-off; or**

- **developing canals on area 2B, retaining the wetland portions of 2A whilst developing low density housing on the highland portions of 2A.**

This would be in keeping with the statement by the proponent that the maximum productive use of land is presently under-utilised; medium density housing would meet housing pressures and would additionally ensure the well being of the rest of the site.

Response:

The Peel Regional Strategy land use plan actually shows Area 2B as urban development and Stage 2A area as future urban, marked with a red triangle over the Stage 2 area signifying tourist and recreation sites.

The alternative forms of development presented in the PER allowed for establishment of a Conservation and Foreshore Reserve and noted that conventional residential development would increase the numbers of residential lots from 501 proposed in the PER to approximately 1,100 residential lots under a conventional residential subdivision, an increase of more than two-fold.

The suggestion of developing Stage 2B as medium to high-density housing would allow for a range of development between R40 and R80. The new Town Planning Scheme No. 3 proposed by the City of Mandurah indicated canal development of R40 density. The proponent has proposed a plan of R15 density generally, with parts of the Outline Development Plan allowing for R20 and two restricted locations of R40 development. A high density urban land use through Stage 2B of the site would suggest an R80 density coding.

Recent experience in Mandurah with regard to public opposition to such high density development is well documented.

The Port Mandurah Stage 2 proposal allows for medium-density development of canals on Stage 2A and 2B, whilst providing for creation of a conservation and foreshore reserve on the wetland portion of Stage 2A.

Minimum lot sizes proposed by the proponent are $612m^2$ which comply with the R15 residential density code. This is within the standard R15 residential R Code proposed by the Ministry for Planning in recent policy documents.

This issue is predominantly a planning and social matter, however implicit in the suggested alternatives is the assumption that the Stage 2A area has high conservation value and should be retained at the expense of increasing the housing density of the Stage 2B area.

Firstly, the Stage 2A area does not have high conservation value. The landform, vegetation, soils, drainage and tidal influence have been significantly modified by past landuses and the area is currently in a state of substantial degradation. The majority of the area has low significance to waterbirds in that waterbird usage is confined to a few species during low frequency peak flood events. All areas of moderate and high conservation significance will be protected and actively managed.

The primary conservation value contained within the Stage 2A area is provided for by the proposed Foreshore Reserve, which will provide a buffer to the adjacent System 6 area and contribute to the objectives of the Peel Regional Park of a continuous foreshore reserve around the Peel-Harvey Estuary. This is recognised within the Peel Inlet Management Plan (Waterways Commission, 1992), which recommends the acquisition of only the foreshore strip on the subject land.

Secondly, high density housing development as suggested (R40 to R80) is not supported by the local population. In contrast, canal estate type development on the site is supported by the City of Mandurah ratepayers. Only 3 submissions opposing the canal estate development were received from the public during the 8 week submission period on the PER.

Thirdly, the alternatives suggested do not consider the environmental benefits of the proposal, with respect to the funding commitments made by EMPL towards environmental management. The alternatives suggested do not consider the cost to the public of purchasing, rehabilitating and managing the Stage 2A area. Development on Stage 2B only (as suggested) would not require EMPL to provide any funding for the management of the adjacent System 6 area. The costs of ongoing management of the high level mosquito breeding areas on Stage 2A (which would be adjacent to high density housing development as suggested), would also need to be borne by the public. The current proposal not only provides land for a foreshore reserve and the construction of public environmental education facilities at no cost to PIMA, CALM or the Local Authority, but also provides funding for the development and implementation of a management plan for the protection of all areas of recognised conservation significance, both on and adjacent to the subject land.

2.2. It was considered that there should be no further development in the area until the results of the Dawesville Cut have been evaluated.

Response:

Whether the Dawesville Channel and catchment management measures implemented under the Peel-Harvey Management Strategy ultimately succeed in fulfilling their objectives will not be known for many years. The construction of the Channel and the ongoing reductions in nutrient losses from the catchment appear to have successfully averted the possibility of total ecological collapse in the estuary (Waterways Commission *et al*, 1994, Securing the Future), however the ecological function and environmental amenity of the estuary remain highly sensitive to additional nutrient inputs. Therefore, the planning and environmental protection authorities appropriately require that rigorous environmental management is applied to any new developments in the catchment.

The Port Mandurah Stage 2 proposal is fully consistent with these requirements for rigorous environmental management, including drainage and nutrient management. The proposal also conforms with the Peel Inlet and Harvey Estuary Management Plan (PIMA, 1992), the EPA's System 6 recommendations and all other current policies and guidelines controlling canal estate development and/or development adjacent to Peel Inlet, as described in Section 2.3 of the PER.

As discussed in Sections 3.1.5 and 3.1.6 of the PER, the predicted changes to the hydrodynamic conditions in Mandurah Channel due to the Dawesville Channel are very minor, and are appropriately considered in the engineering and environmental design.

As discussed in Section 3.1.7 of the PER, dredging of the Mandurah Channel in 1988 resulted in a marked improvement in water quality in Peel Inlet and the channel (EPA, 1989). The Dawesville Channel will further alleviate water quality problems in the estuary and will likely result in improved water quality in Mandurah Channel.

2.3. Three submissions advocated no canal estate development within the area outlined as 2A as:

- **The proposed intensity of the development is unsuitable for this land due to its conservation significance, and**

- **Area 2A stands alone as representative of its type of shoreline both in the Peel-Harvey Estuary and in the State. It also contains the most southerly of the Rockingham type sea level curves in South-western Australia.**

Response:

Response 2.1 addresses the same three submissions which advocated no canal development in Stage 2A.

The conservation values of the Stage 2A area are discussed in Section 3 of the PER and in Response 2.1. Most of the Stage 2A area has been significantly disturbed by grazing sheep and horses, vehicle use, weed invasion, marl excavations and the construction of levee banks to limit the extent of salt water intrusion during peak tides. There are no rare or priority flora present on the site and the site has only very low to moderate habitat values for terrestrial fauna.

Parts of the site have high habitat value to waterbirds, which are the main conservation issue.

The protection and enhancement of all parts of the site having significant conservation value was a principal focus of planning design and environmental management prescriptions for the project. As discussed in Section 5.2 of the PER, the proposed development will not remove valued habitats. To the contrary, the conservation and ongoing management of all existing areas having conservation significance, together with the development and ongoing management of additional foreshore habitat, is likely to increase the conservation values that attach to the site.

The areas of the site having conservation significance and proposed for conservation are not presently contained within any designated reserve and are not actively managed. Elements of the proposal which will better protect the recognised conservation values include the following:

- Creating a continuous foreshore reserve, consistent with the objectives of PIMA for conservation protection of the estuarine boundaries.

- Providing for an enhanced waterbird habitat and an ecologically functional interface between the canal estate and the Conservation and Foreshore Reserve, through provision of an additional 25m buffer zone along the eastern development boundary. The proposed Foreshore Reserve is generally 75-100m wide along its entire length.

- Reducing ongoing impact upon valuable waterbird habitat within the proposed Conservation and Foreshore Reserve due to human activity and feral and domestic animals, by having a canal as a boundary to the Foreshore Reserve and the System 6 area and by installing a vermin-proof fence elsewhere along the Reserve boundary.

- Facilitating the appropriate ongoing environmental management of the Conservation and Foreshore Reserve.

- Providing public facilities relating to environmental education and appreciation of the waterbirds and their habitat.

The proposal will also secure the protection of European and Aboriginal heritage values that exist on the site.

Hence, all parts of the site which have medium or high conservation significance will be protected by inclusion with the adjacent System 6 area in an actively managed Conservation and Foreshore Reserve. Therefore, the submissions do not provide rational justification for precluding a demonstrated low environmental impact development in the Stage 2A area.

The statement concerning the values of the site's geomorphology is inaccurate and requires clarification.

Firstly, it should be recognised that similar types of holocene estuarine deposits (classified as 'Vasse Estuarine and Lagoonal System') occur extensively along both sides of the Mandurah Channel, throughout the lower reaches of the Serpentine, Murray and Harvey Rivers, and elsewhere around the shores of Peel-Harvey Estuary, Leschenault Inlet and Wonnerup Inlet (MacArthur & Bettenay, 1974). More recently, Semeniuk & Semeniuk (1990) sub-divided the Peel - Harvey Estuary into twelve sub-classes of shore types on the basis of soils and stratigraphy. Area 2A is classified by this work as 'Stranded Channel Shoal Complex'. However this sub-class occurs as a portion of a larger zone and does not 'stand alone as a representative of its type of shoreline' as stated in the submission.

Secondly, while different geomorphic zones undoubtably have academic interest, whether a geomorphic feature has sufficient importance or 'value' to be considered of conservation significance is questioned from several perspectives. Given that any landform (geomorphology) is effectively a solid reflection of a set of dynamic processes, the predominant values of a geomorphic feature should be related to 1) the usefulness of the feature in providing scientific or educational information about the processes which engendered its formation, and 2) the importance of that information. Landscape and aesthetic values provide a further value for consideration of conservation significance.

With respect to the Area 2A, the modern veneer (topography and soils), as well as the underlying relict formations, have been disturbed and modified over the majority of the site. Therefore, its value as an intact 'representative of its shoreline type' and its usefulness in providing information is reduced (1). Notwithstanding this, if it is accepted that some useful geomorphological information could occur at depth, it should also be recognised that the proposed development will merely result in the land portions being filled by 2m. Therefore, the existing stratigraphic record will be preserved and protected over a substantial area of the site.

With respect to the importance of the information contained within the geomorphic record (2), the reference to the site containing Rockingham type sea level curves of significance is also misleading. All holocene deposits offer some record of sea level curves. The holocene sedimentary system of the Rockingham-Becher Plain, which has recognised international significance for its wealth of natural history information, is the Quindalup beachridge and dune system which extends southwards to Mandurah and along the west coast of Halls Head only as a narrow band. It does not occur along the margins of the Mandurah Channel.

The holocene sediments of the Halls Head ridge are of the Spearwood dune system. The surface sediments of the project site are unconsolidated holocene estuarine alluvium and lagoonal deposits of the Vasse system. Neither of these systems is of special geomorphic significance. The entire coastal strip from Geraldton to Dunsborough contains holocene coastal deposits and those of the project site have no special significance with respect to sea level studies.

2.4. Where development is not supported for area 2A, it was recommended the area be purchased by the Local Authority or a Government Department for municipal or conservation purposes.

Response:

The recommendations for purchase of Area 2A by the Local Authority or a Government Department is unrealistic, particularly given the present proposal to cede six hectares of the land as Conservation and Foreshore Reserve, together with over two hectares for Public Open Space, at no cost to the City or Government Department.

A proposal for the purchase of Stage 2A by Council or Government for development of the municipal purposes is contrary to the City of Mandurah's desire to secure Crown land for further development of municipal facilities at no cost to Council. Furthermore, Council is currently preparing for sale of its five hectare landholding within Stage 2A of the development area. There is no proposal for the purchase of private landholdings from within tourist and future urban zonings to development municipal facilities, and the high value of this landholding under its tourist zoning makes this option extremely unrealistic.

Furthermore, the submission does not consider the cost of on-going management. Under the present proposal, the developer will fund the development and implementation of a management plan which includes the adjacent System 6 area, with longer term management funded by adjusted rates on the canal estate residents.

3. CONSERVATION AND FORESHORE RESERVE AND MANAGEMENT PLAN

3.1. The foreshore reserve should be based on an ecological line rather than an arbitrary width, in keeping with PIMA policy.

Response:

The proposed boundary of the Conservation and Foreshore Reserve is based on an ecological boundary and is fully consistent with PIMA policy. As described in Section 4.2.1 of the PER, the Reserve will include all areas identified as having high or very high waterbird habitat value and all areas of regularly inundated samphire (identified as having moderate habitat value). A comparison of Figures 7 and 8 with Figure 14 in the PER clearly demonstrates the ecological basis to the Reserve boundary.

The proposed Foreshore Reserve of 75-100m width includes a 25m buffer zone beyond the ecologically derived boundary. The buffer is included to enable the development of a sensitive and natural interface between the conservation habitat and the boundary canal. It will be landscaped and rehabilitated to create additional high-usage waterbird habitat, as detailed in Section 4.2.1 of the PER.

3.2. The overall design of the proposed reserve should ensure that any loss of value to waterbirds is entirely compensated for by the creation of new habitats, rehabilitation of habitats and improved management arrangements (eg fences). The management plan should include a vegetation planting strategy for the revegetation of the area following development and include the public open space (POS) provided for the Interpretive Centre adjacent to the reserve, and details of the operation and construction of the Interpretive Centre.

Response:

This is proposed.

Firstly, the Conservation and Foreshore Reserve will conserve and protect all areas having high waterbird habitat value and all wet samphire areas identified as having moderate habitat value. Section 7.3.1 of the PER describes the measures that will be implemented to protect the conservation area during site preparation and construction.

Secondly, as described in Section 4.2.1 of the PER, the additional 25m interface area of the Reserve will be landscaped to replicate specific waterbird habitat types with a mix of the following landforms:

- Over most of its length, the interface area will be formed to create a gently shelving (approximate slope = 1:80) intertidal flat between the existing samphire flat (at approximately mean high high water) and the edge of the boundary canal at mean low low water). This feature will replicate waterbird habitat types 3 (Tidal Flat), 4 (Bare Shoreline), and 7 (Regularly Inundated Samphire).

- A central upland sector containing *Casuarina obesa* trees will be retained and planted with *Juncus krausii* (rush) to create a supratidal island which will function as a refuge for secretive species and a roosting area for other waterbirds during flood tides - Habitat Type 9 (Open Woodland) and 10 (Seasonal Swamp/sedgeland).

- Scattered, emergent limestone boulders will be incorporated into the design, to provide roosting habitat and refuge during flood tides - Habitat Type 5 (Perches).

Thirdly, it is proposed that the Conservation and Foreshore Reserve Management Plan will include rehabilitation and revegetation elements as appropriate. As detailed in Section 7.2.1 of the PER, the Plan will include the following:

- methods and design of foreshore protection;
- landscape and rehabilitation design and implementation;
- public access and information facilities;
- waterbird monitoring;

- mosquito management; and
- management responsibility.

The only habitat which will not be replaced or rehabilitated will be the 'dry' or seasonally inundated samphire area. This is due to its high mosquito breeding potential and low significance to waterbirds. For example, studies conducted by the Waterways Commission (1990) indicate that this habitat is utilised by the lowest number of species and the lowest proportion of individuals than any other habitat in the Peel-Harvey system. It is not a preferred habitat for any species and is only used opportunistically on the site during rare peak flood events.

Rehabilitation and revegetation is proposed both for the 25m interface (which will be a modified landscape) and for areas of degraded habitat elsewhere in the Reserve. This work will be defined in detail in the Conservation and Foreshore Reserve Management Plan, to be prepared by EMPL in consultation with CALM and PIMA prior to construction.

Fourthly, active management of the Conservation and Foreshore Reserve following construction, together with the provision of the vermin proof fence and the boundary canal to separate the Reserve from the development area, will maintain and enhance the habitat values within the Reserve.

Finally, the Conservation and Foreshore Reserve Management Plan will also include planning and management of the POS comprising the Interpretive Facility, which is part of the proposed Reserve (refer to Figure 16 of the PER).

Specific commitments in the PER pertaining to this matter are as follow:

3. *The project design will incorporate the provision and establishment of a Conservation and Foreshore Reserve meeting the objectives and specifications outlined in Section 4.2.1 of the PER, including a minimum Foreshore Reserve width of 50m and an additional 25m buffer zone, so as to provide for conservation management of all areas identified in the PER as having high or very high waterbird habitat and all areas of wet samphire with moderate waterbird habitat value. This commitment will be accomplished to the satisfaction of the EPA upon advice from DEP, CALM and PIMA.*

4. *The proposed Conservation and Foreshore Reserve will be buffered from the proposed development by a 50m wide boundary canal.*

5. *The Stage 2A proposal will include an area of Public Open Space located in the south eastern corner of the project area, to augment the existing Foreshore Reserve and to be developed and managed for conservation interpretation and public appreciation of waterbird species and habitats. This commitment is to be accomplished to the satisfaction of the EPA upon advice from DEP, CALM and PIMA.*

6. *A Conservation and Foreshore Reserve Management Plan defining the detailed design and management prescriptions for the Reserve will be prepared by EMPL in consultation with DEP, CALM and PIMA, to the satisfaction of the Minister for the Environment. The Plan will be consistent with the objectives proposed for the Reserve in this PER and will include arrangements whereby EMPL will construct and establish the Reserve facilities during construction of the Stage 2A Canal Estate then shall cede its property within the Reserve for ongoing management by CALM.*

16. *EMPL will incorporate environmental conditions including those outlined in Section 7.3.1 into the Construction Contracts to provide for protection of the conservation areas, to the satisfaction of the DEP. In particular, EMPL will ensure that, during construction of Stage 2A, construction contractors do not encroach upon any areas of the Conservation and Foreshore Reserve which are recognised as important waterbird habitat.*

17. *During construction of Stage 2A, EMPL will develop the Conservation and Foreshore Reserve and Conservation Interpretation Facility consistent with the objectives and scope of the Conservation and Foreshore Reserve Management Plan, and will enter into an agreement with CALM for vesting and ongoing management of the Reserve. This commitment will be accomplished to the satisfaction of the Minister for the Environment upon advice from DEP, CALM and PIMA.*

3.3. The lack of coordination in the provision of educational/interpretive facilities and viewing areas in the Inlet was raised. It was suggested that the proponent keep this in mind when developing the Conservation and Foreshore Reserve management plan. Whether the proponent develops the facilities, or the funds are paid into a trust managed specifically for interpretive facilities by the vested authority should remain optional, and be further explored.

Response:

EMPL is committed to establishing and providing for appropriate ongoing management of the Conservation and Foreshore Reserve (which includes the Interpretive Facility), as described in the PER (see Proponent's Commitments No. 5 and 6 listed in Response 3.2). The proposed Interpretive Facility is an important element of the conservation management strategy, due to its role in increasing public awareness and appreciation of the conservation values that are being protected. As stated in the PER and the commitments, EMPL will consult with PIMA and CALM to ensure that the facilities proposed for the Interpretive Facility are consistent and co-ordinate with similar facilities elsewhere in the Inlet. However, EMPL does not consider it appropriate for the costs of establishing the facilities to be directed elsewhere than its own landholding.

3.4. The proposed plan needs to be clear on who will manage the reserve.

Response:

It is proposed that the Reserve and its associated facilities will be established by EMPL then vested in the National Parks and Nature Conservation Authority (NPNCA) and managed by CALM. CALM has confirmed that this is appropriate.

EMPL's commitment in this regard is as follows:

> 6. *A Conservation and Foreshore Reserve Management Plan defining the detailed design and management prescriptions for the Reserve will be prepared by EMPL in consultation with DEP, CALM and PIMA, to the satisfaction of the Minister for the Environment. The Plan will be consistent with the objectives proposed for the Reserve in this PER and will include arrangements whereby EMPL will construct and establish the Reserve facilities during construction of the Stage 2A Canal Estate then shall cede its property within the Reserve for ongoing management by CALM.*

3.5. Adequate funding should be provided in trust to cover the cost of ongoing management. Direct funding by the developer, and a contribution through rates or some form of levy was suggested as a means for funding.

Response:

The proponent is committed to the management of the canal waterways system for a period of five years, in accordance with the City of Mandurah's draft Waterways Management Guidelines.

Section 7.4.1 of the PER states that the proponent will implement the Conservation and Foreshore Reserve Management Plan as described in Section 7.2.1 until vesting of the reserve, which is expected to be with the NPNCA.

The proponent is therefore committed to the establishment and on-going management of all vermin proof fencing as described in the PER, the environmental interpretive facility and appropriate walking trails, boardwalks, bird hides and fencing to control public access within the conservation and foreshore reserve areas.

The Conservation and Foreshore Reserve Management Plan will include provision for appropriate waterbird monitoring programs, mosquito breeding controls, water and sediment quality monitoring programs and other appropriate details as agreed in the Management Plan, to be established in consultation with PIMA, CALM, DEP for the final approval by the Minister for the Environment.

The proponent's commitments in this regard include the following:

3. *The project design will incorporate the provision and establishment of a Conservation and Foreshore Reserve meeting the objectives and specifications outlined in Section 4.2.1 of the PER, including a minimum Foreshore Reserve width of 50m and an additional 25m buffer zone, so as to provide for conservation management of all areas identified in the PER as having high or very high waterbird habitat and all areas of wet samphire with moderate waterbird habitat value. This commitment will be accomplished to the satisfaction of the EPA upon advice from DEP, CALM and PIMA.*

6. *A 'Conservation and Foreshore Reserve Management Plan defining the detailed design and management prescriptions for the Reserve will be prepared by EMPL in consultation with DEP, CALM and PIMA, to the satisfaction of the Minister for the Environment. The Plan will be consistent with the objectives proposed for the Reserve in this PER and will include arrangements whereby EMPL will construct and establish the Reserve facilities during construction of the Stage 2A Canal Estate then shall cede its property within the Reserve for ongoing management by CALM.*

17. *During construction of Stage 2A, EMPL will develop the Conservation and Foreshore Reserve and Conservation Interpretation Facility consistent with the objectives and scope of the Conservation and Foreshore Reserve Management Plan, and will enter into an agreement with CALM for vesting and ongoing management of the Reserve. This commitment will be accomplished to the satisfaction of the Minister for the Environment upon advice from DEP, CALM and PIMA.*

27. *For the initial five years following construction of Stage 2A then subject to the agreement with the City of Mandurah, EMPL will annually monitor the shoreline and nearshore shoal in the vicinity of the Stage 2 entrance channel, to the satisfaction of the DEP on advice from CALM and PIMA. In the unlikely event that sediment erosion or accretion associated with the development causes significant adverse impact upon the Conservation and*

Foreshore Reserve, then the Waterways Manager will prepare and implement a management response to the satisfaction of EPA upon advice from CALM and PIMA.

Funding for the establishment and ongoing management of the Conservation and Foreshore Reserve will be agreed as part of the Management Plan. Funds will not be provided in trust, as the proponent will provide management funding on an annual basis. Contribution to management through rates has already been established in Port Mandurah Stage 1 by the City of Mandurah. It would be appropriate that specific area rating for Port Mandurah Stage 2 be applied coincident with Council assuming responsibility for waterways management, at the expiration of the five year term of management by the proponent.

3.6. The issue of a contingent fund for unpredicted liabilities, such as erosion and accretion, was raised. It was suggested that the proponent establish a bank guarantee in favour of the Minister for the Environment, for adequate funds to address any such contingent liability and that this be held for a medium term period (10 years).

Response:

Contingent funds for unpredicted liabilities were provided for a five year period in Port Mandurah Stage 1. At the handover and completion of all remedial works between the proponent and the City of Mandurah, there was no requirement for any drawdown on the contingent funds, due to the fact that the proponent has, through a detailed construction and engineering program, fully addressed all maintenance items required by the City of Mandurah before handover of the canal system to the City of Mandurah.

It has never been intended that contingent liability funding would be put in trust. However if the City of Mandurah's requirements extend to contingency funds, these can be negotiated at the time of subdivision approval with the City of Mandurah, who will be the ultimate Waterways Manager. There has never been any management role assumed by the Minister for the Environment or the State Government.

3.7. Details of the proposed low profile, permeable bund of limestone boulders, and assessment of the potential impact of flushing of the conservation areas should be submitted to PIMA for approval.

Response:

This is proposed in Section 4.2.1 of the PER, which provides that foreshore protection design specifications will be determined in consultation with CALM, PIMA and DEP so as to maintain the Reserve's natural attractiveness and enhance its ecological function, whilst also securing adequate foreshore stability and discouraging vessel encroachment upon waterbird habitat. Following approval of the proposal canal estate development and prior to its construction, EMPL will prepare a Conservation and Foreshore Management Plan to the satisfaction of the Minister for the Environment upon advice from CALM, PIMA and DEP (Proponent's Commitment No. 6). As detailed in both Section 4.2.1 and Section 7.2.1 of the PER, this Plan will include detailed design and management prescriptions for the boundary canal revetment.

4. OUTLINE DEVELOPMENT PLAN

4.1. The Outline Development Plan (ODP) was criticised on a number of issues :

- **a clear identification of the existing System 6 and conservation / foreshore resources, as distinct from the 6ha of land which the proponent proposes to cede for conservation / foreshore reserve purposes, should be illustrated;**

- **existing dry or partially inundated land as distinct from submerged shoals needs to be identified; and**

- **the ODP does not show any jetty envelopes - are they intended and if so where?**

Response:

Figure 16 of the PER clearly delineates the following:

- The 14.9ha of the proposed Conservation and Foreshore Reserve which comprises the area recommended for conservation by the System 6 Report (diagonal hatching).

- The 23.9ha comprising the total Conservation and Foreshore Reserve (shaded with black boundary).

Figure A attached hereto further delineates the property boundary and the component areas of the Reserve, as follows:

- Approximately 5.2ha contained within the north-eastern part of property which will be ceded for conservation and management of waterbird habitat.

- Approximately 0.84ha of elevated woodland contained within the south-eastern corner of the property, which will be established as public open space and ceded as part of an Interpretive Facility for public access and appreciation of waterbird habitat within the Conservation and Foreshore Reserve.

- Approximately 16.92ha of intertidal and shallow subtidal land that is contiguous with the property, which will be integrated within the Conservation and Foreshore Reserve for conservation and management of waterbirds and their habitat.

- Approximately 0.94ha of elevated woodland that is contiguous with the south-eastern corner of the property, which will be integrated within the proposed Interpretive Facility.

Figure A also delineates the following areas within the Conservation and Foreshore Reserve:

- Dry upland areas;
- Regularly inundated samphire; and
- Intertidal shoal.

Jetty envelopes are proposed within the canals and will be included on the subdivision plan.

5. FAUNA

5.1. Concern was expressed about bias towards waterbirds and the dismissal of terrestrial fauna values.

Response:

The perceived bias towards waterbirds reflects the actual nature of the conservation values of the site. The main conservation issue is waterbirds and their habitats.

Terrestrial fauna were not dismissed in the PER, rather the site has very low habitat values for terrestrial fauna. As explained in detail in Appendix F and summarised in Section 3.2.2 of the PER, virtually all upland habitats within the site have been severely impacted by marl pit excavations, constructed levee banks, tracks, weed invasion, clearing and the long-term impacts of cattle, sheep and horses. This high level of degradation was a primary motive for evaluating them as poor quality fauna habitats, and this was supported by the results of specific terrestrial fauna investigations by A.R. Bamford and Ninox Wildlife Consulting (Appendix F).

5.2. It was considered that the conservation values assigned to waterbird habitats were misleading, particularly those areas assigned lower values. Specifically the assessment of habitat 9 (open woodland) as 'low value' was questioned in two submissions. It was stated in the PER that this area provides habitat - becoming increasingly rare in the metropolitan area - to the Splendid Wren. In view of this, Ninox Consultant's evaluation methodology for surveying and rating habitat values was requested to be made available for review of members of the public.

Response:

As described in Sections 3.2.2 and 3.3.2 of the PER, the value of the project site and the adjacent estuarine environment was assessed for its significance as fauna habitat, particularly waterbirds (refer Response 5.1), by Ninox Wildlife Consultants and E.M. Goble-Garratt & Associates, with further fauna investigations conducted by M.J. and A.R. Bamford and Ninox Wildlife Consultants. Each of these investigators is a highly respected, independent scientific authority in their respective discipline and each has very extensive experience in assessing habitat conservation values on the Swan Coastal Plain.

The methodology used to determine the significance of each habitat is based on the regional and site-specific observed use of each habitat unit by fauna. Clearly, the greater the number of species, the greater the number of total individuals, and the higher the frequency of use of each habitat, the higher the significance to fauna. This is an accepted and unambiguous methodology. The relative scarcity of the habitat in relation to its significance to fauna, as well as the conservation status of particular species and their habitat requirements, were also considered and discussed in the PER.

The statement in the fauna report referring to the Splendid Fairy-Wren unambiguously discusses the fact that its habitat, even though significantly disturbed from stock, vehicle tracks and week invasion, still has conservation value for passerine (perching) birds (the habitat has low significance for waterbirds). The value of this area of woodland is fully recognised in the PER (Section 3.2.2), and consequently a significant portion has been retained as Public Open Space (PER Section 4.2.3), with the open woodland in the south-east of the site being included in the Conservation and Foreshore Reserve (PER Section 4.2.1).

The connection between the Splendid Fairy-Wren (open woodland habitat) and the criticism of the evaluation methodology used by Ninox Wildlife Consulting for waterbird habitat values is not immediately apparent. However for the sake of clarity, the evaluation methodology is further detailed in the following.

Ninox Wildlife and their specialised sub-consultants assessed the project area nine times between November, 1988 and December, 1989 and on two occasions in January, 1995. Consequently, they are very familiar with the project area and its conservation status, particularly with reference to waterbirds and their habitats. Upland habitats were superficially assessed in 1988-89 for the Mosquito Control Review Committee and evaluated in more detail in January 1995. Ninox Wildlife Consulting are respected as the principle non-government authority in waterbird usage in the Peel-Harvey estuarine system.

The submission regarding the evaluation methodology used by Ninox Wildlife Consulting appears to refer mainly to Habitat 9 - Open Woodland, therefore the techniques used in upland habitat evaluation are described below:

- Wetland habitats cannot be assessed in isolation, therefore upland sites which provide roosting, nesting and refuge areas were considered, not only in the 1988-89, but in the 1995 surveys.

- All habitats, whether wetland or upland, were assessed in conjunction with an experienced botanist.

- Both the botanist and Ninox agreed that all upland habitats were degraded through the combined effect of marl pit excavations, drainage, tracks, weed invasion, clearing and the long-term impact of cattle and sheep.

- Habitat 9, the open woodland, while not as degraded as some communities, was assessed as being too small and too close to pre-existing development for there to be an opportunity to adequately conserve a representative proportion of its original fauna, even if totally protected by vermin-proof fences and other conservation measures. However, its remaining value was recognised and the major portion of the woodland has accordingly been retained as Public Open Space.

6. VEGETATION

6.1. The mitigation of 'less valuable' habitat lost elsewhere (non reserve) in the development area needs further description. Specifically how do the areas of lost habitats versus created habitats compare for each habitat type and habitat value? How do the species and numbers of water birds supported by lost and created habitats compare?

Response:

Habitat loss due to the Stage 2 development is essentially limited to the central portions of the Stage 2A area. This area is beyond the regularly inundated estuary periphery where the highest waterbird species richness and abundance occurs. Figure 12 in the PER clearly illustrates this for waterbird abundance. In terms of species richness, of the 36 waterbird species known from the site, only five main species are likely to regularly venture into the primarily upland habitats of the central portions of the Stage 2A area in any numbers, and then only in low numbers.

Based on data collected by Ninox Wildlife and their specialist subconsultants to assess waterbird usage of Peel Inlet during the period from October, 1988 to December, 1989, only 23% (14) of all waterbird species visit inland seasonally inundated areas (Table1). Of those species, only 0.7% (114) individuals were observed in inland habitat over the entire year of data collection. Of the species which have been observed on the Stage 2 site, the proportions of usage of seasonally inundated upland areas are Darter (1.7%); White-faced Heron (3.3%), Great Egret (1.1%); Black Swan (1.8%) and the Black-winged Stilt (1.4%). Use of the "dry" samphire by each of these species would be limited to their opportunistically taking advantage of temporary pools and rare peak flood events.

Yellow-billed Spoonbills have been reported as observed in the area, however the monitoring data indicate that this occurrence is very infrequent: Spoonbills were not recorded within dry samphire areas throughout the monitoring period.

The seasonally inundated samphire is not a significant habitat for any of the forementioned species.

The complete summary data of waterbird utilisation ('percentage of species' count and individual count for each species) of inland samphire flats within Peel Inlet between October 1988 and December 1989 is presented in Table 1.

Table 1: Waterbird utilisation of inland samphire flats surrounding Peel Inlet (Based on observations in Peel Inlet from October 1988 to December 1989)

Species	Total number observed	Number observed in inland seasonally inundated habitat	% of total
Darter*	171	3	1.7
White-faced Heron*	662	22	3.3
Great Egret*	340	4	1.1
Black Swan*	489	9	1.8
Australian Shelduck*	3113	6	0.2
Pacific Black Duck*	1920	2	0.1
Grey Teal*	4240	15	0.4
Whistling Kite	25	1	4
Marsh Harrier	8	1	12.5
Red Capped Plover	287	22	7.6
Black Winged Stilt*	1503	21	1.4
Greenshank *	987	3	0.3
Red Necked Stint*	261	4	1.5
Silver Gull*	2298	1	0.04
Total for species using inland habitat	**16,309**	**114**	**0.7**
All species	**26,758**		**0.4**

*Occurring at Port Mandurah Stage 2

Species covered by international agreements are extremely poorly represented in the central portions of the Stage 2A area because of the lack of productive, regularly inundated feeding areas.

Construction of the canals with their permanent water, regularly inundated intertidal flats in the buffer zone, limestone perches and the supratidal island (as fully described on pages 51 and 52 of the PER) will inevitably raise waterbird species richness and abundance well above the currently low levels in the central portions of the Stage 2A area. The created habitat should more than compensate for lost habitat. Any attempt (as suggested in the submission) to develop an accurate analysis or balance sheet of species richness and abundance between lost and created habitat would be speculative at best, and therefore open to subjective interpretation rather than scientific analysis. However the main issue, and one that is beyond question, is that increasing wetland habitat diversity will have a similar effect on waterbird diversity.

Further, the ongoing management and protection of valuable existing and created habitat within the proposed Conservation and Foreshore Reserve is itself a mitigative measure.

6.2. Remnant vegetation in Stage 2B was not considered to be mapped adequately.

Response:

As described in Section 3.2.1 of the PER, the Stage 2B area (west of Old Coast Road) consists of cleared pasture containing a mix of exotic and perennial grasses under occasional scattered Flooded Gums (*Eucalyptus rudis*).

The primary objective of habitat mapping was to allow assessment and description of conservation values, not to provide a comprehensive flora and vegetation map showing the disposition and content of all plant communities. By any ecological criterion, the entire Stage 2B area has very low conservation value.

Notwithstanding the foregoing, the aesthetic and cultural value of remaining individual trees and stands of trees was recognised during project planning, and a large proportion of them will be preserved. Significant individual trees and stands within the area of POS in the north-western corner of Stage 2B, and in the Sutton Farm heritage precinct, and along the western boundary of Stage 2B, will all be retained.

7. DUST

7.1. The proponent should state explicitly that they will use fresh water only for dust suppression during construction.

Response:

EMPL reiterates its commitment in this regard is as follows:

> *18. Dust emissions from the project area during construction activities will be managed and monitored in compliance with the EPA's Guidelines for Assessment and Control of Dust and Windborne Material from Land Development Sites, to the satisfaction of the City of Mandurah.*

It is proposed that water used for dust suppression during construction would be drawn from the dewatering settlement pond. This water will be fresh or, at worst, slightly brackish. Saline water which may leave a salt residue, with subsequent difficulties in site revegetation and landscaping, would be avoided. Estuarine water will not be used under any circumstances.

8. MOSQUITO MANAGEMENT

8.1. Two submissions considered the benefit of removing mosquito habitat was over-exaggerated to the loss of the bird or vegetation habitat. It was noted that the areas where mosquitos breed and grow are also generally good bird habitat.

Response:

It is certainly accepted that areas particularly attractive to mosquitoes may often be also attractive to waterbirds. However, much of the central portion of the Stage 2A project area has been highly modified by marl pits and bunds such that the original tidal flushing does not occur. The end result is many small, temporary pools which rapidly stagnate, for example in Habitat 8 (Appendix F, p9) which consists of mostly seasonally inundated samphire in poor condition. These stagnant locations are prime mosquito breeding areas

and show opportunistic, but rarely significant, waterbird usage over the period during which standing water persists, and have little value as vegetation or waterbird habitat. The lack of emphasis regarding loss of bird or vegetation habitat as stated is a true reflection of degraded state and low significance of the area in question.

The relationship between waterbirds and natural mosquito breeding areas has to be viewed in the context that most of the larger mosquito breeding areas around Peel Inlet are a direct result of historical human intervention which occurred before any detailed environmental review process was in place. Most mosquito breeding sites in the project area have been formed through the interruption of drainage patterns. The resulting temporary pools are used by very few species of waterbirds and only on rare occasions.

The emphasis on removing high mosquito breeding habitat was specifically for the purpose of highlighting the public health risk and the increasing incidence of Ross River Virus which is transmitted by mosquitos. At present, the management of mosquito breeding areas on the site consists of spraying with insecticides, which may in turn be detrimental to waterbird breeding. The removal of this mosquito breeding habitat will be of benefit to the public, of potential benefit to waterbirds with respect to reduction in insecticide levels in the environment, and of only minor impact to waterbirds with respect to loss of limited feeding area.

8.2. One of the species of mosquito mentioned in the report is not known to be a major vector yet in the South West, and is therefore not a public health risk as stated in the report.

Response:

The PER does not state that both species of mosquitos are a public health risk as indicated, however this may be implied from the wording of the paragraph, hence the correction is acknowledged. Both *Aedes camptorhyncus* and *Ae. vigilax* are nuisance biting mosquitos. In other parts of Australia both *Aedes camptorhyncus* and *Ae. vigilax* are major vectors of polyarthritis (Ross River virus). Although both species breed in estuarine conditions in South Western Australia and have been recorded from the site, *Ae. vigilax* occurs in lower numbers and has a restricted breeding season. Therefore, only *Ae. camptorhyncus* is currently considered to be the major public health risk.

8.3. If the mosquitos are of a significant nuisance alternative management other than infill, as proposed in the PER, can be considered.

Response:

As stated in Section 3.4 of the PER, the City of Mandurah and the W.A. Health Department currently monitor the project site on a fortnightly basis and conduct aerial spraying using ABATE larvicide when large larval numbers are recorded. Alternative management such as filling the depressions and improving site drainage may reduce mosquito breeding, however this management alternative has not been conducted by the above authorities, and would require significant public funding which has not been available to date.

9. CANAL ENTRANCE

9.1. It is of concern that the entrance channel will affect the System 6 area by removing some of the land within this reserve. The discussion concerning the loss of waterbird habitat and habitat value caused by the construction of the entrance channel could be better addressed. Can the entrance channel be redesigned to avoid carving up this area?

Response:

As described in Section 5.4.2 of the PER, the entrance channel will dissect the northernmost area of the System 6 area and subtidal shoal, which is one of the areas of high waterbird usage. This issue was addressed early in the design phase, with the current design minimising impact in that the entrance channel is located as far north as possible. While this will obviously result in some loss of feeding area for waterbirds, the area involved is relatively small and the loss will be mitigated by the creation of new tidal flats within the boundary canal/Conservation and Foreshore Reserve interface.

With reference to Figure 14 compared with Figures 7 and 8 in the PER and Appendix F of the Technical Appendices, the proposed entrance channel location represents the best achievable balance between conservation and development for the following reasons:

- the area of samphire at the northern limits of the project area, through which the entrance channel will run, is already highly degraded;
- the current route minimises the potential disturbance of waterbirds in the tidal lagoon through its location at the extreme northern limits of the project area;
- the alternative placement of the entrance channel through the existing gap between the tidal flat and large samphire island and running it north through the tidal lagoon has the potential to result in far greater impact;
- additional protection to the lagoon area between the samphire island and the shore will be afforded by limiting boat access with a limestone revetment wall and strategically placed boulders.

PIMA has acknowledged the proposed location for the entrance channel as being appropriate and has no objection to it.

9.2. Breach of the entrance channel in the construction phase should occur on an ebb tide.

Response:

As described in Section 5.4.1 of the PER, dredging of the entrance channel will be managed in consultation with PIMA and will conform with PIMA Dredging Policy WS4.1. Section 4.4.4 of the PER proposes that the timing of the final connection to Mandurah Channel will be controlled in consultation with PIMA in recognition of the need to manage turbid water escape to the estuary.

EMPL acknowledges this requirement of PIMA and will make it part of the dredging contract specifications that the final opening to the Mandurah Channel be carried out on an ebb tide.

9.3. Foreshore stability, adjacent to the new entrance channel, should be included in monitoring provisions with strategies in place for the management of any accretion or erosion.

Response:

This is recognised in Section 6.3 and proposed in Section 7.4.5 of the PER. The relevant commitment is as follows:

> 27. *For the initial five years following construction of Stage 2A then subject to the agreement with the City of Mandurah, EMPL will annually monitor the shoreline and nearshore shoal in the vicinity of the Stage 2 entrance channel, to the satisfaction of the DEP on advice from CALM and PIMA. In the unlikely event that sediment erosion or accretion associated with the development causes significant adverse impact upon the Conservation and Foreshore Reserve, then the Waterways Manager will prepare and implement a management response to the satisfaction of EPA upon advice from CALM and PIMA.*

10. GROUNDWATER HYDROLOGY

10.1. Concern was expressed about the use of a single transect as the basis for the groundwater hydrology study over the subject land (the southern portion of area 2A and the entire portion of 2B). It was considered that the hydrology of these southern areas, which contain the most sensitive conservation areas and are prone to degradation during dewatering, could not be understood from the data derived from the single transect.

Response:

The transect shown in Figure 3 of the PER was compiled using the bore data from 5 bores in an east-west line (Figures 4 and 5). These bores form part of a series of over 20 bores over the entire Port Mandurah project area that provided data for the preparation of Appendix D of the PER. The transect is believed to be a reasonable representation of the conditions across the site, including Stages 2A and 2B.

As stated in Section 1.2 of Appendix D, data relevant to the groundwater hydrology study were derived from hydrogeological and environmental studies prepared for previous Environmental Review and Management Programs and Notices of Intent for the region, and from reports, maps and borehole information held by the Geological Survey Division of the Department of Minerals and Energy. Electric friction cone penetrometer test data collected for the development area in February and March, 1995 were also examined.

Water level and water quality data were available to the study from 1987-88, 1991 and 1993 from 25 monitoring sites.

Bore ED4 quoted in the PER (Figures 1-4, Appendix D) is in a similar location and general proximity to the Mandurah Estuary as much of Stage 2A. The data from ED4 shows that the groundwater quality under this area is similar to seawater (PER Figure 6). The effects of dewatering on groundwater quality are therefore likely to be nil or minimal. Saline groundwater is likely to be present over much of Stage 2A, particularly near the Estuary.

10.2. The location of monitoring bores does not give adequate information on groundwater flows in Stage 2A, where most of the conservation potential of the development is located.

Response:

The data available for the interpretation of the conditions on Stage 2A (refer to Response 10.1) are believed to be adequate for the purposes of describing the groundwater hydrology and assessing the potential development impacts. Coincident with project development, additional groundwater monitoring boreholes within Stage 2A are planned, as indicated in Appendix D of the PER.

11. DEWATERING

11.1. The proponent should include a commitment to ensure that dewatering activities will not affect the existing vegetation, and specifically include provision to restrict approximately 80% of dewatering to winter to avoid stressing remnant vegetation.

Response:

Section 5.3.2 of the PER addresses the potential impacts of dewatering operations upon phreatophytic vegetation and trees with heritage value. In Section 7.3.4, it is proposed that trees which are proposed to be retained will be monitored and watered if necessary to maintain their viability during the period of watertable drawdown.

EMPL's specific commitment to ensuring that dewatering activities do not affect the phreatophytic and heritage trees is as follows:

> *21. The effects of dewatering operations upon trees on the upland areas of the Stage 2A site, those within the adjacent Castle Fun Park, and the trees of heritage significance, will be monitored by EMPL and watered if necessary to maintain their viability during the period of temporary water table drawdown. This commitment will be fulfilled to the satisfaction of the DEP.*

With regard to the additional management responsibilities that would incur if dewatering was required to extend over the summer months, EMPL will expend all reasonable effort to schedule project construction during winter. The current schedule is for excavation of the Port Mandurah Stage 2A canals to occur from May to September, 1996. However, in the event that there are unanticipated delays to project approvals or detailed design, it is considered unreasonable to preclude possible construction during the non-winter months, subject to the commitment to maintain the trees.

11.2. The details of dewatering and dredging activities should be submitted to PIMA for approval and licensing prior to construction activities commencing.

Response:

This is recognised in the proponent's Commitment 21, which provides that "*The discharge of dewatering and dredge spoil water will... be in accordance with PIMA's requirements and published policies.*" The PER specifically references PIMA's Dewatering Policy WS4.2 (Section 5.3.3) and PIMA's Dredging Policy WS4.1 (Section 5.4.1) in this regard.

11.3. The discharge of water into the estuary from the dewatering operation should be monitored in compliance with the Swan River Trust Guidelines, and reports submitted to PIMA on a regular basis for its information.

Response:

As described in Section 4.4.2, reiterated in Sections 5.3.3 and 7.3.3, and included within Commitment 21, the discharge of dewatering and dredge spoil water will be in accordance with PIMA's requirements and published policies. The details of dewatering and dredging activities, including details of proposed monitoring and reporting, will be submitted to PIMA for approval and licensing prior to construction activities commencing.

12. STORMWATER DRAINAGE

12.1. An obvious, shallow drainage channel runs alongside the southern side of Mary Street, past the Shell Service Station and discharges into the Samphire wetland (adjoining the Blue Marina Site), although the PER states there is no surface drainage in the area.

Response:

Section 3.1.3 of the PER correctly states that there is no defined surface drainage on the

development site, save for road runoff from nearby streets in the Halls Head residential estate which is piped under Old Coast Road at the junction of McLarty Road.

The drainage culvert under Old Coast Road on the south side of the Shell Service Station, together with a second culvert under Old Coast Road near the entrance to the Sutton Farm House, both collect ephemeral drainage and discharge it to the Mandurah Marina Site some distance north of the boundary of the Stage 2A project site. The responsibility of handling the discharge from these culverts rests with the owners of the Mandurah Marina Site.

As this site has now been approved for residential and canal development, appropriate drainage designs and strategies will be required to facilitate development. The majority of drainage collected within Stage 2B remains in that portion of the landholding. The significant and obvious drainage channel in the northern to eastern edge of Stage 2B was a temporary dewatering discharge channel used at the end of construction of Port Mandurah Stage 1.

In any event, as soon as Port Mandurah Stage 2B is developed there will no longer be a need for these culverts under Old Coast Road.

12.2. The PER states that stormwater run off was directed into Stage 2A about 6-7 years ago. The proposed fate of this drainage is not addressed nor how it will be managed.

Response:

As stated in Section 4.5.2 of the PER, the road drainage management system proposed therein will encompass all road surfaces within the Canal Estate, together with road runoff from the adjacent Halls Head Estate which is currently collected at the junction of McLarty Road and Old Coast Road and discharged to the site.

See also Response 12.1.

12.3. Stage 2A is located within the Peel-Harvey Coastal Plain Catchment, and is therefore subject to the provisions of the Ministry of Planning Statement of Planning Policy No. 2. Consequently the minimum criteria for the maximisation of the consumption and retention of stormwater drainage on-site should be the retention of a 1 in 10 year event on-site for between 3-4 days (EPA Bulletins 558, 561,563,564 & 565). It was considered that this should also apply to Stage 2B. In complying with this criteria, the proponent has the option of employing any number of the 125 Best Management Practices identified in the Water Sensitive Urban (Residential) Design Guidelines.

Response:

The objective of the policy provisions defined by the Ministry of Planning Statement of Planning Policy No. 2 (SPP No. 2) is to minimise nutrient inputs from rural and residential developments to the Peel-Harvey Coastal Plain Catchment. To achieve this objective, the SPP No. 2 requires that subdivision proposals should make provision for a system which maximises the consumption and retention of drainage on site. The Policy (Clause 5) specifically allows for flexibility in the interpretation of its planning controls, provided projects are designed to significantly reduce nutrient flows to the estuary.

The criterion for stormwater retention of a 1 in 10 year event on-site for 3 - 4 days quoted in the submission is not specified in SPP No. 2, but has been used by the EPA as an interim criterion for drainage design for rural and residential developments, subject to a requirement for further investigation of this issue. The EPA Bulletins quoted in the submission confirm the objective of the drainage design as minimising the export of nutrients from the site.

The proposed nutrient and drainage management design for Port Mandurah Stage 2 is described in Section 4.5 of the PER and is fully consistent with the objective of minimising nutrient inputs to the estuary. In summary, the design provides for the segregation of irrigation and stormwater runoff and seepage to the canal into the following elements:

- Rainwater runoff from the roof will discharge directly into the canals.

- Rainwater and irrigation water from landscaped and paved areas within residential blocks will be directed to soakwells and will only enter the canals by subsurface seepage and soil adsorption of nutrients as well as geotextile filter cloth and strip drain filters at the rear of canal wall panels.

- Road drainage will be directed to the canals via silt trapping and grease baffle devices to minimise the discharge of soil sorbed contaminants.

The stormwater drainage management design that is described in Section 4.5 of the PER will ensure that the entry of nutrients and other contaminants to the canals and adjacent estuary will be minimal. The Port Mandurah Stage 2 proposal incorporates the same high standards of environmental design criteria as Stage 1, subject to minor modification where experience has shown to be appropriate to secure improved environmental performance. Monitoring data for the Port Mandurah Stage 1 canals and the nearby Waterside Mandurah canals have shown that appropriate canal estate design and management as proposed in the PER can minimise nutrient losses from the estate.

The report Planning and Management Guidelines for Water Sensitive Urban (Residential) Design (Whelans *et al.*, 1994) aims to encourage the application of stormwater management systems that minimise the rate, volume and pollutant load of stormwater leaving residential areas. The Guidelines include 58 Best Management Practices aimed to promote water balance, to maintain and enhance water quality, and to promote water conservation.

Subject to the engineering and economic practicalities of developing the project site, the nutrient and drainage management design proposed for Port Mandurah Stage 2 is fully consistent with the water quality objectives of Water Sensitive Design. Appropriate Best Management Practices are incorporated into the proposed design.

The criterion for on-site retention of a 1 in 10 year storm event is not practical for a canal estate development. Whilst the SPP No. 2 does not specify 3 - 4 days detention, it does require provision for a drainage system which maximises the consumption and retention of drainage on-site. The drainage design for Port Mandurah Stage 2 is in accordance with this objective.

12.4. A need for a contingency plan for emergency spills and pollution events during construction was identified. The stormwater drainage system does not seem to take into account the provision of facilities to control accidental spills that may enter the system.

Response:

There is an in-built contingency plan to cater for emergency spills and pollution events during construction, since there will be a detention basin constructed immediately prior to discharge of dewatering water to the estuary. This detention basin will be very large to enable fine suspended solids to settle out prior to water discharge to the estuary. In the event of a major spill, dewatering on-site could cease while a clean up operation of the pollutant from this detention basin was accomplished. In the unlikely event of an accidental spill during construction, no pollutant should reach the estuary.

13. DREDGING

13.1. Dredging operations will be required to comply with a Dredge Spoil Disposal Management Plan and submitted to PIMA.

Response:

This is acknowledged. As stated in Section 2.3.6 of the PER and reiterated in Section 4.4.4, Section 5.4.1 and Section 7.3.3, dredging operations will be managed in consultation with PIMA and will conform with PIMA's requirements and published policies. These policies include the following:

- PIMA Dredging Policy WS4.1.
- PIMA Policy Statement of September, 1994 for the dredging of riverine and estuarine water bodies.
- PIMA Dewatering Policy WS4.2.

14. WATER QUALITY MANAGEMENT AND MONITORING

14.1. The conversion of rural land use to canal estates would not necessarily result in a net reduction in nutrients exported to the Estuary as conveyed by the PER.

Response:

The existing rural use of the land for low intensity grazing is not economically viable, as demonstrated by the low current stocking rate, hand-feeding of stock, and heavy seasonal application of fertilisers. As outlined in Section 2.5.2 of the PER, the development of the land for rural use would require an intensification of its existing use. Intensified rural landuse would likely require considerably increasing nutrient additions to the land. Due to the diffuse drainage that occurs across the site, increased nutrient input would undoubtedly result in loss of nutrients directly to the Mandurah Channel.

In contrast, the Port Mandurah proposal incorporates stringent nutrient and drainage management design precautions (Section 4.5) which will ensure that the entry of nutrients to the canals and adjacent estuary will be minimal. Minimal applications of nutrients, the use of slow release fertilisers and the use of native plant species within future residential gardens will be actively encouraged by EMPL (Section 7.4.3 of the PER). Monitoring data from the Port Mandurah Stage 1 Canal Estate and the nearby Waterside Mandurah canals have shown that these measures can successfully minimise nutrient losses to the canals.

Nutrient losses from appropriately designed and managed residential canal estate developments are significantly less than from most rural land uses.

14.2. The endorsement of PIMA on the final water quality monitoring programme should be a condition of any approval to the programme.

Response:

EMPL's commitment in this regard is that, prior to the commencement of project construction:

> *13. EMPL will prepare a water and sediment quality monitoring program for the canals to the satisfaction of the DEP on advice from PIMA.*

14.3. The monitoring programme should be designed to be consistent with the previous monitoring programme for Stage 1.

Response:

This is acknowledged. Refer to response 14.2.

14.4. The general water quality and sediment monitoring parameters as stated in the PER were considered satisfactory. However, the final sampling regime including the parameters, their measurement in a spatial and temporal sense, and historical compatibility with other canal data needs to be discussed with appropriate input from Department of Environmental Protection, DOT, Office of Catchment Management and PIMA / WWC. Additional parameters such as pH, salinity and copper (frequently a constituent of anti-fouling preparations on boats), should also be included.

Response:

This is acknowledged. Refer to response 14.2.

14.5. The company should agree to make any necessary changes to the canal system if unacceptable monitoring results or inadequate flushing are demonstrated.

Response:

The assessment of canal flushing and water quality described in Section 6.2 and Technical Appendix E of the PER is based and modelled upon experience from Port Mandurah Stage 1. It demonstrates a high rate of flushing and supports a very high degree of confidence that water quality in the canals would not deteriorate.

In the unlikely event that unacceptable monitoring results or inadequate flushing are demonstrated, EMPL as Waterways Manager would first need to assess the cause of the unanticipated problem and to identify solutions. This would be undertaken in consultation with DEP, PIMA, Department of Transport and the City of Mandurah. If silting of the entrance channel or elsewhere had reduced flushing efficiency, maintenance dredging would be implemented. If augmentation of flushing was required, EMPL would undertake any necessary works after agreeing any improvements and changes with DEP, PIMA and Mandurah Council.

However, it is emphasised that there is negligible risk of inadequate flushing and that the likelihood of requiring a contingent response is considered remote.

EMPL's management obligations and commitments in this regard are firmly established within State Planning Commission Policy DC1.8 (PER Section 2.3.3), the City of Mandurah's Draft Waterways Management Policy (PER Section 2.3.4), and Town Planning Scheme No. 3 (PER Section 2.3.2). The proponent additionally reiterates the following commitments:

1. *The Canal Estate will comply with the provisions of the State Planning Commission's Policy DC1.8, Procedures for Approval of Artificial Waterways and Canal Estates, to the satisfaction of DPUD on advice from DEP, PIMA, the Department of Transport and the City of Mandurah.*

2. *The design, construction and management of the Canal Estate will be in accordance with the requirements for canal zoning defined by the proposed City of Mandurah Town Planning Scheme No. 3, and with the City of Mandurah's Draft Waterways Management Policy, to the satisfaction of the City of Mandurah.*

26. *For the initial five years following construction then subject to the agreement with the City of Mandurah, EMPL will annually monitor the depths of the canals and the entrance channel to ensure the maintenance of adequate flushing and safe navigable depths, to the satisfaction of the EPA and Department of Transport. If and when required by the Department of Transport or PIMA, EMPL (or the City of Mandurah subject to agreement) will submit plans for dredging and disposal of dredged material to PIMA for approval prior to their implementation.*

28. *For the initial five years following construction and then subject to agreement with the City of Mandurah, EMPL will implement the water and sediment quality monitoring program for the canals, to the satisfaction of the DEP upon advice from the Department of Transport and PIMA.*

14.6. Annual reports should be submitted to PIMA, for review and comment, and to the WAWA. Where significant changes in water quality are detected the Water Authority should be notified immediately.

Response:

EMPL acknowledges and will accommodate the Water Authority's request to be advised of the results of groundwater monitoring described in Sections 7.3.4 and 7.4.2 of the PER. The requirement for the Water Authority to be immediately advised of any significant changes in groundwater levels or quality is also acknowledged.

PIMA's requirement for consultation and advice with respect to the water and sediment quality monitoring program is acknowledged in the PER. EMPL's relevant commitments in this regard are as follows:

> *13. EMPL will prepare a water and sediment quality monitoring program for the canals to the satisfaction of the DEP on advice from PIMA.*
>
> *28. For the initial five years following construction and then subject to agreement with the City of Mandurah, EMPL will implement the water and sediment quality monitoring program for the canals, to the satisfaction of the DEP upon advice from the Department of Transport and PIMA.*

The recent series of water quality reports prepared in the previous 2 years for Port Mandurah Stage 1 have been sent direct to PIMA for its comment and records, therefore the appropriate protocol is currently in place. This reporting protocol will be fomalised in the water and sediment quality monitoring program.

With respect to the requirement for the Water Authority to be advised of any significant changes in groundwater levels or quality, EMPL's Commitment 25 is revised as follows:

> *25 EMPL will monitor the impact of the canals upon groundwater abstracted at nearby residential properties. In the event that the canals cause any reduction in the quality or quantity of groundwater available to local bore owners, then EMPL would pay the bore owner to modify the bore or would compensate him/her for changing to scheme water, to the satisfaction of the City of Mandurah. If any significant change in groundwater levels or quality is detected by the monitoring program, then EMPL would immediately notify the Water Authority of Western Australia, to the Water Authority's satisfaction.*

15. STRUCTURES

15.1. PIMA advise that there is a need for the proponents to discuss (either to provide a commitment for or an argument against) the provision of houseboat mooring facilities and other structures associated with marine vessels, their use and upkeep, rather than it becoming a foreshore management issue later in time.

Response:

House boat mooring facilities are not planned. House boats are generally beyond the scope and size of the design vessel for the canal waterways system. People utilising house boats to live on the canal system are not adequately serviced within the Peel-Harvey estuary for water or sewage disposal. Further, house boats moored on the canal waterways system would intrude upon privacy to the waterside frontage and entertaining areas of residential properties facing canal waterways.

The Peel Inlet Management Programme (Waterways Commission, 1992) recognised that people living on boats can create environmental and management difficulties and require management to avoid problems. There are conflicts because of effluent disposal problems and inappropriate use of mooring sites. The requirement for hire houseboats to be fitted with effluent storage tanks that are serviced by the operators does not extend to private vessels. The Peel Inlet Management Plan recommended that the residential use of boats on the waterway should be regulated, however this recommendation has not been implemented to date.

There has been considerable debate as to houseboat mooring facilities within the Peel Inlet over the last 12 months. The planning for the Port Mandurah canal waterways system does not provide for a public marina facility and there is not an adequate water area for the provision of public moorings. All vessels mooring at private jetties within the estate will be associated with the residences. Canal systems must be maintained with maximum water quality at all times, and it is inappropriate to allow or provide for the residential use of moored vessels.

16. CONSERVATION AND FORESHORE RESERVE AND MANAGEMENT PLAN

16.1. The stability of the Conservation and Foreshore Reserve is a critical issue. The PER presents insufficient detail to allow for an evaluation of surface stability of the reserve. The potential for erosion, including 'gullying', wave induced erosion or scour by currents, and the physical characteristics of the likely vegetation cover, would assist in evaluating surface stability of the Conservation and Foreshore Reserve.

Response:

Whilst it is acknowledged that the stability of the Conservation and Foreshore Reserve is a critical requirement for management, it is not anticipated to be a difficult management issue. The eastern (Mandurah Channel) side of the Reserve is stable and will not be affected by the development. The western boundary will be protected from erosion by a revetment specifically designed to provide adequate foreshore protection.

The PER proposes that the finally agreed balance between the engineering structural specifications for the revetment and the desire to optimise the aesthetic and natural appearance of the foreshore will be defined in consultation with CALM, PIMA and the DEP prior to project construction, as an element of the Conservation and Foreshore Management Plan. The marine engineers to the project have advised that adequate protection for the surface stability of the Reserve can be readily assured (PER Appendix E). However, construction of a lower profile structure incorporating a variation in landscaping may be desirable from an aesthetic perspective. Because the proposed Reserve integrates publicly owned land with land currently owned by the proponent, and because it is proposed that CALM will ultimately manage the Reserve, it is inappropriate for the proponent alone to dictate the final foreshore protection design.

The preliminary concept design for the Reserve foreshore protection adjacent to the boundary canal is described in Section 4.2.1 of the PER, as follows:

- A low profile, permeable bund of limestone boulders to the level of the highest astronomical tide (0.5m AHD), bedded upon a limestone core-stone foundation below lowest astronomical tide levels (-0.14m AHD). The rock bund would allow free flowing water exchange so that water levels between the intertidal flat and the boundary canal remain equal, but would be an effective barrier to boat wash from the canal and prevent sediment loss from the interface area into the canals.

- Shoreline vegetation combined as appropriate with low profile post and log walling will be used to protect the foreshore of the proposed supratidal island.

The potential for erosion of the Reserve was specifically assessed by the marine engineers to the project (Addendum to Appendix E) and the results are described in Section 6.3 of the PER. Calculations of waterflow across the Reserve under high tidal conditions show that it will be less than 0.05m/s (0.1 knots) or 20% of the water velocity in the main canal, at worst, which should not result in significant scour of the Reserve.

The minimum water depth over the Reserve during over-topping of the revetment would be 0.4m. The revetment would attenuate or break any boat wash from the boundary canal during extreme tidal conditions, and there would be no wave induced erosion in such water depths.

It is reiterated that the detailed design of foreshore protection for the Reserve will be determined in consultation with CALM, PIMA and DEP, with due acknowledgment of the critical requirement to assure shoreline stability. The conceptual design described in the PER will certainly assure a stable Reserve, well within the existing variability due to natural and previous human influences.

EMPL's commitments in this regard are as follows:

6. *A Conservation and Foreshore Reserve Management Plan defining the detailed design and management prescriptions for the Reserve will be prepared by EMPL in consultation with DEP, CALM and PIMA, to the satisfaction of the Minister for the Environment. The Plan will be consistent with the objectives proposed for the Reserve in this PER and will include arrangements whereby EMPL will construct and establish the Reserve facilities during construction of the Stage 2A Canal Estate then shall cede its property within the Reserve for ongoing management by CALM.*

27. *For the initial five years following construction of Stage 2A then subject to the agreement with the City of Mandurah, EMPL will annually monitor the shoreline and nearshore shoal in the vicinity of the Stage 2 entrance channel, to the satisfaction of the DEP on advice from CALM and PIMA. In the unlikely event that sediment erosion or accretion associated with the development causes significant adverse impact upon the Conservation and Foreshore Reserve, then the Waterways Manager will prepare and implement a management response to the satisfaction of EPA upon advice from CALM and PIMA.*

16.2. Public access to the Reserve should be limited to the southern end to minimise disturbance to waterbirds.

Response:

As described in Section 4.2.1 and reiterated in Section 6.6 of the PER, this is proposed. The intention and design of the Conservation and Foreshore Reserve is to provide for the protection and management of valuable waterbird habitat. Public entry to the Reserve will be through a gate in the vermin-proof fence at the southern extent. Human access for environmental education and appreciation will be encouraged only within the southern upland Interpretive Facility and will be strongly discouraged by barriers and appropriate signage throughout the remainder of the Reserve.

EMPL's commitment in this regard is as follows:

5. *The Stage 2A proposal will include an area of Public Open Space located in the south eastern corner of the project area, to augment the existing Foreshore Reserve and to be developed and managed for conservation interpretation and public appreciation of waterbird species and habitats. This commitment is to be accomplished to the satisfaction of the EPA upon advice from DEP, CALM and PIMA.*

16.3. The development of the Conservation and Foreshore Reserve Management Plan needs to be produced in consultation with the DEP and local Authority as well as PIMA and CALM. It was considered that the final Management Plan should then be cleared by the EPA prior to commencement of project construction.

Response:

EMPL's commitment in this regard is as follows:

6. *A Conservation and Foreshore Reserve Management Plan defining the detailed design and management prescriptions for the Reserve will be prepared by EMPL in consultation with DEP, CALM and PIMA, to the satisfaction of the Minister for the Environment. The Plan will be consistent with the objectives proposed for the Reserve in this PER and will include arrangements whereby EMPL will construct and establish the Reserve facilities during construction of the Stage 2A Canal Estate then shall cede its property within the Reserve for ongoing management by CALM.*

17. VEGETATION

17.1. Vegetation assemblages need to be considered in a regional context including representation of like assemblages in protected areas elsewhere throughout the State. This would allow for a more comprehensive evaluation of the area and its conservation value, particularly with regard to area 2A.

Response:

The vegetation of the project site is described in Section 3.2.1 of the PER. It has been severely disturbed due to clearing, marl pit excavations, constructed levee banks, vehicle tracks, altered drainage, weed invasion and long term grazing by sheep, cattle and horses, resulting in a severe reduction in species diversity, the absence of the majority of native understorey species, and the presence of a high percentage cover of introduced species.

There are no rare or priority flora present on the site.

As such, all of the Stage 2B area, and virtually all of Stage 2A outside of the areas proposed to be protected and managed as Reserve or Public Open Space, have been so seriously impacted by historical land uses as to render them very poor quality in terms of the quality of the remnant vegetation assemblages. Accordingly, the remaining vegetation has very low conservation value and an analysis of representation of like asemblages in protected areas is not considered to be warranted.

Notwithstanding the foregoing, and subject to the substantial effects of site disturbance, the distribution of remnant vegetation within the Stage 2A area may be seen to closely reflect the site's lowlying landform and saline soil characteristics. Using the terminology described by McArthur and Bettenay (1974) and adopted by Wells (1989), the site is geomorphically described as Vasse Estuarine and Lagoonal System and includes the following elements.

- V1 Saline tidal flats along the estuarine fringe which support the regularly inundated samphire community. This area is wholly contained within the proposed Conservation and Foreshore Reserve.

- V2 This geomorphic unit comprises the sand and mud flats which are inland of, and slightly higher than, V1. Virtually all of the V2 area in Stage 2A has been substantially degraded by previous human activity. There is an area in the north of the Stage 2A site which has not been affected by constructed levees and which is still seasonally inundated by saline water during winter floods, however even here, there are widespread impacts from animals and vehicles. The remaining vegetation in this area is a disturbed and sparse open cover of dry samphire species, which has very low conservation value for vegetation and low conservation value for waterbirds.

- V3 This comprises sand flat similar to V2 but marginally higher, which occurs within the central southern part of Stage 2A. A large proportion of this landform now contains only pasture grasses and weeds, however there is a low sedgeland in the southern part of the site which includes two vegetation components: vegetation associated with seasonal brackish water (saltwater paperbark (*Melaleuca cuticularis*) and *Juncus krausii*); and vegetation associated with seasonal fresh water (*M. raphiophylla* and *Gahnia trifida*). The vegetation within this unit has been substantially modified by fresh water inflows from road drainage.

- V4 A low ridge of sand and sandy loam extends in a south-eastern direction through the middle of Stage 2A, which supports relict Salt She-oak (*Casuarina obesa*). This area has been substantially impacted by grazing and weed invasion and has no remaining understorey vegetation. Consequently, this vegetation assemblage has low conservation value.

The south-eastern and south-western corners of Stage 2A contain higher landform with Spearwood type soil which support *C. obesa* or Flooded gum (*Eucalyptus rudis*) and occasional Marri (*E. calophylla*). These overstorey trees have significance for passerine birds. Representative areas are retained within the Interpretive Facility and the public open space in the south-western corner of Stage 2A.

In conclusion, the extensive effects of past human activities throughout the Stage 2A area deems the vegetation as having very low regional conservation value. Like vegetation assemblages that are in much better condition are regionally widespread on similar lowlying Vasse type landforms with saline soils elsewhere on the fringes of Peel Inlet, Harvey Estuary, the lower reaches of the Serpentine, Murray and Harvey Rivers, and Leschenault and Wonnerup Estuaries. There are extensive Foreshore Reserves and Nature

Conservation Reserves, including those on the fringes of the lower Serpentine River, over the Murray and Harvey River deltas, and along the eastern and southern shores of both Peel Inlet and Harvey Estuary, which provide protection elsewhere for these vegetation assemblages.

18. CONSTRUCTION MANAGEMENT

18.1. Environmental specifications as outlined under section 7.3, should be approved by DEP/EPA before construction begins.

Response:

The PER acknowledges and meets appropriate requirements for approval of environmental specifications for construction management prior to commencement of construction. The relevant commitments include:

11. The Stage 2 proposal will apply the same high standards of environmental design criteria as Stage 1, subject to minor modifications as described in the PER where experience has shown to be appropriate to secure improved environmental performance. This commitment will be implemented to the satisfaction of the DEP upon advice from the Department of Transport, PIMA and the City of Mandurah.

16. EMPL will incorporate environmental conditions including those outlined in Section 7.3.1 into the Construction Contracts to provide for protection of the conservation areas, to the satisfaction of the DEP. In particular, EMPL will ensure that, during construction of Stage 2A, construction contractors do not encroach upon any areas of the Conservation and Foreshore Reserve which are recognised as important waterbird habitat.

18. Dust emissions from the project area during construction activities will be managed and monitored in compliance with the EPA's Guidelines for Assessment and Control of Dust and Windborne Material from Land Development Sites, to the satisfaction of the City of Mandurah.

19. *Construction activities will be restricted to daylight hours. Appropriate techniques will be employed to suppress any noise nuisance to nearby residents, to the satisfaction of the City of Mandurah.*

20. *The effects of dewatering operations during project construction upon nearby domestic bores will be monitored by EMPL and, in the event that the bores become unsuitable for garden irrigation, EMPL will pay the affected bore owner to use scheme water for the period of effect. This commitment will be fulfilled to the satisfaction of the City of Mandurah.*

21. *The effects of dewatering operations upon trees on the upland areas of the Stage 2A site, those within the adjacent Castle Fun Park, and the trees of heritage significance, will be monitored by EMPL and watered if necessary to maintain their viability during the period of temporary water table drawdown. This commitment will be fulfilled to the satisfaction of the DEP.*

22. *The proposed canals will be excavated in a land-locked basin; with dredging being required only for opening the entrance channel to Mandurah Channel. The discharge of dewatering and dredge spoil water will incorporate large capacity stilling basins to allow settlement of suspended material prior to discharge to the estuary and will be in accordance with PIMA's requirements and published policies.*

23. *The proposed canals will be constructed to a high standard to the satisfaction of the City of Mandurah and EPA upon advice from PIMA and the Department of Transport.*

The routine nature of the requirements for noise and dust control have recently been reviewed by the DEP, resulting in responsibility being primarily vesting in the Local Authority and the proponent's engineer. Given the specificity of the regulations and guidelines defining the accepted limits, the City of Mandurah is considered to be the appropriate authority for review of these matters. The commitment to compensate bore owners who may be affected by water table drawdown is considered similarly.

EMPL is committed to managing the discharge of dewatering and dredge spoil water in accordance with PIMA's published guidelines and policies. PIMA is therefore considered to be the appropriate referral authority in this regard.

In this response, EMPL does not seek to reduce any of its responsibilities for appropriate environmental management of construction activities, merely to avoid the unnecessary duplication of referral and review.

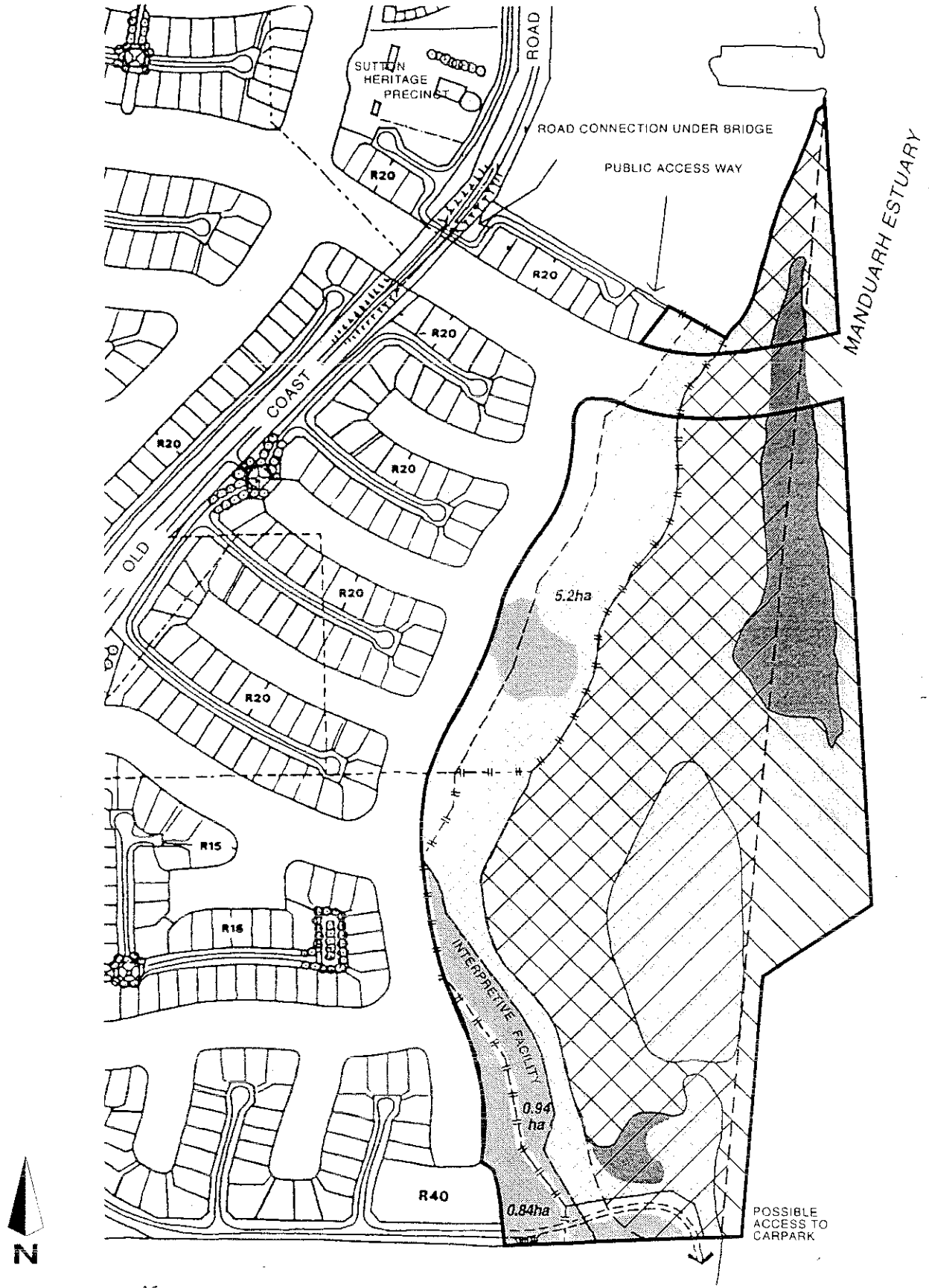
19. WATER QUALITY MANAGEMENT AND MONITORING

19.1. The management and monitoring programme for water quality should be designed with attention to the water quality in the 'end points' of the canals.

Response:

This is acknowledged and will be incorporated into the water and sediment quality monitoring program. EMPL's commitment in this regard is that prior to commencement of project construction:

> *13. EMPL will prepare a water and sediment quality monitoring program for the canals to the satisfaction of the DEP on advice from PIMA.*



Key

- Conservation & Foreshore Reserve - 23.9ha
- System 6 (C50) - 14.9ha
- Shallow subtidal
- Upland
- Wet samphire
- Shoal
- EMPL property boundary

Source : BSD, 1995

PORT MANDURAH STAGE 2

CONSERVATION AND FORESHORE RESERVE

Figure A

BOWMAN BISHAW GORHAM
ENVIRONMENTAL MANAGEMENT CONSULTANTS

BBG0009F

Appendix 3

List of submitters

Peel Preservation Group
Conservation Council
Mr W Wilson
Fisheries Department of WA
Water Authority of Western Australia
Department of Conservation and Land Management
Peel Inlet Management Authority/ Waterways Commission
Department of Transport

A late submission was received from:
Australian Nature Conservation Authority (ANCA)

Appendix 4

Consolidated list of proponent's commitments

SUMMARY OF PROPONENT'S COMMITMENTS

The principal project design and environmental management commitments given by Esplanade (Mandurah) Pty Ltd in the Public Environmental Review and following consideration of public submissions upon the Public Environmental Review are as follows:

General

1. The Canal Estate will comply with the provisions of the State Planning Commission's Policy DC1.8, Procedures for Approval of Artificial Waterways and Canal Estates, to the satisfaction of DPUD on advice from DEP, PIMA, the Department of Transport and the City of Mandurah.

2. The design, construction and management of the Canal Estate will be in accordance with the requirements for "canal zoning" defined by the proposed City of Mandurah Town Planning Scheme No. 3, and with the City of Mandurah's Draft Waterways Management Policy, to the satisfaction of the City of Mandurah.

Project Design

Project design commitments to be satisfied prior to the commencement of project construction include the following:

3. The project design will incorporate the provision and establishment of a Conservation and Foreshore Reserve meeting the objectives and specifications outlined in Section 4.2.1 of the PER, including a minimum Foreshore Reserve width of 50m and an additional 25m buffer zone, so as to provide for conservation management of all areas identified in the PER as having high or very high waterbird habitat and all areas of wet samphire with moderate waterbird habitat value. This commitment will be accomplished to the satisfaction of the EPA upon advice from DEP, CALM and PIMA.

4. The proposed Conservation and Foreshore Reserve will be buffered from the proposed development by a 50m wide boundary canal.

5. The Stage 2A proposal will include an area of Public Open Space located in the south eastern corner of the project area, to augment the existing Foreshore Reserve and to be developed and managed for conservation interpretation and public appreciation of waterbird species and habitats. This commitment is to be accomplished to the satisfaction of the EPA upon advice from DEP, CALM and PIMA.

6. A Conservation and Foreshore Reserve Management Plan defining the detailed design and management prescriptions for the Reserve will be prepared by EMPL in consultation with DEP, CALM and PIMA, to the satisfaction of the Minister for the Environment. The Plan will be consistent with the objectives proposed for the Reserve in this PER and will include arrangements whereby EMPL will construct and establish the Reserve facilities during construction of the Stage 2A Canal Estate then shall cede its property within the Reserve for ongoing management by CALM.

7. The Stage 2B proposal will include a Heritage Conservation Area of approximately 1.4ha to preserve the existing Sutton Homestead and ancillary farm buildings, to the satisfaction of the City of Mandurah.

8. The Stage 2B proposal will include an area of Public Open Space at the heritage graveyard site, to enable its appropriate conservation and management. This commitment is to be accomplished to the satisfaction of the City of Mandurah.

9. The Stage 2B proposal will include two areas of Public Open Space at the two identified Aboriginal heritage areas, to the satisfaction of the City of Mandurah upon advice from the Department of Aboriginal Affairs.

10. The Port Mandurah Stage 2 canals will be connected to both the Mandurah Inlet and the Stage 1 canals, to provide an integrated canal estate and to secure enhanced flushing of the waterways.

11. The Stage 2 proposal will apply the same high standards of environmental design criteria as Stage 1, subject to minor modifications as described in the PER where experience has shown to be appropriate to secure improved environmental performance. This commitment will be implemented to the satisfaction of the DEP upon advice from the Department of Transport, PIMA and the City of Mandurah.

12. EMPL will enter into an agreement with the City of Mandurah which clearly delineates responsibilities for the physical maintenance and waterways management of the Canal Estate and the entrance channel. This agreement is to be to the satisfaction of the Minister for the Environment on advice from the DEP.

13. EMPL will prepare a water and sediment quality monitoring program for the canals to the satisfaction of the DEP on advice from PIMA.

14. EMPL will prepare a waterbird monitoring program for the Conservation and Foreshore Reserve, to the satisfaction of the DEP on advice from CALM and PIMA.

15. EMPL will undertake additional investigations and provide detailed design specifications to ensure that the through flow of water in the integrated Stage 1 and 2 canals will not result in unacceptable scouring of the canal batters. This will be accomplished to the satisfaction of the City of Mandurah upon advice from the Department of Transport.

Project Construction

Project construction commitments, to be satisfied prior to final subdivisional approval of the relevant stage of development, include the following:

16. EMPL will incorporate environmental conditions including those outlined in Section 7.3.1 into the Construction Contracts to provide for protection of the conservation areas, to the satisfaction of the DEP. In particular, EMPL will ensure that, during construction of Stage 2A, construction contractors do not encroach upon any areas of the Conservation and Foreshore Reserve which are recognised as important waterbird habitat.

17. During construction of Stage 2A, EMPL will develop the Conservation and Foreshore Reserve and Conservation Interpretation Facility consistent with the objectives and scope of the Conservation and Foreshore Reserve Management Plan, and will enter into an agreement with CALM for vesting and ongoing management of the Reserve. This commitment will be accomplished to the satisfaction of the Minister for the Environment upon advice from DEP, CALM and PIMA.

18. Dust emissions from the project area during construction activities will be managed and monitored in compliance with the EPA's Guidelines for Assessment and Control of Dust and Windborne Material from Land Development Sites", to the satisfaction of the City of Mandurah.

19. Construction activities will be restricted to daylight hours. Appropriate techniques will be employed to suppress any noise nuisance to nearby residents, to the satisfaction of the City of Mandurah.

20. The effects of dewatering operations during project construction upon nearby domestic bores will be monitored by EMPL and, in the event that the bores become unsuitable for garden irrigation, EMPL will pay the affected bore owner to use scheme water for the period of effect. This commitment will be fulfilled to the satisfaction of the City of Mandurah.

21. The effects of dewatering operations upon trees on the upland areas of the Stage 2A site, those within the adjacent Castle Fun Park, and the trees of heritage significance, will be monitored by EMPL and watered if necessary to maintain their viability during the period of temporary water table drawdown. This commitment will be fulfilled to the satisfaction of the DEP.

22. The proposed canals will be excavated in a land-locked basin; with dredging being required only for opening the entrance channel to Mandurah Channel. The discharge of dewatering and dredge spoil water will incorporate large capacity stilling basins to allow settlement of suspended material prior to discharge to the estuary and will be in accordance with PIMA's requirements and published policies.

23. The proposed canals will be constructed to a high standard to the satisfaction of the City of Mandurah and EPA upon advice from PIMA and the Department of Transport.

Ongoing Management and Monitoring

Upon completion of each stage of the proposed development, EMPL will fulfill the following commitments:

24. The canal waterways will be ceded free of cost to the Crown, for vesting with the City of Mandurah.

25. EMPL will monitor the impact of the canals upon groundwater abstracted at nearby residential properties. In the event that the canals cause any reduction in the quality or quantity of groundwater available to local bore owners, then EMPL would pay the bore owner to modify the bore or would compensate him/her for changing to scheme water, to the satisfaction of the City of Mandurah. If any significant change in groundwater levels or quality is detected by the monitoring program, then EMPL would immediately notify the Water Authority of Western Australia, to the Water Authority's satisfaction.

26. For the initial five years following construction then subject to the agreement with the City of Mandurah, EMPL will annually monitor the depths of the canals and the entrance channel to ensure the maintenance of adequate flushing and safe navigable depths, to the satisfaction of the EPA and Department of Transport. If and when required by the Department of Transport or PIMA, EMPL (or the City of Mandurah subject to agreement) will submit plans for dredging and disposal of dredged material to PIMA for approval prior to their implementation.

27. For the initial five years following construction of Stage 2A then subject to the agreement with the City of Mandurah, EMPL will annually monitor the shoreline and nearshore shoal in the vicinity of the Stage 2 entrance channel, to the satisfaction of the DEP on advice from CALM and PIMA. In the unlikely event that sediment erosion or accretion associated with the development causes significant adverse impact upon the Conservation and Foreshore Reserve, then the Waterways Manager will prepare and implement a management response to the satisfaction of EPA upon advice from CALM and PIMA.

28. For the initial five years following construction and then subject to agreement with the City of Mandurah, EMPL will implement the water and sediment quality monitoring program for the canals, to the satisfaction of the DEP upon advice from the Department of Transport and PJMA.