Industrial Infrastructure and Harbour Development, Jervoise Bay

Department of Commerce and Trade

Report and recommendations
of the Environmental Protection Authority

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Summary and recommendations

The Department of Commerce and Trade (DCT) proposes to develop Industrial Infrastructure and a Southern Harbour in Jervoise Bay. This report provides the Environmental Protection Authority's (EPA's) advice and recommendations to the Minister for the Environment on the environmental factors, conditions and procedures relevant to the proposal.

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

Environmental factors

In the EPA's opinion, the following environmental factors have been identified as being relevant to the proposal:

(a) Marine flora;

(b) Marine fauna;

(c) Landform;

(d) Shoreline;

(e) Seabed;

(f) Vegetation communities;

(g) Terrestrial fauna;

(h) Wetlands;

(i) Marine water quality;

(j) Public health and safety;

(k) Noise and vibration;

(l) Dust and particulates;

(m) Heritage; and

(n) Recreation.

These factors were assessed under the following issues:

1. Marine waters - changes to water circulation, quality and sediments;
2. Marine flora and fauna - loss of seagrass and habitat;
3. Coastal processes - impact on shoreline and seabed;
4. Impact on System Six area M91 - loss of 10.5ha of the northern portion of M91 and impact on terrestrial flora and fauna;
5. Impacts on Cockburn Road realignment - impacts on wetlands and drainage;
6. Noise and dust - impacts associated with the construction of the harbour and road realignment;
7. Heritage - impact on sites of cultural significance; and
8. Recreation - loss of open water and access to the coast; public health and safety.

Conclusion

The EPA has considered the issues which have arisen as a consequence of the proposal, and has concluded that three issues are fundamental to this assessment: water quality, marine flora and the "A" Class Reserve 24309 (termed M91 in System Six).

The overriding environmental issue is water quality in that the proposal is likely to reduce flushing times in an area where the nutrient levels and chlorophyll a are already too high. The proposal is likely to lead to a further deterioration in environmental quality through an increase in chlorophyll a and an increased frequency of algal blooms. Within the context of the current water quality, the EPA has concluded that the proposal is unable to be managed to meet the EPA objectives for this issue.

The marine flora issue has been focussed through the loss of seagrass. Although the amount of seagrass loss would be relatively small, nevertheless it needs to be considered within the context of the historical loss since the 1960's during which time about 80% of the seagrass meadows have been lost as a result of changing water quality. Although the project would result in the removal of only about 2 ha of seagrass meadows, the EPA has concluded that within the context of the historical loss of seagrass, the proposal is unable to be managed to meet the EPA objective for this issue.

The removal of part of the "A" Class Reserve 24309 (M91 of System Six) would result in there being a significant loss of representative coastal landform and associated vegetation from the Beeliar Regional Park. As it appears unlikely that this complex can be replaced by reservation in another area, the EPA has concluded that the proposal is unable to be managed to meet the EPA objective for this issue.

In summary, the current condition of the environment, in this portion of Cockburn Sound, is a constraint on further development in that water quality is already poor and the proposal, if implemented, is likely to lead to further deterioration.

As set out in the EPA's Strategic Environmental Advice on Cockburn Sound (EPA, 1998b), it is the role of the EPA to provide the best environmental advice to assist Government in the decision-making process, but it is the role of Government to make decisions as to whether or not a project should be implemented.

If a decision is taken that the proposal is to be implemented, the EPA has a responsibility to provide advice on the Conditions and Procedures to which that proposal should be subject. Some of that advice results from the commitments given by the proponent following discussions with the Department of Environmental Protection, acting on behalf of the EPA, and some results from EPA advice given as Other Advice in this report and in the Cockburn Sound Strategic Environmental Advice (EPA, 1998b).

The EPA has a responsibility to provide advice to assist Government in relation to environmental response initiatives aimed at ensuring overall environmental acceptability of projects. The EPA is aware that this may not be able to be achieved by the proponent within the context of the project area. Accordingly, the EPA proposes that a very broad view be taken by Government whereby environmental gains can be made through other initiatives throughout the State.

A decision by Government to implement the proposal should be accompanied by a broad-based environmental response but which includes a commitment to an on-going programme of research and investigation aimed at providing information on which to base environmental management decisions as well as the establishment of a management structure which can bring about management to ameliorate the environmental impacts.

Other Advice

The EPA has recently considered the implications of possible future developments in Cockburn Sound. In its report entitled "The Marine Environment of Cockburn Sound - Strategic Environmental Advice" (EPA, 1998b), the EPA has outlined its position on a number of environmental and management issues.

The EPA has pointed out that development of new projects both in terms of siting and design should avoid or minimise environmental impact and should be consistent with the ecological sustainability and the long-term community vision for the Sound (EPA, 1998b).

There is a need for a workable and clear mechanism for marine-use planning and management in Cockburn Sound that is ecosystem-based and takes into account multiple-use and equity issues (among users and generations). Also, terrestrial planning needs to give adequate consideration to the links between land-based activities and the quality of near-shore marine waters. Adequate statutory management arrangements to address multiple-use and environmental issues affecting Perth's marine waters, particularly Cockburn Sound, must be considered in parallel with this proposal.

Along with the achievement of improved water quality leading to seagrass regrowth in Cockburn Sound, the Government should establish a programme which actively re-establishes seagrass in appropriate habitat areas within Cockburn Sound.

The EPA is aware that four Prospecting Licence Applications (PLAs) have been applied for over M91 and M92. While these are only applications and have yet to be granted, the EPA would be most concerned if they were granted and mining was to occur.

One of the consequences of the revised alignment of Cockburn Road along Russell Road is that the section of Rockingham Road between Fanstone Avenue and a point south of Wattleup requires upgrading. The proponent has outlined the reasons for and environmental implications of this in Appendix 2 of the Response to Submissions (DCT, 1998).

Although Main Roads Western Australia (MRWA) has sought assessment of this upgrade, the EPA considers that this is a change that was not alluded to in the PER, has not been subject to public review and comment, and not all relevant environmental information is available at this time. However, to assist the progressing of this upgrading, the EPA has provided comment and advice.

Recommendations

The EPA submits the following recommendations to the Minister for the Environment:

1. That the Minister considers the report on the relevant environmental factors of marine flora, marine fauna, landform, shoreline, seabed, vegetation communities, terrestrial fauna, wetlands, marine water quality, public health and safety, noise and vibration, dust and particulates, heritage and recreation as set out in Section 3.

2. That the Minister notes that in relation to marine water quality, the EPA has concluded that:

   (i) the chlorophyll a levels are above the nutrient related environmental quality criteria set out in the Southern Metropolitan Coastal Waters Study;

   (ii) the impact of the proposal is likely to lead to a further increase in the chlorophyll a levels; and

   (iii) that within the context of (i) and (ii), the proposal is not able to be managed to meet the EPA's objectives.

3. That the Minister notes that in relation to seagrass as part of marine flora, the EPA has concluded that:

(i) while the amount of seagrass being considered in relation to the proposal is not large, the EPA's advice needs to take into account the historical reduction in seagrass abundance;

(ii) the impact of the proposal will be to further reduce the seagrass abundance and potential habitat; and

(iii) within the context of (i) and (ii), the proposal is not able to be managed to meet the EPA's objectives.

4. That the Minister notes that in relation to Reserve A 24309 System Six M91, as part of landform and vegetation communities, the EPA has concluded that the landform and conservation values which would be lost through the impact of the proposal on a portion of the Reserve would not be able to be replaced, and thus the proposal is not able to be managed to meet the EPA's objectives.

5. That the Minister notes that the summary situation is that the proposal cannot be managed to meet the EPA's objectives in relation to the issues of water quality, marine flora and Reserve 24309, but the proposal can be managed to meet the EPA's objectives for the other environmental factors.

6. That when considering this assessment report, the Minister also considers the advice provided in the Cockburn Sound Strategic Environmental Advice as set out in Bulletin 907 as well as the Other Advice provided in Section 6 of this report.

7. That the Minister recommends to Government that it provide a commitment to an ongoing programme of research and investigation in Cockburn Sound to assist in broad decision-making, as a basis for the consideration of management action over time aimed at ameliorating both the specific and cumulative impacts on the marine environment arising from existing and future developments.

8. That the Minister requests the EPA to provide a report outlining an ongoing programme of management-oriented research and investigation, taking into account information requirements, the proposed co-ordination arrangements for that research, and the benefits in terms of management action which could result from the research undertaken for Cockburn Sound.

9. The Minister recommends to Government that it establish a management structure, to include representatives of Government, business and community sectors, to coordinate environmental management within Perth's marine coastal waters, including Cockburn Sound, and between these waters and their land catchments.

10. That the Minister notes that if the Minister, in consultation with decision-making authorities, decides to allow the project to proceed, the Government should be encouraged to consider an environmental response that would result in a net gain to the environment which need not be limited to the Cockburn Area, but could be in a State wide context.

11. That the Minister notes that the EPA has provided in Appendix 3, a set of Conditions and Procedures to which the project should be subject if a decision is taken that the proposal may be implemented.

12. That the Minister impose the Conditions and Procedures set out in Appendix 3 if the proposal is to be implemented.

Conditions

Having considered the proponent's commitments and information provided in this report, the EPA has developed a set of Conditions and Procedures which the EPA recommends be imposed if the proposal by the Department of Commerce and Trade to develop Industrial Infrastructure and a Southern Harbour in Jervoise Bay is approved for implementation. These

conditions are presented in Appendix 3. Matters addressed in the conditions include the following:

(a) the proponent shall fulfil the commitments in the Consolidated Commitments statement set out as an attachment to the recommended conditions in Appendix 3;

(b) in order to manage the environmental impacts of the project, and to fulfil the requirements of the Conditions and Procedures in this statement, prior to construction, the proponent shall demonstrate that there is in place an environmental management system which includes the following elements:

- environmental policy and commitment;
- planning of environmental requirements;
- implementation and operation of environmental requirements;
- measurement and evaluation of environmental performance; and
- review and improvement of environmental outcomes.

(c) project specific conditions relating to:

- seagrass;
- water quality;
- a dredging and spoil management plan;
- a reserve replacement plan;
- a public access management plan; and
- a noise management plan.

1. Introduction and background

In February 1997, the Department of Commerce and Trade (DCT) referred a proposal to the EPA to develop an industrial estate and a harbour immediately south of the existing marine shiplift facility in Jervoise Bay (see Figures 1 and 2).

The level of assessment was set at Public Environmental Review. The Public Environmental Review document entitled "Industrial Infrastructure and Harbour Development, Jervoise Bay" (Halpern Glick Maunsell, 1997), hereafter referred to as the PER, was made available for public review for a period of eight weeks from 15 December 1997 to 9 February 1998, although comments were accepted until 23 February 1998.

The proposal involves:

- reclamation of waterfront land for construction of berths, wharves and onshore fabrication areas including associated servicing;
- construction of two major breakwaters to provide wave and swell protection;
- dredging of an approach channel and harbour basin;
- clearing and excavation of land either side of Cockburn Road to provide for development of support industry inclusive of associated services; and
- realignment of Cockburn Road.

In response to submissions received on the project and consideration by the EPA, work was undertaken to address issues raised:

1. Pursuant to Section 16(e) of the *Environmental Protection Act 1986*, the EPA undertook a strategic assessment of Cockburn Sound to look at the long term marine environmental issues associated with future harbour developments generally in Cockburn Sound and examine the potential cumulative environmental changes which could arise from these port developments when considered together.

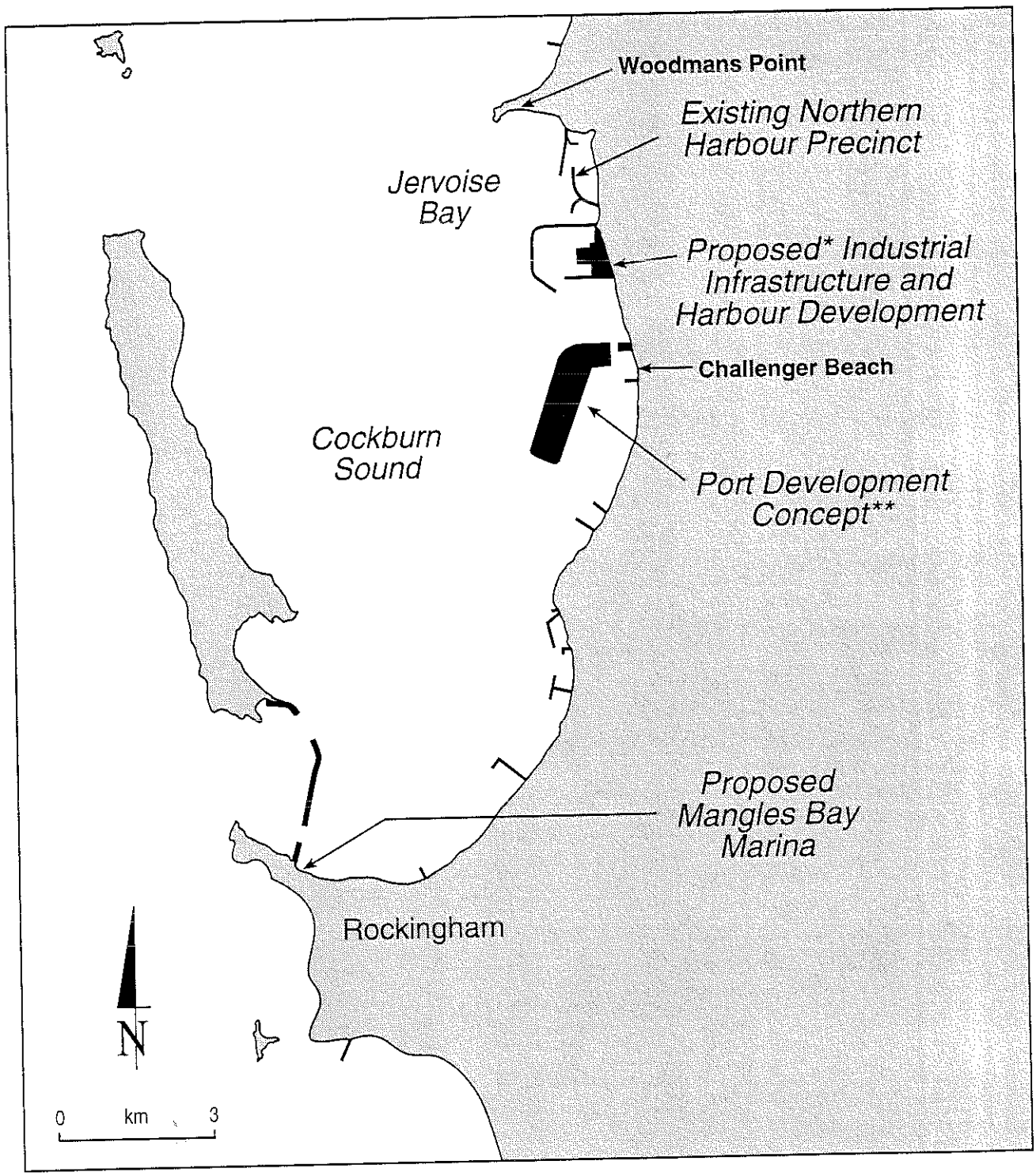
2. The EPA sought independent appraisals from Dr Paul Lavery (Edith Cowan University) and Emeritus Professor Arthur McComb (Murdoch University) on the adequacy of the PER in addressing some key marine-related issues and technical advice from the Department of Environmental Protection (DEP).

3. The proponent redesigned two aspects of the proposal to include:

   - an island breakwater which is approximately 250m closer to shore (Figure 3) ; and
   - an alternative Cockburn Road realignment that links the new Cockburn Road to Rockingham Road via Russell Road (Figure 4).

4. The EPA requested that the proponent undertake additional modelling in relation to the modified harbour design in relation to the potential impacts on flushing within the harbour and between harbours and implications for changes in water quality in these areas.

5. The DEP commissioned Kinhill to review cumulative water circulation impacts of the modified design, with and without the proposed Fremantle Port Authority (FPA) Harbour Option.



* Harbour design from PER (Halpern Glick Maunsell, 1997). This design has been modified.
** Concept based on FPA and DOT advice (28 May 1998).

Figure 1. Industrial Infrastructure and Harbour Development, Jervoise Bay Locality Map.

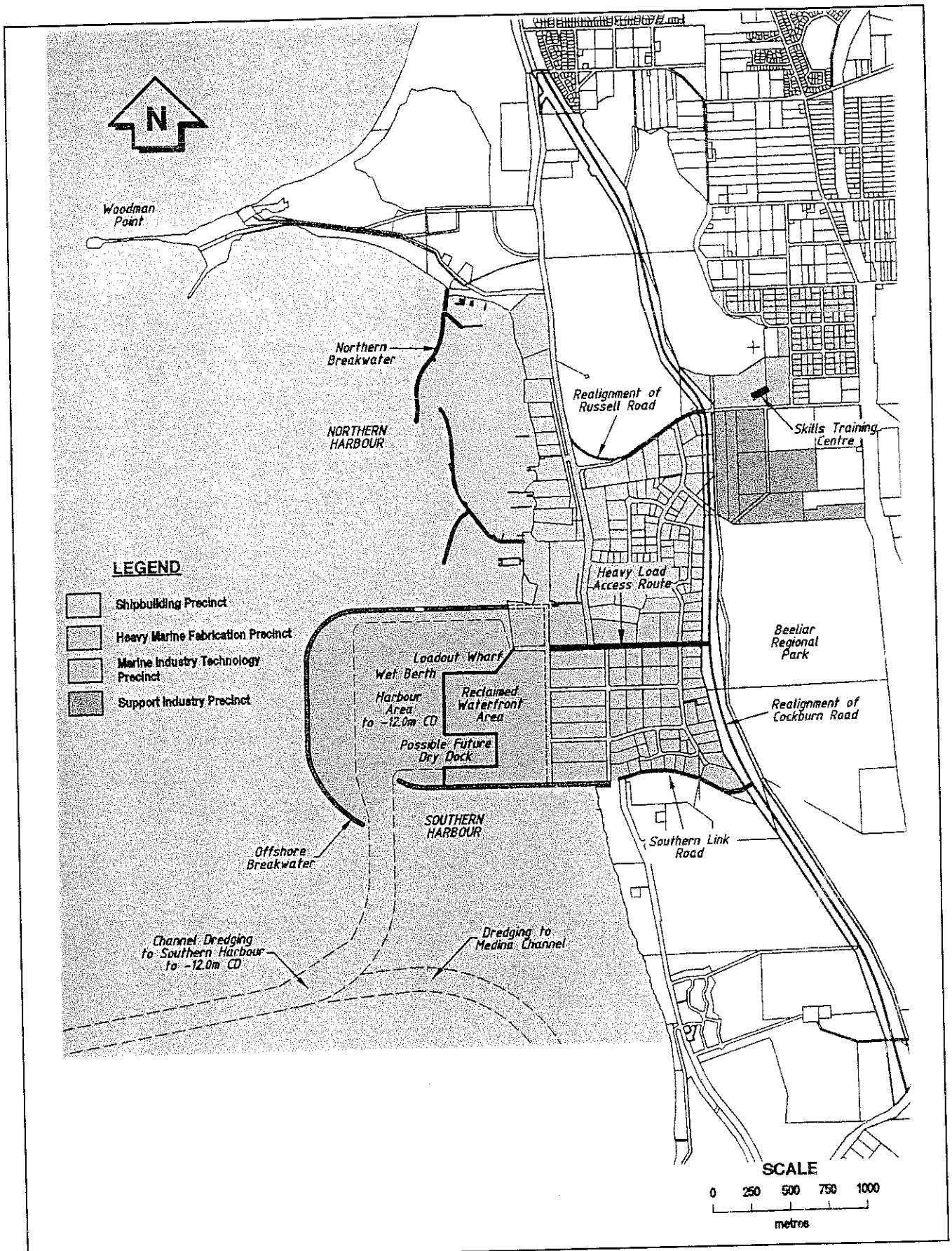


Figure 2. Industrial Infrastructure and Harbour Development, Jervoise Bay - Original Proposal (HGM, December 1997).

Further details of the proposal are presented in Section 2 of this Report. Section 3 discusses the environmental factors relevant to the proposal and the significant environmental issues which arise from these. Section 4 discusses decision making by Government if the proposal is to be implemented and Section 5 presents the EPA's conclusion. Conditions and Procedures to which the proposal should be subject if the Minister determines that it may be implemented are set out in Section 6. Other EPA advice is outlined in Section 7 and Section 8 the EPA's recommendations.

A list of people and organisations that made submissions is included in Appendix 1. References are listed in Appendix 2, and recommended conditions and procedures and proponent's commitments are provided in Appendix 3.

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

2. The proposal

The DCT proposes to develop Industrial Infrastructure and a Southern Harbour in Jervoise Bay immediately south of the existing Northern Harbour Precinct and including the Marine Support Facility (MSF).

The proposed harbour will provide a sheltered waterway for companies operating on the common-user shorefront area and adjacent freehold sites. The type of activity anticipated is the supply of modules and manufactured components to the oil, gas and resource industry sectors. When fully operational there is the potential for six loadouts per year. Each loadout is the culmination of a six to eighteen month construction schedule and will involve a large barge or heavy lift vessel, accompanied by four tugs, being in the harbour for approximately three days.

In addition, the proposed harbour may also facilitate the fitout or refit contracts on Floating Production Storage and Offtake (FPSO) vessels.

Following comment in submissions, the DCT modified the proposal outlined in the PER. The revised proposal, which is outlined in the response to submissions, includes:

- reclamation of 60ha of waterfront land for construction of berths, wharves and onshore fabrication areas including associated servicing;
- construction of an island breakwater to provide wave protection. This configuration increases the harbour's northern entrance to approximately 180m in width. The offshore breakwater is approximately 2.05km long and the southern entrance to the harbour is approximately 300m wide. The southern breakwater remains the same as the previous design and extends from the shore to a distance of 1.25km. The revised proposal covers 191ha of Cockburn Sound against the original (PER) proposal of 150ha;
- dredging of an approach channel and harbour basin. The channel is now 164m wide against the original proposal of 152m and will initially be dredged to a depth of -12m CD but could ultimately be dredged to -14.7m CD. The approach channel has been reconfigured to avoid seagrasses on the western margin on the development;
- the construction of the two breakwaters will continue in parallel throughout the project's development. Construction could take up to three years with no stages;
- the MSF area incorporated within the harbour;
- clearing and excavation of land either side of Cockburn Road to provide 80ha to be developed as freehold lots for development of support industry inclusive of associated services; and

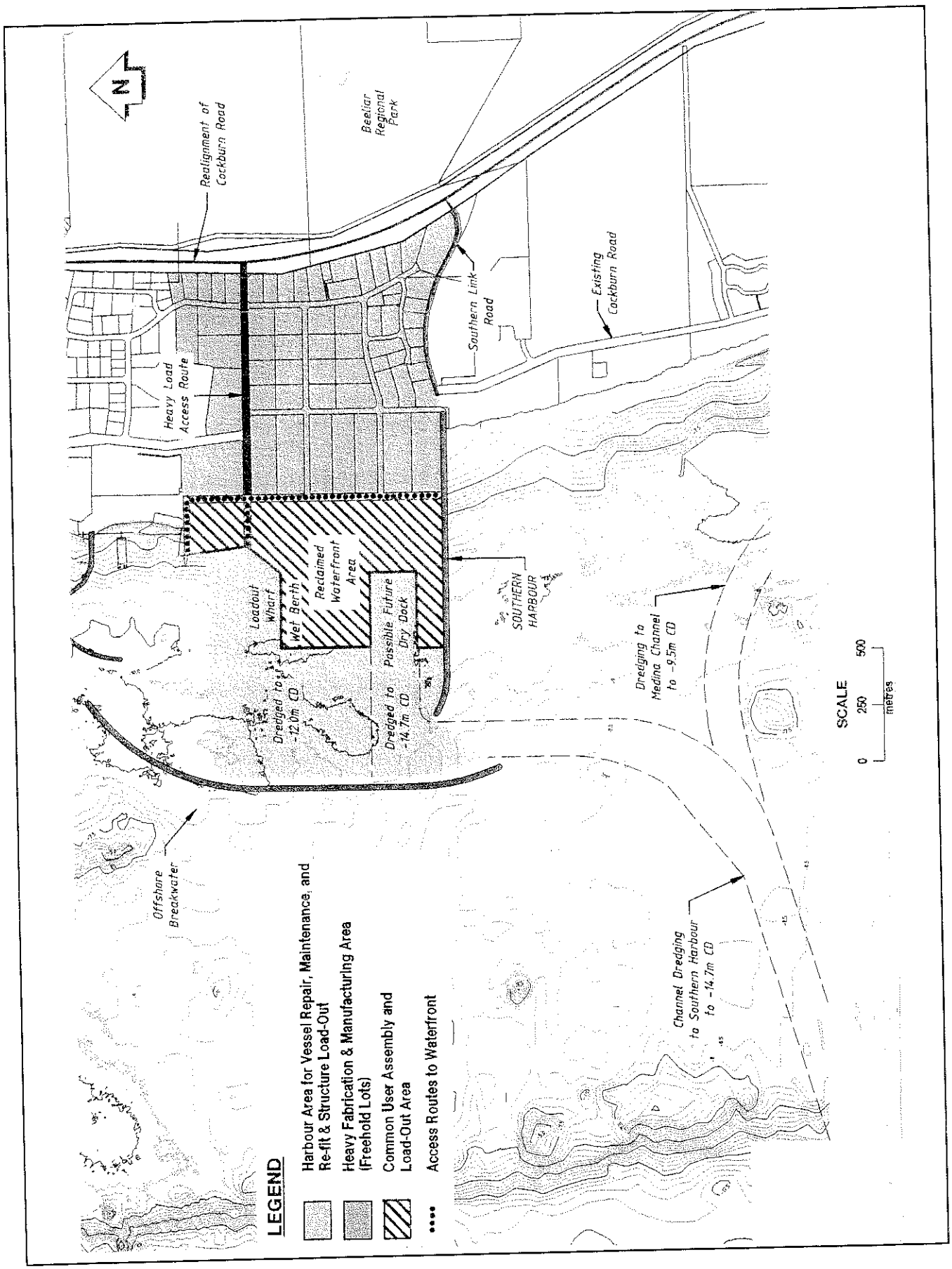


Figure 3. Industrial Infrastructure and Harbour Development, Jervoise Bay - Modified Proposal (DCT, August 1998).

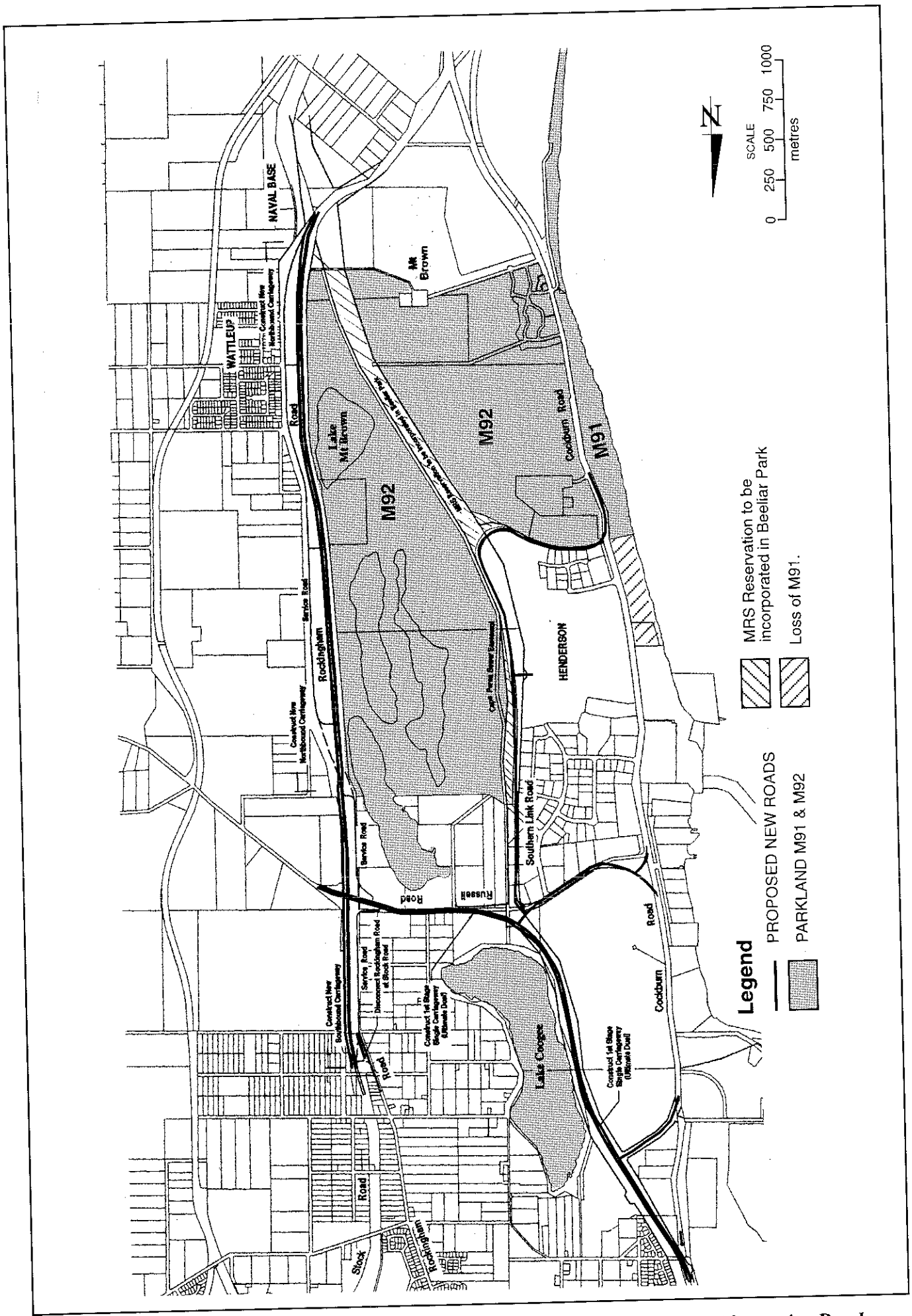


Figure 4. Industrial Infrastructure and Harbour Development, Jervoise Bay - Alternative Road Network Configuration (DCT, 1998).

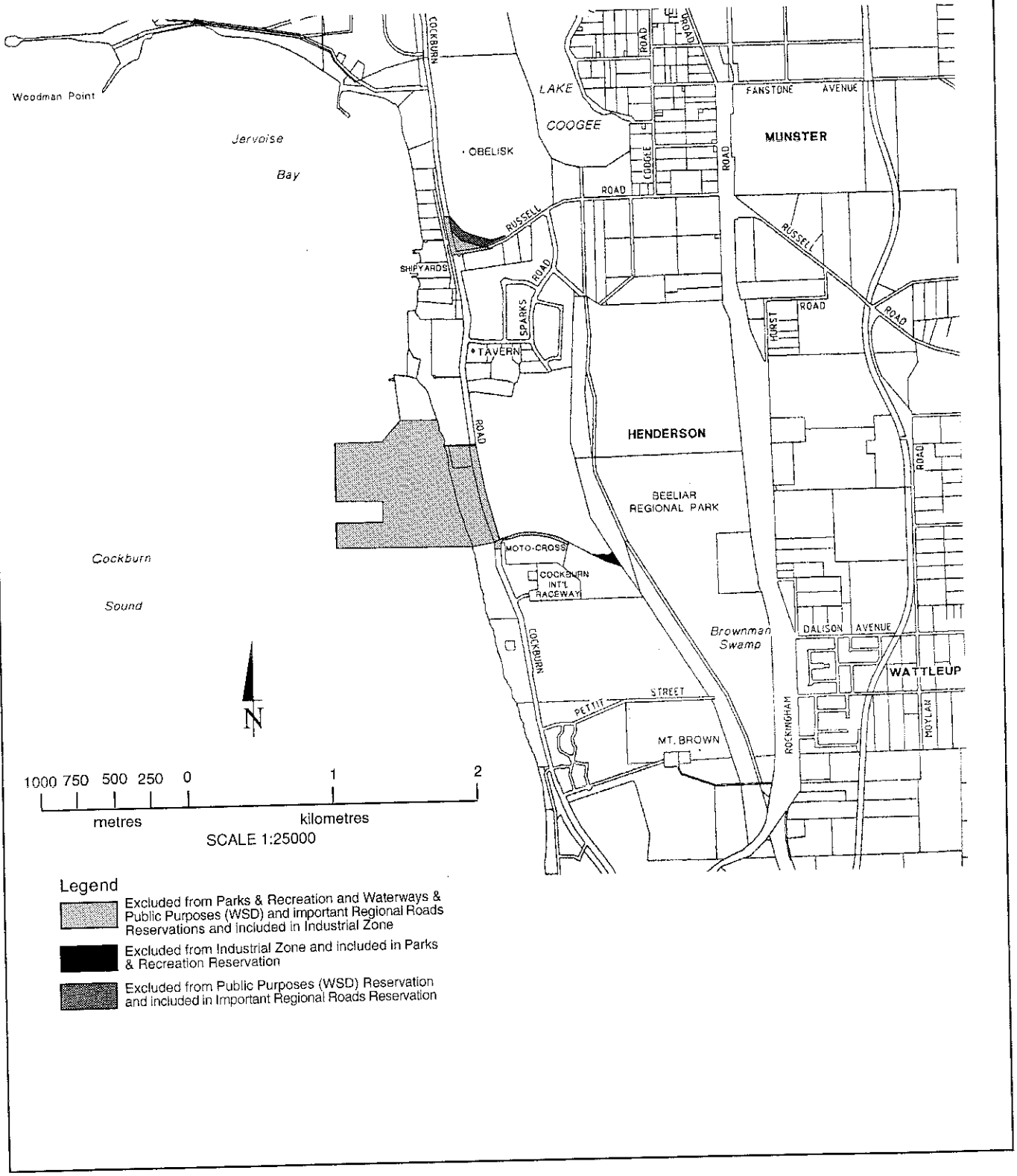


Figure 5. Metropolitan Region Scheme (MRS) Amendment 1001/33 South West Districts Omnibus (No 3A) (WAPC, 1997).

- realignment of Cockburn Road. This realignment links the new Cockburn Road via Russell Road and avoids bisecting Beeliar Regional Park along the current Fremantle-Rockingham Controlled Access Highway reserve. The road network will include construction of a lower standard distributor road along the eastern boundary of the Henderson industrial area and a link to the old Cockburn Road south of Henderson. Approximately 6.5km of Rockingham Road from Fanstone Ave to south of Wattelup will also be required to be upgraded.

It should be noted that the proposal does not include a future drydock, a casting basin for concrete gravity structures or "scrape and paint" jobs on vessels. If proposed in the future they would be subject to separate assessment processes.

The Western Australian Planning Commission (WAPC) is currently progressing Metropolitan Region Scheme (MRS) Amendment 1001/33 South West Districts Omnibus (No. 3A) related to the proposal (refer to Figure 5). The amendment proposes the following specific changes to the zones and reservation in the MRS:

- Southern Harbour: the transfer of a portion of Reserve 24309 Cockburn Road, Henderson from 'Parks and Recreation' reservation to 'Industrial' zone and part of Cockburn Sound from 'Waterways' reservation to 'Industrial' zone.

- Southern Link Road: the transfer of vacant Crown land and portion of Reserves 39455 and 39584 Cockburn Road, Henderson and a portion of Cockburn Road reserve from 'Parks and Recreation' reservation to 'Industrial' zone and portion of Lot 2 Cockburn Road, Henderson from 'Industrial' zone to 'Parks and Recreation' reserve.

- Russell Road: the transfer of a portion of Lot 9 Cockburn Road from public Purposes (WSD) reservation to Important Regional Roads reservation and Industrial zone, transferring a portion of Lot 5 Russell Road and a portion of Russell Road reserve from Important Regional roads reservation to Industrial zone and a portion of Cockburn Road reserve from Public Purposes (WSD) reservation to Industrial zone.

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

Table 1. Summary of Key Proposal Characteristics

Proposal Characteristic	Description
Breakwaters	• Offshore breakwater approx 2.05km long. • Southern breakwater approx 1.25 km long. • Total material approx 1.3 million cubic metres. • Material will be sourced from excavation operations during construction of the onshore industrial estate together with local quarry sources.
Marine structures	• 350m long wet berth, piled with concrete deck. • 80m long load out wharfs, sheet piled.

Dredging works	• Channel - 2.8km length, 164m wide, depth -14.7m CD (although dredging will initially only be to -12m CD). • Channel area - 46ha. • Entrance basin depth -14.7m CD. • Wharf area depth -12.0m CD. • Total dredge material approx 6.2 million cubic metres (for land reclamation).
Harbour	• Enclosed water volume 14.5 million cubic metres. • Water surface area of 131 ha. • Southern entrance approx 300m wide. • Northern entrance approx 180m wide. • the existing Marine Support Facility.
Reclamation of waterfront land	• Approx 60ha in area, extending over 900m coastline south from existing offshore construction yard and up to 950m offshore. • Approximately 7.5 million cubic metres of fill required for reclamation of waterfront land for construction of berths, wharves and onshore fabrication areas. This fill will comprise approx 4.0 million cubic metres of excavated material from the onshore industrial estate with the remainder of fill to come from dredging activities. • The reclaimed area will be levelled and compacted, grading from a waterfront elevation of 3.5m AHD to approx 5.0m AHD at the landward extent of the common user area.
Onshore land development	• Approx 80 ha. • Clearing, excavation and contouring of land immediately east of the reclaimed waterfront area for development of associated onshore industrial lots. • Excavation material approx 4 million cubic metres.

Activities	• Provision of a sheltered waterway for companies operating on the common-user shorefront area and adjacent freehold sites. Type of activity anticipated is the supply of modules and manufactured components to the oil, gas and resource industry sectors. There is the potential for six loadouts per year. involving a large barge or heavy lift vessel, accompanied by four tugs, in the harbour for approximately three days. • Facilitation of the fitout or refit contracts on Floating Production Storage and Offtake (FPSO) vessels. • The proposal does not include a future dry dock, a casting basin for concrete gravity structures or "scrape and paint" jobs on vessels.
Realignment of Cockburn Road	• Initially, single carriage upgrade of Russell Road, construction of single carriage Henderson perimeter/ southern link road and construction of new carriageway on Rockingham Road. Ultimately construction of dual carriageway between Mayor Road and Rockingham Road via Russell Road.
Restricted access to waterway	• The public will have restricted access for approximately 18 days of the year during loadouts.

Zoning	• Metropolitan Region Scheme (MRS) Amendment 1001/33 South West Districts Omnibus (No. 3A). The amendment proposes the following specific changes to the zones and reservation in the MRS:
	  • Southern Harbour: the transfer of a portion of Reserve 24309 Cockburn Road, Henderson from 'Parks and Recreation' reservation to 'Industrial' zone and part of Cockburn Sound from 'Waterways' reservation to 'Industrial' zone.
	  • Southern Link Road: the transfer of vacant Crown land and portion of Reserves 39455 and 39584 Cockburn Road, Henderson and a portion of Cockburn Road reserve from 'Parks and Recreation' reservation to 'Industrial' zone and portion of Lot 2 Cockburn Road, Henderson from 'Industrial' zone to 'Parks and Recreation' reserve.
	  • Russell Road: the transfer of a portion of Lot 9 Cockburn Road from Public Purposes (WSD) reservation to Important Regional Roads reservation and Industrial zone, transferring a portion of Lot 5 Russell Road and a portion of Russell Road reserve from Important Regional Roads reservation to Industrial zone and a portion of Cockburn Road reserve from Public Purposes (WSD) reservation to Industrial zone.

3. Environmental considerations

3.1 Environmental factors

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

This proposal will allow for a harbour, an industrial area and the realignment of Cockburn Road.

The following are considered to be the environmental factors relevant to the proposal. The identification process is summarised in Table 2 and a summary of the EPA's assessment is set out in Table 3.

(a) Marine flora - loss of seagrass;

(b) Marine fauna - modification of habitat;

(c) Shoreline - impact on coastal processes;

(d) Seabed - impact on sediment regime and potential for siltation;

(e) Landform - loss of northern portion of System Six area M91;

(f) Vegetation Communities - impact on System 6 areas M91 and M92;

(g) Terrestrial fauna - impact on fauna listed on Schedule 1 of the Wildlife Conservation Act;

(h) Wetlands - impact on Lake Coogee, Brownman Swamps and Lake Mt Brown;

(i) Marine water quality - impact on water circulation and quality;

(j) Noise and vibration - associated with construction;

(k) Dust and particulates- associated with construction;

(l) Heritage - impact on sites of cultural or heritage significance;

(m) Public health and safety - in relation to consuming fish/ shellfish caught in the harbour; and

(n) Recreation - loss of open water and access to the coastline.

The above relevant factors were identified from the EPA's consideration and review of all environmental factors (preliminary factors) generated from the PER document and the submissions received (Appendix 1), in conjunction with the proposal characteristics (including significance of the potential impacts), the adequacy of the proponent's response and commitments, and the effectiveness of current management. On this basis, the EPA considers that light overspill and soil contamination factors do not require further evaluation by the EPA.

The relevant environmental factors can be broadly grouped and assessed in relation to eight significant environmental issues arising from the proposal. These are:

1. Marine waters - changes to water circulation, quality and sediments;
2. Marine flora and fauna - loss of seagrass and habitat;
3. Coastal processes - changes to nearshore processes and sediment regime;
4. System Six area M91 and M92 - loss of 10.5ha of the northern portion of M91, and impact on terrestrial flora and fauna;
5. Realignment of Cockburn Road - impact on wetlands, drainage;

Table 2. Identification of Relevant Environmental Factors

FACTOR	PROPOSAL COMPONENT WITH POSSIBLE IMPACT	GOVERNMENT AGENCY AND PUBLIC COMMENTS	IDENTIFICATION OF RELEVANT ENVIRONMENTAL FACTORS
BIOPHYSICAL			
Marine flora	Through the construction of breakwaters, dredging and reclamation there will be a: • loss of 2.9 ha of seagrass (2.1ha dense and 0.8ha sparse); and • loss of approximately 20.29ha of limestone reef/ pavement and mixed reef and seagrass habitat It should be noted that these figures are from the PER (HGM, 1997).	The majority of submissions focussed on: • the amount of seagrass that has already been lost from Cockburn Sound (ie approx 750ha of an original 3900ha remain in Cockburn Sound) ; • the direct loss of 220ha of existing habitat, including 2.9ha of seagrass and 20.29 ha of limestone reef/ pavement and mixed reef and seagrass habitat; • other areas of dense seagrass cover (both nearshore and offshore) in the proximity of the proposal which may be subject to increased stress through light limitation, increased phytoplankton, increased epiphyte densities and increased water column turbidity from channel dredging and shipping movements. • the draft environmental impact assessment policy for the protection of marine benthic primary producer habitats. Comments raised here indicated that the draft policy statement seeks to limit cumulative, irreversible loss of key primary producer habitat to less than 5% of its original cover and that approval for the destruction of further seagrass would be inconsistent with this draft policy.	Marine flora is considered to be a relevant factor and is discussed under the issue of marine flora and fauna.
Marine fauna	Through the construction of breakwaters, dredging and reclamation there will be a loss of approximately 19 ha of limestone reef/pavement and mixed reef and seagrass habitat.	Comments made in submissions related to the impact on small invertebrates.	Marine fauna is considered to be a relevant factor and is discussed under the issue of marine flora and fauna.
Shoreline	The breakwater and harbour configuration may lead to a possible change in nearshore processes.	Concern was expressed in submissions in relation to the impact of the Southern Harbour on coastal processes and sediment transport and what impact these will have on beaches on the southern side of Woodman Point.	Shoreline is considered to be a relevant factor and is further evaluated under the issue of coastal processes.

Table 2. Identification of Relevant Environmental Factors

FACTOR	PROPOSAL COMPONENT WITH POSSIBLE IMPACT	GOVERNMENT AGENCY AND PUBLIC COMMENTS	IDENTIFICATION OF RELEVANT ENVIRONMENTAL FACTORS
Seabed	Through the construction of breakwaters, dredging and reclamation, there is potential for change in the nearshore sediment regime and potential for siltation of the dredged channel.	No comments made.	Seabed is considered to be a relevant factor and is discussed under the issue of coastal processes.
Landform	The proposal will result in the: • loss of 10.5ha of coastal limestone habitat which forms part of System Six area M91. • removal of an approximate 900m length of limestone cliff formation; and • and 30 ha of Quaternary dunes.	**DEP** - The Tamala limestone platform is of high conservation value and important regionally as it is the most extensive platform and cliffs on the mainland in the region. The limestone coastal cliff and platform is also unusual in that the coastal and near coastal Tamala limestone ridges and associated soils (Gozzard, 1983) form the actual coastline instead of the Quindalup Dunes. Such distinctive limestone cliffs are also found on the mainland between Trigg and North Beach, at Mindarie and at Burns Beach. However these are the best developed and most extensive example in the Perth Metropolitan area. The System 6 Report (DCE, 1983) considers "....there is no similar section of coastline near Perth".	Landform is considered to be a relevant factor and is discussed under the issue of System Six area M91 and M92.
Vegetation Communities (System 6 Areas M91 (Reserve A24309, Coogee)) & M92 (Cockburn Wetlands - Western Chain)	The proposal will result in the: • loss of approx 30ha of vegetated Quaternary dunes (20ha of M92 area); • loss of approximately 40ha of the vegetation type Cottesloe Complex, as a result of the realignment of Cockburn Road through the regional open space south of Russell Road; and • severance of the southern portion of M92.	**City of Cockburn** - System 6 Reserve areas M91 and M92 support good quality vegetation of uncommon and poorly reserved vegetation types. **DEP** - the Tamala limestone platform and cliffs and associated vegetation of M91 are of high conservation value and important regionally as they represent: • a significant landform and landscape feature; • the most extensive vegetated platform on the mainland in the region with a vegetated hinterland not proposed/ approved for housing development; • a sequence of plant communities typically associated with Tamala limestones as well as a wetland community typical of such cliff edges, the combination is confined to such coastal platforms and cliffs;	Vegetated communities represented in M91 and M92 are considered to be relevant environmental factors and are discussed under the issue of System Six area M91 and M92.

Table 2. Identification of Relevant Environmental Factors

FACTOR	PROPOSAL COMPONENT WITH POSSIBLE IMPACT	GOVERNMENT AGENCY AND PUBLIC COMMENTS	IDENTIFICATION OF RELEVANT ENVIRONMENTAL FACTORS
		• a series of plant species that have not been located in other mainland coastal areas in the region; and • an area of historical interest botanically. **CALM** - M91 supports vegetation with an average condition of 4 on a scale from 1 (highly disturbed) to 5 (pristine). The reserve land is currently the subject of joint management arrangements between the Department of Conservation and Land Management (CALM), Ministry for Planning and local government. The reserve is an "A" class reserve for the purpose of 'recreation and camping". Variation of an "A" class reserve boundary requires approval from both Houses of Parliament. Submissions also raised the question of compensation or securing areas of equal conservation value based on the 'no nett loss' principle for the terrestrial habitats that will be destroyed; the severance of the east west transect from the limestone cliffs to the wetlands; the loss of conservation and recreation values of the Beeliar Regional Park and the fact that Beeliar Regional Park is listed on the register of the National Estate by the Australian Heritage Commission.	
Terrestrial fauna	The loss of approx 40ha of habitat resource which will potentially impact on fauna listed on Schedule 1 of the Wildlife Conservation Act 1950 (for example the Southern Brown Bandicoot).	Concern was expressed in relation to the impact of the road realignment on faunal movement through Reserve M92 and the impact on the Southern Brown Bandicoot and the Western Brush Wallaby which are listed as Near Threatened in the 1996 Action Plan for Australian Marsupials and Monotremes.	Terrestrial fauna is considered to be a relevant factor and is discussed under the issue of System 6 area M91 and M92.

Table 2. Identification of Relevant Environmental Factors

FACTOR	PROPOSAL COMPONENT WITH POSSIBLE IMPACT	GOVERNMENT AGENCY AND PUBLIC COMMENTS	IDENTIFICATION OF RELEVANT ENVIRONMENTAL FACTORS
Wetlands	Possible impact on water quality at Lake Coogee, Brownman Swamps and Lake Mt. Brown.	Community concern focused on: • Environmental impacts resulting from the close proximity (40m) of the Fremantle to Rockingham Controlled Access Highway to the western shore of Lake Coogee in relation to road runoff, deterioration in the water quality of the lake, impact on avifauna, reduced amenity; • the impact of the proposed realignment of Cockburn Road through Brownman Swamps Reserve and Mt Brown. **City of Cockburn** - The M92 wetland systems contain Brownman Swamps and Lake Mt Brown which represent the freshwater end of the spectrum of wetlands within the Coogee suite of consanguineous wetlands and are regionally significant as they are not represented elsewhere on the Swan Coastal Plain. The report by V & C Semeniuk Research group found that the wetlands appear to be hydrologically linked and may assume international importance on the basis of the presence of dolomite and carbonate precipitates within the wetlands.	Wetlands is considered to be a relevant factor and is discussed under the issues of System 6 area M91 and M92 and realignment of Cockburn Sound.

Table 2. Identification of Relevant Environmental Factors

FACTOR	PROPOSAL COMPONENT WITH POSSIBLE IMPACT	GOVERNMENT AGENCY AND PUBLIC COMMENTS	IDENTIFICATION OF RELEVANT ENVIRONMENTAL FACTORS
POLLUTION			
Marine water quality	Through the construction of breakwaters, dredging and reclamation there will be: • potential impacts on nutrient concentrations in the vicinity of the harbour; • changes to circulation patterns within Cockburn Sound; • an increase in residence time of water within the Southern Harbour; • impacts on residence times of the Northern Harbour; • ballast water discharge; • potential for further tributyltin contamination of the sediments; and • turbidity through localised and temporary plumes of suspended sediment generated during construction of the breakwaters, reclamation of the berth areas and dredging of the channel.	The majority of submissions expressed concern in relation to poor water quality already experienced in Cockburn Sound and the impact of the harbour on flushing and circulation. The DEP submitted a detailed submission which focussed on the impact of the harbour on water quality, hydrodynamic flushing and circulation, sediment quality, phytoplankton blooms and the need for a cumulative impact study. The DEP also raised concerns in relation to the impact of the southern harbour in terms of water quality within the harbour, between the proposed harbours and in Cockburn Sound. Other issues raided in submissions focused on the impact of tributyltin and ballast water and the cumulative impact of proposed developments.	Marine water quality is considered to be a relevant factor and is discussed under the issue of marine waters.
Noise and vibration	Construction activities may generate noise and vibration.	No comments made.	Noise and vibration is considered to be a relevant environmental factor and is discussed under the issue of noise and dust.

Table 2. Identification of Relevant Environmental Factors

FACTOR	PROPOSAL COMPONENT WITH POSSIBLE IMPACT	GOVERNMENT AGENCY AND PUBLIC COMMENTS	IDENTIFICATION OF RELEVANT ENVIRONMENTAL FACTORS
Particulates/ dust	Construction activities may generate dust.	Submissions expressed concern that air pollution will increase over the whole metropolitan region through increased vehicular traffic, that contamination from atmospheric pollutants from the proposed road realignment has been completely ignored and that no reference has been made to the Kwinana Air Quality Buffer Zone policy.	Particulates/ dust is considered to be a relevant environmental factor and is discussed under the issue of noise and dust.
Light overspill	There are no residential areas in the vicinity of the harbour. Some residents near the northern section of Cockburn Road realignment may be affected.	No comments made.	Light overspill is not considered to be a relevant factor.
Soil contamination	During construction/ site works contaminated material may be uncovered.	No comments made.	Soil contamination is not considered to be a relevant environmental factor.
SOCIAL SURROUNDINGS			
Heritage (indigenous and non-indigenous cultures)	Through construction there may be possible impact on several sites of cultural significance.	**Aboriginal Affairs Department** - The proponent will need to address the probable presence of subsurface artefactual and skeletal material prior to and during development.	Heritage is considered to be a relevant environmental factor and is discussed under the issue of heritage.
Public health and safety	There is potential for increase in levels of TBT in mussels. Safety issues in relation to ongoing industrial use of the harbour.	Submissions raised questions in relation to whether the proponent would be erecting warnings in the area surrounding the harbour advising the public that pollution from within this facility is likely to render seafood that enter the are unfit for human consumption.	Public health and safety is considered to be a relevant environmental factor and will be discussed under the issue of recreation.
Recreation	Through the construction of the harbour there will be loss of open water and access to the coastline.	In terms of recreation submissions, focussed on the issue of beach access, the displacement of recreational uses (ie fishing, and boating), the loss of Parks and Recreation Reserves and areas of coastline and whether the area would be an exclusion zone to the public.	Recreation is considered to be a relevant environmental factor and is considered under the issue of recreation.

Table 2. Identification of Relevant Environmental Factors

FACTOR	PROPOSAL COMPONENT WITH POSSIBLE IMPACT	GOVERNMENT AGENCY AND PUBLIC COMMENTS	IDENTIFICATION OF RELEVANT ENVIRONMENTAL FACTORS
Realignment of Cockburn Road and traffic	During construction and operation of the facility there may be an increase in traffic volumes. The realignment of Cockburn Road will impact on Beeliar Regional Park.	**City of Cockburn** supports a modified version of Scenario 3 (as outlined in the PER) which gives priority to Rockingham/ Stock Road, provides a direct connection from Cockburn Road north to Rockingham Road via Russel Road and provides a two lane distributor road to the east of Henderson between Russell Road and Cockburn Road. **Environment Australia** in its submission indicated that all options except scenarios 2 and 4 would have an adverse impact on the national estate values of the Beeliar Regional Park. In view of significant national estate values in the Brownman Swamps, Lake Mount Brown area, scenarios 1, 3, 5 and 6 would have a significant adverse impact on the national estate values of the Beeliar Regional Park and surrounding area. **Ministry for Planning** indicated that the preferred alignments for future rail and Rowley Road alignments, between the coast and slightly east of the existing railway line, which will service the port expansion, has been agreed in principle. The preferred alignments will involve the closure of the existing Cockburn Road south of the Jervoise Bay proposal. It is considered that the progression of the preferred alignments will not impact on the proposed development. **CALM** indicated that its first preference is that Rockingham Road (Option 2) is used as an alternative as this totally avoids any further fragmentation of Beeliar Regional Park. CALM's other preferences would be to follow option 4 (Cockburn - Russell Road) until Rockingham Road (option 2) or Option 4 (Cockburn - Russell Road) and then diverting along option 7 to the south until this meets Rockingham Rd.	The realignment of Cockburn Road is considered to be a relevant environmental factor and is discussed under the issues of System 6 area M91 and M92 and Realignment of Cockburn Road.

Table 3. Summary of Assessment of Relevant Factors

RELEVANT ISSUE	RELEVANT AREA	EPA OBJECTIVES	EPA ASSESSMENT	EPA ADVICE
BIOPHYSICAL				
Marine flora and fauna	The shallow eastern margin of Cockburn Sound between James Point and Woodman Point.	(i) To maintain the ecological function, abundance, species diversity and geographic distribution of seagrasses. (ii) to maintain the ecosystem function, abundance, species diversity, productivity and geographic distribution of marine faunal communities.	The EPA notes: • the proposal has been redesigned in response to submissions. These design changes include an island breakwater which is 250m closer to the shore and a southerly adjustment in the approach channel; • the proposal now results in the direct loss of approximately 220ha of existing habitat through the impacts of dredging, reclamation and breakwater construction. This habitat consists of 200.5ha of bare sand, 17.4 ha of low relief reef and 2.1 ha of dense seagrass meadow. In addition, 0.2 ha of reef with small invertebrates will be directly impacted on by the development; and • previous EPA decisions (Cockburn Cement) and conclusions within EPA Bulletin 907 in relation to seagrass. The proponent has made commitments to: • manage the impact of turbidity on seagrasses near the western end of the channel during dredging through implementation of a dredge management plan; and • contribute up to $50,000 to fund a seagrass revegetation study in Cockburn Sound to develop and implement techniques for successful seeding and transplanting of *Posidonia sinuosa* to mitigate for the loss of seagrasses associated with the construction of the Southern Harbour.	The DCT has modified the proposal to reduce seagrass loss, but the re-design of the harbour does not fully avoid seagrass loss. While the amount of seagrass being considered in relation to this project is not large, the EPA needs to provide advice taking into account the historical reduction in seagrass abundance in Cockburn Sound. The impact of the proposal will be to further reduce the seagrass abundance and potential habitat, and within this context the proposal is not able to meet the EPA's objectives for this issue. The EPA has provided recommended environmental conditions in Appendix 3 if the proposal is to be implemented.
Landform	The relevant area includes: • Northern portion of System Six area	Protect representative land systems.	The EPA notes that in relation to landform that: • 10.5 ha of System 6 area M91 which includes limestone habitat and an approximate 900m length of low coastal limestone cliff will be lost;	The EPA concludes that the conservation values that would be lost as a result of this proposal cannot be replaced as there are no

Table 3. Summary of Assessment of Relevant Factors

RELEVANT ISSUE	RELEVANT AREA	EPA OBJECTIVES	EPA ASSESSMENT	EPA ADVICE

	M91 which represents 10.5ha of coastal limestone habitat;
	• 30 ha of vegetated quaternary dunes (20ha of M92 area).
			• the proponent is examining options for offsetting this loss through provision of land of equivalent environmental value elsewhere;
			• this landform does not occur elsewhere near Perth; and
			• the proponent has made commitments to:
			  • seek to progress transport corridor planning in the locality with the aim of ensuring isolated bushland contiguous with Beeliar Regional Park is available for consolidation into the Park;
			  • incorporate areas of the highway reservation south of Russell Road into the Beeliar Regional Park; and
			  • landscape and rehabilitate the surplus highway reserve land.
				known sites that are not already protected in the Perth Metropolitan Area. Accordingly, the EPA is of the view that the proposal cannot be managed to meet EPA objectives for this issue.
				
				The EPA has provided recommended environmental conditions in Appendix 3 if the proposal is to be implemented.

Coastal processes	The relevant area includes the coast to the north and south of proposed development and the seabed.	(i) Development should not have a significant impact on existing coastal processes, including off-shore sediment movement; and (ii) Maintain the integrity, function and environmental values of the foreshore area.	The EPA notes that: • the proposed harbour may influence local coastal processes (sand transport and beach shape) by trapping sand movement and reflecting wave energy; and • the beach at Woodman Point has been subjected to some erosion following completion of the Northern Harbour. The proponent has committed to: • review aerial photographs on an annual basis to determine any trends of erosion or accretion following construction of the harbour; • prepare and implement a coastal monitoring plan which includes remedial works; and • undertake a further wave modelling study, before the construction of the island breakwater, to fine tune the alignment to ensure that here will be no undue impacts on Woodman Point.	The EPA concludes that the proposal can be managed to meet the EPA's objectives.
Terrestrial flora and	System 6 Areas M91	To maintain the abundance,	The EPA notes that:	The EPA concludes that the

Table 3. Summary of Assessment of Relevant Factors

RELEVANT ISSUE	RELEVANT AREA	EPA OBJECTIVES	EPA ASSESSMENT	EPA ADVICE
			alignment to ensure that here will be no undue impacts on Woodman Point.	
Terrestrial flora and fauna associated with System Six areas M91 and M92	System 6 Areas M91 (Reserve A24309, Coogee) & M92 (Cockburn Wetlands - Western Chain) west of the Controlled Access Highway.	To maintain the abundance, diversity and geographic distribution of vegetation communities and terrestrial fauna	The EPA notes that: • there will be a loss of 40 ha of Cottesloe complex vegetation association; • during the redesign of the project, the proponent proposed an alternative Cockburn Road realignment which avoids bisecting Beeliar Regional Park and that this alternative alignment will link the new Cockburn Road via Russell Road; • the proponent has indicated that this road rearrangement will provide the opportunity for a potential net increase of about 25ha to the area of Beeliar Regional Park through the deletion of the southern portion of the Controlled Access Highway reservation which will not be required; • the revised approach to the realignment of Cockburn Road will result in minimal impacts on the vegetation within M92; • the new road realignment should also facilitate the survival of faunal species such as the bandicoot; and • the proponent has made a commitment to carry out a threatened flora survey followed by he preparation and implementation of a management plan, prior to the commencement of vegetation clearing.	The EPA concludes that the conservation values that would be lost as a result of this proposal cannot be replaced as there are no equivalent sites that are not already protected in the Perth Metropolitan Area. Accordingly, the EPA is of the view that in this context the proposal cannot be managed to meet EPA objectives for this issue. The EPA acknowledges and supports the deletion of the portion of Cockburn Road along the Fremantle-Rockingham CAH route south of Russell Road. The EPA considers M91 and M92 should be protected. The EPA has provided recommended environmental conditions in Appendix 3 if the proposal is to be implemented.
Wetlands	Lake Coogee, Brownman Swamps and Lake Mt Brown.	Protect the integrity, functions and environmental values of wetlands.	The EPA notes that: • during the redesign of the project, the proponent proposed an alternative Cockburn Road realignment which avoids bisecting Beeliar Regional Park and that this alternative alignment will link the new Cockburn Road via Russell Road;	The EPA acknowledges and supports the deletion of the portion of Cockburn Road along the Fremantle-Rockingham CAH route south of Russell Road. This avoids significant protection to

Table 3. Summary of Assessment of Relevant Factors

RELEVANT ISSUE	RELEVANT AREA	EPA OBJECTIVES	EPA ASSESSMENT	EPA ADVICE

			• at one point lake Coogee (an EPP wetland) is separated from the Controlled Access Highway (CAH) alignment by 40m. At this point the alignment is constrained by the Water Corporations wastewater infrastructure to the west;
			• the proposed development will not alter the conservation status of the wetland systems protected by Beeliar Regional park;
			• the proponent has committed to:
			  • to prepare and implement a detailed drainage design monitoring programme (as part of the Environmental Management Plan) to protect Lake Coogee from further reductions in water quality due to the proximity of the highway.
			  • prepare a Rehabilitation and Landscape plan as part of the Environmental Management Plan prior to commencement of construction.
			  • preparing and implementing a monitoring programme of water quality in Lake Coogee to include hydrocarbons, lead nitrogen and phosphorous. baseline data will be collected prior to road realignment and control data obtained from other wetlands.
			  • undertake DRF and priority Flora surveys of the alignment route in spring.
			  • providing community access via a dual use path and the provision of viewing platforms on the foreshore of lake Coogee.
				Brownman Swamps and Lake Mt Brown.
				
				The EPA concludes that the Cockburn Road realignment segment of the proposal could be managed to meet the EPA's objectives.

POLLUTION				
Marine waters	Cockburn Sound, and in particular the north eastern portion	(i) Maintain or improve the quality of marine water consistent with the draft WA	The EPA notes that: • the proponent has redesigned the marine component of the proposal to include an island breakwater. This revised	The scale and shape of the proposed harbour results in a substantial mass (the harbour)

Table 3. Summary of Assessment of Relevant Factors

RELEVANT ISSUE	RELEVANT AREA	EPA OBJECTIVES	EPA ASSESSMENT	EPA ADVICE

	containing the proposed harbour and Jervoise Bay	Guidelines for Fresh and Marine Waters (EPA, 1993).
		
		(ii) Maintain or improve marine water and sediment quality consistent with EQO's and EQC defined in the SMCWS (1996)
			configuration increases flow through the harbour though its northern entrance (180m), is approximately 250m closer to the shore and reduces the size of hydrodynamic 'shadowing' of Jervoise Bay. The offshore breakwater is approximately 2.05km long, the southern breakwater is approx 1.25km in length and the southern entrance width is approximately 300m;
			• the autumn e-folding time of the harbour has been reduced from the order of 12 days as originally proposed (with a 50 m gap in the breakwater) to the order of 5-6 days when the revised layout is modelled within a new domain with temporary causeway and 50% construction of breakwater, to 3-5 days when the revised layout is modelled in its final configuration;
			• the proponent has committed to:
			  • undertaking a five year programme of sediment and water quality monitoring to include sampling for phytoplankton, screening for toxic species, quarterly measurements of average vertical light attenuation coefficient, faecal coliforms, total nitrogen, dissolved inorganic nitrogen, chlorophyll a and dissolved oxygen concentration; and annual measurements of heavy metals, TBT and organic sediment;
			  • incorporating the requirements of the most recent ANZECC guidelines for TBT management in the Operational and Contingency Management plan for the development;
			  • ensuring that biannual surveys for toxic dinoflaggelates will be conducted and the AQIS ballast water management procedures will be followed as part of the Contingency and Operational Management Plan;
				reducing water circulation further north into Jervoise Bay, and reducing circulation in the area covered by the harbour. Reduced flows to the north of the harbour will lead to poorer circulation in the remainder of Jervoise Bay, which will likely result in enhanced conditions for biological activity, and may result in algal blooms. The consequence of this is that a poor water quality in Jervoise Bay will get worse. The chlorophyll a levels are above the draft nutrient - related environmental quality criteria set out in the SMCWS (DEP, 1996), and the impact of the proposal is likely to lead to a further increase in this level. Within this context the proposal is not able to be managed to meet the EPA's objectives.
				
				The EPA has provided recommended environmental conditions in Appendix 3 if the proposal is to be implemented.

Table 3. Summary of Assessment of Relevant Factors

RELEVANT ISSUE	RELEVANT AREA	EPA OBJECTIVES	EPA ASSESSMENT	EPA ADVICE
			• prepare and implement a management plan to address monitoring requirements, stormwater management, breakwater maintenance, navigation issues and a contingency plan setting out procedures to control and mitigate possible degradation in water or sediment quality. • The EPA considers that the design and consequent flushing of the harbour has improved and that construction will be scheduled to avoid the coincidence of the most enclosed configuration and calm autumn conditions. • In relation to the recent strategic environmental assessment of Cockburn Sound, the EPA is concerned that the cumulative effect of a number of large scale developments along the eastern margin will reduce the rate of exchange of water between the eastern margin and the remainder of the sound and that harbour structures will adversely affect water quality through reduced water circulation and increase the likelihood of algal blooms.	
Noise and dust	Area west of Rockingham Road between Woodman Point and Mt Brown.	(i) Protect the amenity of nearby residents from noise and vibration impacts resulting from activities associated with the proposal by ensuring that noise and vibration levels meet statutory requirements and acceptable standards. (ii) Ensure that dust levels generated by he proposal do	The EPA notes that: • Russell Road will be upgraded next to the school; • the proponent will comply with the Environmental Protection (Noise) Regulations 1997 and Land Development Sites and Impact on Air Quality Guidelines (DEP, 1996). • the proponent has made a commitment to prepare an Environmental Management Plan for the construction phase of the project, before commencement of construction that will include plans to manage dust and noise during construction to avoid undue disturbance to	Having particular regard to noise and dust it is the EPA's opinion that the proposal can be managed to meet the EPA's objective. The EPA has provided recommended environmental conditions in Appendix 3 if the proposal is to be implemented.

Table 3. Summary of Assessment of Relevant Factors

RELEVANT ISSUE	RELEVANT AREA	EPA OBJECTIVES	EPA ASSESSMENT	EPA ADVICE
		not adversely impact upon welfare and amenity or cause health problems by meeting statutory requirements and acceptable standards..	local residents.	
SOCIAL				
Heritage	Area west of the Controlled Access Highway between James Point and Woodman Point and land adjoining Russell Road.	To ensure that changes to the biophysical and physical environment resulting from the project do not adversely affect cultural associations with the area.	The EPA notes that: • two sites of Aboriginal ethnographic significance have been identified within the Southern Harbour location, namely the nearshore waters and the chain of islands extending to Rottnest and including Cockburn Sound. The second is the limestone ridge running parallel to the coast through the proposed Industrial Estate; • Cockburn Sound's nearshore waters and the associated coastal lands are subject to several overlapping native title claims; • in relation to the Realignment of Cockburn Road, the survey documented one site of archaeological significance within the project development area to the west of Lake Coogee (quartz artefact scatter); • the ethnographic assessment for the road realignment has yet to be completed; • the proponent has committed to developing and implementing a strategy for the treatment of subsurface artefactual or skeletal material to respond to the uncovering of any subsurface artefactual or skeletal material prior to commencement of the onshore earthworks component of the development.	Having particular regard to heritage it is the EPA's opinion that the proposal can be managed to meet the EPA's objective.
Recreation	Eastern margin of Cockburn Sound between James Point and Woodman Point.	To maintain the quality of the broader area in relation to boating, fishing, swimming and coastal use.	The EPA notes that: • there will be a loss of more than 200ha of water area and 11ha of coastline with some existing recreational use; • the proposal will impact on fish habitat areas but that the proposed breakwaters will create approx 11ha of new	Having particular regard to recreation it is the EPA's opinion that the proposal can be managed to meet the EPA's objective.

Table 3. Summary of Assessment of Relevant Factors

RELEVANT ISSUE	RELEVANT AREA	EPA OBJECTIVES	EPA ASSESSMENT	EPA ADVICE
			rock (artificial reef) habitat. • the FRIARS committee has agreed that a social impact analysis will be commissioned as part of the FRIARS study, and that this assessment will involve all community sectors with an interest and involvement in the area; • public will now be allowed controlled access to the southern harbour; and • the proponent has indicated that the only possible exclusion zone would be inside the proposed harbour for the reason of public safety when moving large vessels; The proponent has made commitments to: • erect signs, to notify the public, that the taking of shellfish and other filter feeding marine life is prohibited for human health reasons; and • to only control access to the harbour waters by the general public during the movement of large vessels for safety reasons.	

6. Noise and dust - impacts associated with construction of the harbour and road realignment;
7. Heritage - impact on sites of cultural significance; and
8. Recreation - loss of open water and access to the coast; public health and safety.

The relationship between the relevant environmental factors and significant environmental issues arising from the proposal is shown in Table 4.

Table 4. Relationship Between Factors and Issues

Relevant Environmental Factor	Environmental Issue
Marine water quality	Marine waters - changes to water circulation, quality and sediments
Marine flora, Marine fauna	Marine flora and fauna - loss of seagrass and habitat
Shoreline, Seabed	Coastal processes - changes to nearshore processes and sediment regime
Landform, Vegetation Communities associated with M91 and M92, terrestrial fauna	System Six area M91 and M92 - loss of 10.5ha of the northern portion of M91, and impact on terrestrial flora and fauna
Vegetation Communities associated with M92, Terrestrial fauna, Wetlands	Realignment of Cockburn Road - impact on wetlands, drainage
Noise and vibration, dust and particulates	Noise and dust - impacts associated with construction of the harbour and road realignment
Heritage	Heritage - impact on sites of cultural significance
Public health and safety	Recreation - access to the coast, risk of eating contaminated shellfish
Recreation	Recreation - loss of open water and access to the coast

The environmental significance of the above issues of the proposal and their assessment are discussed in Sections 3.2 to 3.9 of this report. The description of each issue shows how it relates to the project. The assessment of each issue, combined with the consideration of the environmental factors relevant to it, is where the EPA considers if the proposal can be managed to meet its environmental objectives.

3.2 Marine waters - changes to water circulation, quality and sediments

Description

The revised harbour development will lead to the enclosure of approximately 191ha of Cockburn Sound. This includes 131 ha of water area within the breakwaters and a further 60ha being reclaimed by fill and dredge spoil. This total area is an increase from the original 150ha (HGM 1997), primarily as a result of the inclusion of the pre-existing MSF. Redesign of the development has also reduced the extent of the intrusion of the northern breakwater into Cockburn Sound from 1.8 km to 1.5 km.

The PER proposes a 14.7m deep channel and harbour, and is assessed on this basis although the initial works and the related EMP will be for a 12m deep channel and harbour. At 12m, all dredge spoil will be used in land reclamation.

Should a project come along that requires a 14.7m channel and harbour, the proponent would address the additional dredge spoil disposal through a further EMP.

Agency and public comments

Submissions and comments on the PER expressed concern about the implications of the proposed harbour on water quality and water circulation. Some of the key concerns were:

- The PER (Section 5.4) has failed to demonstrate that there will be no significant changes in basin-scale (Cockburn Sound) circulation, flushing and exchange of contaminants between the Sound and external waters due to the presence of the proposed breakwater.
- The modelling for the PER predicts that, external to the proposed breakwaters, two 'shadow' areas of weak currents (covering an area equivalent to about three times the proposed harbour) would be formed as a result of the proposal. Together with the historical and existing poor nutrient-related water quality in the surrounding waters of Jervoise Bay and the eastern Cockburn Sound margin, increased retention times in these 'shadow' areas are likely to result in further water quality deterioration.
- The PER predicted increases in retention times of the proposed Southern Harbour site (5-fold increase) and the MSF (3.8-fold increase) as a result of the breakwater construction. Together with the historical and existing poor nutrient-related water quality in the surrounding waters of Jervoise Bay and the Cockburn Sound eastern margin, these prolonged retention times (coupled with phytoplankton doubling times of 1-2 days) are likely to result in further water quality deterioration in these areas.
- Although the hydrodynamic flushing time of the Northern Harbour itself may not change, it will receive source waters from inner Jervoise Bay, an area of PER-predicted weakened circulation due to the proposed breakwaters. Hence the nutrient-related water quality of the 'source' waters may be expected to decline. In this way the proposal may indeed have an adverse influence on the water quality of the Northern Harbour.
- Under southwesterly winds, water, nutrients and phytoplankton will be advected northward from the James Point region (near the CSBP site) along the eastern Cockburn Sound margin to the proposal site. This constitutes a major alternative nutrient source in addition to local nutrient inputs through groundwater discharge.
- The PER notes the proliferation of filamentous green algae (Chlorophyta) on reefs and limestone outcrops in the study area. The PER also acknowledges that Chlorophyta are often associated with eutrophic conditions. The eutrophic condition of the eastern margin of Cockburn Sound has been repeatedly documented as a result of studies and monitoring over the past twenty years. Yet the proponents are proposing to build extensive breakwaters in this eutrophic area which will increase the retention time of enclosed waters by a factor of five and reduce the flushing rates of surrounding waters.
- What caused the algal bloom in the Northern Harbour? How comparable is that situation to that for the Southern Harbour?
- What lessons have been learnt, in terms of water quality and the Northern Harbour, and how will the proponent ensure an algal bloom doesn't occur in the Southern Harbour?
- Any oil spill from the proposed development will pollute the clean waters of Coogee Beach. What measures/contingencies will be in place to prevent this from occurring?
- What management system will the proponent put in place to ensure materials such as hydrocarbons, heavy metals, paint and coating materials do not get into the water directly and that traps are readily serviced and really work? Will practices such as stripping hull coatings in the water by divers be prohibited?

Commitments

The proponent has made a number of commitments in relation to managing environmental impacts arising from construction and operation of the proposed harbour. These include:

1. Preparing an Environmental Management Plan (Construction) to address all issues of construction which potentially impact on the environment including noise, dust, turbidity and erosion. A risk assessment and management approach will be incorporated in the EMP (Construction) including a coastal monitoring plan outlining options for any sand bypassing remedial work.

2. Preparing an Environmental Management Plan (Operations) for the harbour and shorefront industrial estate, to include:

   - monitoring requirements;
   - clean-up and containment procedures;
   - stormwater and waste management;
   - breakwater maintenance; and
   - navigation issues.

   The stormwater containment measures will include permeable drainage pits with access points for cleaning and inspection. A regular stormwater system maintenance schedule will be implemented and direct discharge of any other form of waste stream into the harbour will be prohibited.

   A risk assessment and management approach will be incorporated into the EMP (Operations) which will include:

   - AQIS ballast water management procedures
   - contingency plan for the treatment and clean up of oil and other spills to control and mitigate possible degradation in water and sediment quality
   - annual reviews of aerial photographs taken by the Department of Land Administration to determine any trends in erosion or accretion.

3. Monitor marine water quality in the Jervoise Bay region by implementation of a water quality monitoring programme which includes sampling for, or measurements of:

   - light penetration
   - phytoplankton (including screening for toxic phytoplankton species);
   - total nitrogen;
   - dissolved inorganic nitrogen;
   - chlorophyll a and
   - dissolved oxygen concentration; and
   - temperature and salinity profiles.

   Monitoring surveys will be conducted over the summer months. The programme will be detailed in consultation with DEP as part of the preparation of the Marine EMP.

   The target water and sediment quality criteria for the harbour will be determined in consultation with the DEP when the substantially revised ANZECC water and sediment quality guidelines are released.

4. Monitor sediment quality in the Jervoise Bay region through a programme which includes annual measurements of:

   - heavy metals;
   - tributyltin (TBT) compounds: and
   - organic content.

5. Adopt best practice in respect of the management of TBT through the preparation of specific management plans for control of TBT in accordance with the latest ANZECC guidelines.

Assessment

The area considered for assessment of this factor is Cockburn Sound, and in particular the north eastern portion containing the proposed harbour and Jervoise Bay.

Relevant environmental factors

The following relevant environmental factors were identified from consideration and assessment of the potential direct and indirect impacts to marine waters resulting from the proposed development.

Relevant Factor	EPA Objective
Marine water circulation	(i) Maintain or improve the quality of marine water consistent with the draft WA Guidelines for Fresh and Marine Waters (EPA, 1993). (ii) Maintain or improve marine water and sediment quality consistent with environmental quality criteria set out in the SMCWS (DEP, 1996).
Marine water quality	(i) Maintain or improve the quality of marine water consistent with the draft WA Guidelines for Fresh and Marine Waters (EPA, 1993). (ii) Maintain or improve marine water and sediment quality consistent with environmental quality criteria set out in the SMCWS (DEP, 1996).

Water Circulation

One of the reasons for revision of the harbour design was to improve water exchange between the harbour and the surrounding waters. The redesign has lead to the proposal for an island breakwater with a gap of 180m between an extended spur breakwater off the existing Northern Harbour breakwater, and retention of the 300m gap at the main entrance to the harbour.

Harbour flushing-times have been modelled as part of the harbour design. The DEP requested DCT's consultant's to model the revised harbour design and the DEP commissioned Kinhill to independently model the revised design, with and without the possible FPA harbour (Option 7A). This was undertaken so that the EPA could gauge the individual and cumulative effects of these proposals.

The PER indicated that the original harbour design would result in harbour flushing times in the order of 10 days under summer (sea breeze cycle) conditions and greater than 20 days under autumn conditions. By including a 50m gap in the Southern Harbour northern breakwater, the flushing time would be reduced to 5 days under south-west conditions and 12 days under autumn conditions (HGM, 1997).

Table 5 (Kinhill, 1998b) shows modelled flushing times for several zones both within and adjacent to the Southern Harbour Precinct proposal. For each of these zones the flushing times have been modelled for (1) the existing situation (without the Southern Harbour Precinct), (2) the original Southern Harbour Precinct design (as given in the PER) together with a future FPA harbour concept (Option 7A), (3) the revised Southern Harbour Precinct design in the absence of a future FPA harbour concept (Option 7A), and (4) the revised Southern Harbour Precinct design together with a future FPA harbour concept (Option 7A) (refer to Figure 6). The flushing times are estimated by mathematical models operating under a set of assumptions, and their absolute values depend on the strength of the wind forcing used in the model. Therefore, the primary interest of the EPA in this table is the relative change in the predicted flushing times within each zone, rather than their absolute values.

Table 5. Estimated Flushing Times (days) for Southern Harbour Development Scenarios*****

Model zone	Existing (without Southern Harbour)	PER proposed Harbour	Revised DCT Harbour	Revised DCT Harbour (with potential FPA harbour)
Southern Harbour Precinct	0.4	9.5 *	2.0	2.1
Marine Shiplift Facility (MSF)	1.2	3.8	1.9	1.9
Jervoise Bay (Woodman Point - Southern Harbour)	5.2	7 *	6.2	6.6
South of Southern Harbour	1.1	5.5	3.1	5.3

* these zones are slightly larger in the case of the PER proposed harbour.

** using summer (sea-breeze cycle) wind forcing (February - March 1993).

*** results from Kinhill (1998 a and b).

As indicated by Kinhill (1998b), the modelling shows "that the proposed modification in the design has lead to a significant improvement in the flushing of the harbour as compared to the previous design (as presented in Kinhill, 1998a). Flushing times [of the modified harbour] are almost identical for development scenarios with and without FPA 7A option harbour" (Kinhill 1998b p2-4).

Kinhill has advised that flushing has also improved for the MSF harbour relative to what it would have been with the previous design. However "flushing times for Jervoise Bay display reduced influence of current design of Southern Precinct Harbour on bay's flushing compared to PER design. Furthermore, the scenario without FPA 7A option harbour shows even smaller difference between the flushing times for existing conditions and development scenario" (Kinhill, 1998b p2-4).

The Kinhill modelling suggests that the revised design will increase the time taken to flush the harbour site, relative to existing conditions, by a factor of 5. This is a substantial improvement over the PER design, which would have caused an increase by a factor of more than 10, relative to existing flushing times. The presence of the revised Southern Harbour proposal would increase flushing times for the area of Jervoise Bay, even under the relatively favourable wind conditions used in the model, ie typical summer sea-breeze cycle conditions.

Construction of the island breakwater could be undertaken in several different ways. The preferred option is to construct the breakwater as an extension of the spur on the existing northern breakwater, and then to create the gap of 180m by removing that portion of the breakwater (DCT, 1998). DCT's consultant's have predicted that, during construction of the breakwater using this option, circulation within the harbour will be up to approximately 5-6 days, and that this will reduce to 3-4 days once the breakwater is completed and the temporary portion removed.

Table 5 also outlines the predicted changes to flushing times for the adjacent region to the south of the proposed harbour under summer wind conditions. Construction of the harbour will create a substantial barrier extending 1.5 km from the shoreline. Compared to the existing situation, the flushing times for this zone are predicted to increase three-fold if the proposed harbour is constructed, and five-fold if, subsequently, the possible FPA harbour (Option 7A) were to proceed.

Contaminants

There was a rapid increase in environmental contaminants and nutrients discharged into Cockburn Sound during the 1960's and 1970's, and then a progressive decline in the discharges over the past two decades. A key biostimulant in these discharges has been nitrogen. In 1994, annual nitrogen loads into Cockburn Sound were estimated to be about 490 tonnes, down from about 2 000 tonnes in 1978. As a result of reductions in direct discharge point sources, these sources contributed only about 30 per cent of the 1994 total nitrogen load to the Sound, and the nitrogen contribution via groundwater inflow was about 70% of the total (DEP, 1996). The groundwater contribution was primarily found south of James Point, with another focus into Jervoise Bay.

The pollutant inventory estimates have been recently updated by the DEP. In 1997, the estimated total annual nitrogen load had fallen to 421 tonnes, with groundwater contribution remaining proportionately the same as 1994 (EPA, 1998b). However, the estimated nitrogen load from groundwater discharging into Cockburn Sound must be considered as a rough estimate due to the limited data available.

Monitoring over the past two decades has revealed water quality trends in Cockburn Sound. From its worst state in the 1970's, the water quality improved during the early-mid 1980's in response to significant reductions in directly discharged nitrogen loads from industrial and domestic wastewater outfalls. However, during the late 1980's- early 1990's, the water quality in Cockburn Sound again deteriorated. The early to mid 1990's saw renewed efforts to reduce direct nitrogen loads, and a growing awareness of the importance of contaminated groundwater inflows as a source of nitrogen to the Sound. During this period the water quality remained relatively constant, with no further deterioration.

In the mid-late 1990's further initiatives to reduce nitrogen-rich waste discharges, including those to shallow groundwater aquifers, have been implemented, and water quality monitoring throughout Cockburn Sound has shown some early signs of a possible improvement in water clarity (EPA, 1998b). However this trend has not occurred in Jervoise Bay. Based on summer monitoring, water quality in Jervoise Bay has deteriorated considerably during the 1990's. The decline in water quality in this portion of Cockburn Sound probably relates to the contribution of nutrient-rich groundwater inflow and may also reflect changed water circulation patterns and nutrient retention times resulting from construction of the northern harbour in Jervoise Bay.

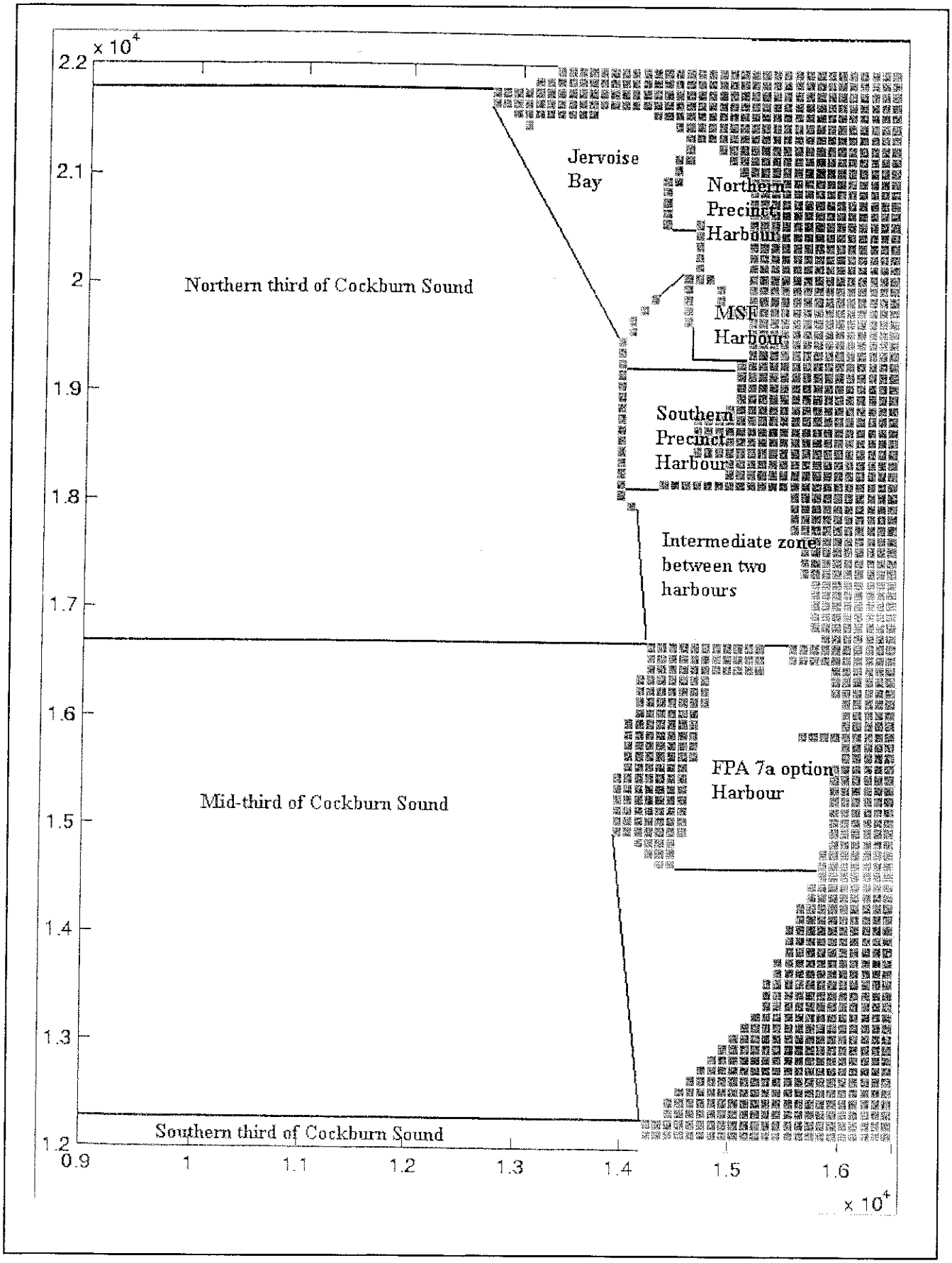


Figure 6. Model zone (Kinhill, 1998b).

In relation to biologically toxic contaminants, tributyltin (TBT) has been of significant concern. The SMCWS (DEP, 1996) indicates that very high levels of contamination were found in sediments in Jervoise Bay, primarily associated with ship-lift and boat building facilities. The MSF (and associated ship-lift) would be incorporated into the Southern Harbour under the revised design. The concentration of TBT in sediments near the MSF ship-lift exceed levels at which biological effects would be expected to frequently occur (DEP, 1996 p26). In addition, concentrations of TBT in mussels near harbours and wharves in Cockburn Sound have been recorded at levels likely to cause physiological stress in mussels (DEP, 1996 p83).

Dredging of the entrance channel and harbour has the potential to cause the release of nutrients. These nutrients are likely to lead to reduced water quality, especially within the enclosure of the harbour, and may result in phytoplankton blooms.

Sediment and turbidity will be generated during construction of the harbour, from a combination of breakwater construction, dredging and reclamation. The EPA notes that the proponent has committed to preparing an Environmental Management Plan to manage construction-related impacts.

Conclusion

Having considered the information in the SMCWS, the PER and other data, it is clear to the EPA that existing water quality in Jervoise Bay is relatively poor compared to much of the remainder of Cockburn Sound, due to the contribution of nutrients in groundwater flowing into this portion of Cockburn Sound and the movement of water carrying nutrients along the eastern portion of Cockburn Sound from the south.

The scale and shape of the proposed harbour structure would result in reduced flow within the harbour site and reduced water circulation further north into Jervoise Bay. Reduced flows and circulation to the north of the harbour will increase nutrient retention time and result in enhanced conditions for biological activity, and may result in algal blooms. The consequence of this is that the risk of poor water quality conditions in Jervoise Bay will increase. The chlorophyll a levels are above the draft nutrient-related environmental quality criteria set out in the SMCWS (DEP, 1996), and the impact of the proposal is likely to lead to a further increase in this level. Within this context the proposal is not able to be managed to meet the EPA's objectives.

The EPA considers that further increases in chlorophyll a levels would be inconsistent with the focus of improved management and reduction of nutrients and contaminants into Cockburn Sound over the past two decades.

If a decision is taken that the proposal may be implemented, it remains essential that actions to improve water quality within Cockburn Sound generally, and along the eastern portion of the Sound specifically, be undertaken. There would need to be a specific focus on the contribution of groundwater contaminants.

Management of nutrient contributions to Cockburn Sound through catchment management and further reductions in point source discharges will improve environmental conditions in the long term (likely to be greater than 10 years) but there will be a lag between changes of management and the water quality response in the waters of Cockburn Sound.

3.3 Marine flora and fauna - loss of seagrass and habitat

Description

Through the construction of breakwaters, dredging and reclamation associated with the proposal:

(a) there will be a loss of 220ha of existing habitat. This habitat consists of:

- 200.5ha of bare sand which supported seagrass meadows until the 1970's;

- 17.4ha of low relief reef. The low relief reef is predominantly colonised by macroalgal species such as *Saragassum* spp., *Caulerpa cactoides* (Chlorophyta), *Padina* sp. (Phaeophyta); several sponges; ascidians; corals; and small patches (approximately 0.2-1.0m diameter) of dense *Posidonia sinuosa*, with some *Posidonia australis*, *Amphibolis antarctica* and *Halophila ovalis*. These communities continue west into depths where marine macrophytes are replaced by invertebrate assemblages and bare sand;

- 2.1 ha of dense seagrass meadow (predominantly *Posidonia sinuosa*).

  It should be noted that the amount of seagrass meadow directly impacted by the development has been reduced by 0.8ha from the original proposal. This has been achieved by reconfiguring the approach channel to avoid seagrasses on the western margin of the development; and

(b) 0.2ha of reef with small invertebrates will be directly impacted on by the development.

During the benthic survey conducted by the proponent, marine fauna including the anemone *Heteractis malu,* blue swimmer crab *Portunun pelagicus*, sand dollar *Peronella lesueuri (L. Agassiz)*, schools of Australian herring, sea urchins, sea squirts, polychaete worms and ascidians were observed in the study area.

It is noted that although the proposal will impact on fish habitat areas, the proposed breakwaters will create approx 11ha of new rock (artificial reef) habitat.

Agency and public comments

In response to the PER the majority of submissions commented on:

- the amount of seagrass that has already been lost from Cockburn Sound (ie approximately 750ha of an original 3900ha remain in Cockburn Sound);
- the direct loss of existing habitat, seagrass and limestone reef/ pavement and mixed reef and seagrass habitat;
- the impact on small invertebrates;
- that whilst healthy seagrass meadows in the study area will be directly affected by the development, other areas of dense seagrass cover (both nearshore and offshore) in the proximity of the proposal may be subject to increased stress through light limitation, increased phytoplankton in the water column in surrounding areas where the breakwaters have reduced flushing; increased epiphyte densities in surrounding areas where the breakwaters have reduced flushing and wave energy; and increased water column turbidity from channel dredging and shipping movements;
- the draft EPA's environmental impact assessment policy for the protection of marine benthic primary producer habitats. Comments indicated that the draft policy statement seeks to limit cumulative, irreversible loss of key primary producer habitat to less than 5% of its original cover and that approval for the destruction of further seagrass would be inconsistent with this draft policy; and
- the recently released report from the Senate Environment, Recreation, Communications and the Arts References Committee (October 1997), which recommends that the Commonwealth Government work with State and Local authorities to develop strategies to prevent further damage to seagrass beds from the effects of coastal development, sewerage and stormwater outfalls and diffuse run-off from agricultural activity.

Commitments

Following consideration of public submissions, the proponent has made the following commitment to:

- manage the impact of turbidity on seagrasses near the western end of the channel during dredging through implementation of a dredge management plan.

Assessment

The area considered for assessment of this factor is the shallow eastern margin of Cockburn Sound between Woodman Point (to the north) and James Point (to the south).

Relevant environmental factors and objectives

The following environmental factors were identified from the consideration of the issues.

Relevant factor	EPA Objective
Marine flora	• To maintain the ecological function, abundance, species diversity and geographic distribution of seagrasses.
Marine fauna	• To maintain the ecosystem function, abundance, species diversity, productivity and geographic distribution of marine fauna communities.

In relation to this factor, the EPA considers the key issue of concern is the loss of seagrass and the loss of potential seagrass habitat. The area of potential seagrass habitat currently supports a range of benthic invertebrate fauna.

Seagrasses are important primary producers in the southern metropolitan coastal waters of Perth and occur as extensive meadows, particularly in relatively shallow, depositional environments moderately protected from ocean swells (DEP, 1996).

The EPA recognises that seagrasses not only have intrinsic value as marine flowering plants but they also perform important ecological functions in the marine environment. As well as being a source of organic matter as a food source for animals through the food chain, either directly or after it has broken down into detritus, they provide habitat for diverse assemblages of small plants and animals, nursery areas for invertebrates and fish, and means for storing and recycling nutrients (Larkum, McComb and Shepard, 1989 in DEP, 1996). In addition they also play a part in stabilising the ocean floor (DEP, 1996).

Seagrass meadows in Cockburn Sound have been significantly affected by development especially along its eastern margin. Before industrial activity commenced in Cockburn Sound, the area of seagrass meadows was estimated to be 3900ha and covered much of the seabed (DEP, 1996). By 1973, the area of seagrass in the Sound had reduced to approximately 700ha. This loss was caused mainly by nutrient-rich waste inputs which stimulated the growth of marine algae and reduced the amount of light reaching the seagrasses (EPA, 1998b).

Since the 1970's, there has been no significant recovery of seagrass and recent surveys show that the current area of seagrass in Cockburn Sound is still in the order of 700ha (EPA, 1998b).

In response to the broadscale loss of seagrass from Cockburn Sound, and concern expressed by the community and others, the government has taken strategic steps to remove or reduce point source discharges into Cockburn Sound. It is the EPA's belief that the loss of seagrass from developments, such as the proposed Southern Harbour, also needs to be seen in the wider context of cumulative losses of seagrass from the surrounding waters, and whether the sustainability of the regional marine ecosystem is being adversely affected.

Seagrass and the associated issue of marine water quality is an important consideration for this proposal. The loss of an estimated 80% of the seagrass of Cockburn Sound represents a very significant and unacceptable loss of primary benthic community (EPA, 1998a). Clearly the area of seagrass in Cockburn Sound has been severely reduced and from an environmental perspective any further reduction in seagrass adds to the 80% which has already occurred. Whilst the area of seagrass meadow to be lost is relatively small compared with the area already lost, the impact needs to be viewed as a further reduction to an already significantly reduced resource.

In addition to this, the EPA considers that not only will this development further reduce the already depleted resource, but the opportunity to re-establish seagrass in this area (where seagrass meadows once grew) will also be sacrificed. This is because the construction of the harbour and dredging associated with the harbour basin and shipping channel will create deeper areas where bottom light levels will be severely reduced and the construction of breakwaters and reclamation will permanently cover areas of shallow margins of the sound.

In the EPA's Report and Recommendations on Cockburn Cement Limited's proposal for Medium Term Shellsand Dredging of Success Bank in Owen Anchorage (EPA, 1998a), the EPA reinforced its position on seagrass in Cockburn Sound, stating that "development proposals should not adversely add to the gross changes that have already occurred. As seagrasses are the main biological element significantly affected by the water quality change in Cockburn Sound it is paramount that there should not be any further losses" (EPA, 1998a, pg 29).

The EPA further stated its dual objectives of "protecting the remaining seagrass meadows of Cockburn Sound and the need to conserve those areas where seagrasses are most likely to grow, for example sand banks and sandy sea floor." The establishment and maintenance in Cockburn Sound of environmental conditions that are consistent with the survival, growth, restoration and expansion of seagrass cover are key environmental outcomes for the EPA (EPA, 1998a, pg 21).

Recent monitoring of water quality across the broader Cockburn Sound show early signs of a possible improvement in water clarity and there is a prospect that, with continued nutrient reductions, conditions in the Sound may become more suitable for seagrass growth in areas previously denuded (EPA, 1998b).

Cockburn Cement is undertaking research on the possibility of transplanting sods of seagrass to new areas. Preliminary findings of the transplant work appear encouraging, however, transplanting seagrass is very time consuming and expensive in the short term, and causes significant impacts to, or loss of, donor beds. Furthermore the degree of success in terms of survival and growth will not be known for some years (EPA, 1998b).

The EPA also concluded that the future potential for seagrass re-establishment on those areas in Cockburn Sound where seagrasses once grew (for example sand banks and sandy margins) should be maintained (EPA, 1998b). To do this, however, it is recognised that improved light conditions will need to be achieved and maintained if Cockburn Sound is to provide an environment suitable for seagrass restoration and recovery and that this will require improved management, retention of the shallow sandy margins, and the continued implementation of effective nutrient reduction strategies.

In addition to the loss of seagrass and potential habitat, the EPA is also concerned that decreases in light levels at the sea bed due to increased depth and enhanced water turbidity (from dredging and reclamation) will lead to decreases in microscopic plant communities that dwell on the sea bed (microphytobenthos). It is also likely that the reduction or loss of these communities may significantly affect primary production, sediment oxygenation and benthic communities within the harbour, and that oxygen depletion in bottom waters and sediments will lead to loss of filter feeding animal communities (EPA, 1998b).

Conclusion

The modified proposal will lead to the direct loss of 2.1ha of seagrass meadows and approximately 220ha of seabed which has the potential for seagrass to return.

One of the key management criteria for Cockburn Sound over the past two decades has been to return water quality to a level that sustains existing seagrass and has the capacity to see seagrass regrow. Given the very substantial loss of seagrass that has occurred in Cockburn Sound, any proposal that causes further direct loss could not be supported by the EPA.

The DCT has modified the proposal to reduce seagrass loss, but the re-design does not fully avoid seagrass loss. While the amount of seagrass being considered in relation to this project is

not large, the EPA needs to provide advice taking into account the historical reduction in seagrass abundance in Cockburn Sound. The impact of the proposal will be to further reduce the seagrass abundance and potential habitat, and within this context the proposal is not able to meet the EPA's objectives for this issue.

As set out in its strategic advice on Cockburn Sound (EPA, 1998b), it is the role of the EPA to provide the best environmental advice to assist government in the decision making process, but it is the role of the Government to make decisions.

If a decision is taken that the proposal may be implemented the EPA recommends that it be subject to the following environmental conditions:

(a) The proponent revegetate an area of Cockburn with *Posidonia sinuosa* or other appropriate seagrass species that has a reasonable chance of survival and is equivalent to the area of seagrass that will be lost as a direct consequence of this project (ie 2.1ha); and

(b) That the proponent identify, in consultation with the DEP, an appropriate area for revegetation with seagrass within Cockburn Sound.

3.4 Coastal Processes - impact on shoreline and seabed

Description

Through the construction of breakwaters, harbour configuration, dredging and reclamation, there is potential for change in the nearshore processes and sediment regime and siltation of the dredged channel and harbour.

The approach channel and the harbour entrance will be dredged to a depth of 12 m with the potential for it to be further dredged to a depth of 14.7m. The seabed is currently 8-10m deep.

The Southern Harbour development site experiences two sources of wave energy; wind-induced seas from the south-west and ocean swells generated from the west and north-west. Wind waves from the south-west tend to dominate and this wind pattern tends to set up a northerly current along the eastern margin. The channel is sheltered from westerly swells by Garden Island.

There are two beaches near the proposed Southern Harbour development, a beach on the south side of Woodman Point, approximately 2.3km north of the development and Challenger Beach which is approximately 2km south of the development (refer to Figure 1).

Agency and public comments

Submissions expressed concern in relation to changes in coastal processes which will result from the construction of the harbour and the impact this will have on beaches on the southern side of Woodman Point. The public also queried whether the proponent had modelled the impact of the Southern Harbour on local coastal processes and sediment transport and whether the proponent will undertake shoreline monitoring to determine the impact of the existing Northern Harbour and Southern Harbour.

Commitments

Following consideration of public submissions, the proponent has altered commitments made in PER with regard to coastal processes to the following:

- prepare an Environmental Management Plan for the construction phase of the project which will include a coastal monitoring plan outlining, monitoring, options for any sand bypassing remedial work and beach restoration if monitoring indicates a problem;
- prepare an Environmental Management Plan for the operations phase which will include annual reviews of aerial photographs taken by the Department of Land Administration (DOLA) to determine any trends in erosion or accretion for 5 years post construction; and

- to undertake a further wave modelling study, before the construction of the island breakwater, to fine tune the alignment to ensure that here will be no undue impacts on Woodman Point.

Assessment

The area considered for assessment of this factor is the coast to the north and south of the development and the seabed.

Relevant environmental factors

The following environmental factors were identified from the consideration of the issues.

Relevant factor	EPA objective
Shoreline	• Maintain the integrity, function and environmental values of the foreshore area.
Seabed	• development should not have a significant impact on existing coastal processes, including offshore sediment movement.

The EPA notes that the beach at Woodman Point has been subjected to some localised changes in the form of erosion following completion of the Northern Harbour breakwater.

The potential impacts of the proposed harbour on local coastal processes may include trapping of longshore sediment transport and altering wave energy distribution through reflection and refraction.

The proponent has advised that wave energy from the south is small due to the protected nature of Cockburn Sound and that there has been no accretion on the southern side of the existing Jervoise Bay harbour over the past two decades. The proponent therefore concludes that the proposed harbour is unlikely to have an impact on the beaches to the north. In addition, the proponent has indicated that Woodman Point Beach is thought to be supplied with sand from Parmelia Bank to the west (Cockburn Cement, 1996), and that this process is unlikely to be affected by the development.

The EPA further notes that Challenger Beach to the south is a stable beach in a low energy environment and that existing structures at Jervoise Bay have not had any discernible effects on the beach. It is therefore unlikely that Challenger Beach will be affected by the harbour development (DCT, 1998).

It is also noted that south westerly wind waves do not have the energy to move significant amounts of sandy sediment at 8-10m depth. Siltation has not been an issue at the nearby Medina, Woodman's and Stirling channels and there has been no requirement for maintenance dredging.

The proponent has committed to undertake a further wave modelling study, before the construction of the island breakwater, to fine tune the alignment to ensure that here will be no undue impacts on Woodman Point. In addition the proponent has committed to reviewing aerial photographs on an annual basis to determine whether there are any trends of erosion or accretion following construction of the harbour.

At this time, the proponent does not intend to dredge below -12m, although the ultimate depth may be -14.7m. While the additional dredging is considered to be manageable, disposal of spoil

once the project site has been developed is problematic as some 2.5 million cubic metres of material will need to be managed and stored. The proponent is unable to indicate where and how spoil will be disposed of under these circumstances. As a consequence, the EPA is unable to assess its environmental implications. The EPA has included a recommended condition in Appendix 3 to address this.

Conclusion

The EPA considers that future sedimentation of channels and the harbour does not appear to be a problem. Furthermore, commitments have been given to address management and monitoring requirements.

The EPA is concerned in relation to the potential effects on the beaches at Woodman Point. It is important that this harbour does not adversely affect coastal processes and beach stability. A commitment to undertake additional modelling to avoid such impacts has been given.

The EPA concludes that the proposal can be managed to meet the EPA's objectives.

3.5 System Six areas M91 and M92 - loss of 10.5ha of the northern portion of M91 and impact on terrestrial flora and fauna

Description

The proposal will result in the removal of 40% of System Six area M91 (Reserve A24309), involving approximately 0.9 km of a 2.5km long coastal limestone cliff formation, and 10.5ha of coastal limestone habitat (refer to Figure 4).M91 is an "A" Class Reserve, forms part of the Beeliar Regional Park and has been placed on the Interim List of the National Register by the Australian Heritage Commission. The area is a limestone cliff up to 6m high, with several sandy beaches at its base, and is partly used for recreation. The Tamala limestone platform, cliffs and associated vegetation of M91 are of high conservation value and are regionally important, as they represent:

- a locally and regionally significant landform and landscape feature. The feature is geomorphologically unusual and has aesthetic value to the community;
- the most extensive vegetated platform on the mainland in the region with a vegetated hinterland; the vegetation has an average condition of 4 on a scale of 1 (highly disturbed) to 5 (pristine) and is uncommon and poorly reserved. The proposal will remove the vegetation which is in the best condition;
- a sequence of plant communities typically associated with Tamala limestone as well as a wetland community typical of such cliff edges. There are unlikely to be other areas in the Metropolitan area with similar conservation features;
- a series of plant species (communities) that have not been located in other mainland coastal areas in the region; and
- an area of historical botanical and, in association with M92 (Cockburn Wetlands - Western Chain), is a site used for scientific education.

The M91 Reserve is currently the subject of a joint management arrangement between the Department of Conservation and Land Management (CALM), Ministry for Planning (MfP) and local government.

Both M91 and M92 are included within the Beeliar Regional Park. The east-west transect across M91 and M92 contains an unusual and intact landform, soil and vegetation sequence (Gozzard 1983), representing an integrated ecological system of high scientific and educational value. This sequence does not occur elsewhere.

Following public and agency submissions, the proposed construction of the Rockingham -

Fremantle Controlled Access Highway, which would dissect the System Six area M92, has been realigned. This alternative alignment is assessed in Section 3.6. Figure 2 shows the original proposal (in terms of the road realignment) and Figure 4 shows the modified alignment.

Public And Agency Submissions

Most comments regarded the PER as not acknowledging the quality and importance of the landform unit and floristic communities present in the System Six area M91, and questioned the intention of government in disturbing areas of regional significance that have long been reserved for conservation.

CALM, the DEP, the City of Cockburn and most public submissions commented on the significance of the landform of M91, for both natural resource and aesthetic/landscape values. While it was noted that some limestone cliff formation is also found between Trigg and Mindarie and at Burns Beach, it was also noted that there is no similar section of coastline near Perth, and particularly, south of Perth.

Concerns were also raised in submissions that the mapping of boundaries was incorrect and that the vegetation description of M91 was not at an adequate level of detail, thereby leading to the proponent's suggestion that the vegetation being removed was equally represented throughout the entire Reserve. Instead, description at the level of vegetation community (Gibson *et al*, 1984) indicates that there are three distinct vegetation communities throughout the Reserve, while other studies (Semeniuk, 1997) indicate that the vegetation is comprised of five different assemblages and three different vegetation structures. In addition, survey for Declared Rare Flora (DRF) and priority flora has not been undertaken. As a consequence, the proponent cannot indicate what values would be lost, and therefore the full conservation value of the area to be removed has been understated.

The submissions also stated that the PER fails to recognise the values of M91 and M92 as an overall ecological unit and that the proposal would result in the disturbance of a significant geomorphological and ecological east-west transect from the limestone cliffs in M91 to the wetlands within M92. The combination of M91 and M92 upland areas represents an uncommon example of diversity of landforms and vegetation, and ecologically, are considered to be the most important reserves vested in the City of Cockburn.

It was also noted that the Reserve is "A" Class and that variation of an "A" Class Reserve requires approval from both Houses of Parliament.

Submissions also raised the question of compensation or securing areas of equal conservation value based upon the 'no net loss' principle for the terrestrial habitats that will be destroyed. It was commented that the areas proposed to be exchanged by the proponent are already earmarked for inclusion in the conservation estate (eg proposed southern extension of the Beeliar Regional Park), and that other Lots are already in WAPC ownership, and would occur irrespective of the proposal going ahead.

Commitments

Following consideration of public submissions, the proponent has altered commitments made in the PER with regard to management of M91 and M92, to the following:

- seek to progress transport corridor planning in the locality with the aim of ensuring isolated bushland contiguous with Beeliar Regional Park is available for consolidation into the Park;
- incorporate areas of the highway reservation south of Russell Road into the Beeliar Regional Park; and
- comprehensive landscaping and rehabilitation of the surplus highway reserve land.

Assessment

The area considered for assessment is the coastal portion of the Perth Metropolitan Area and especially System Six area M91 and M92.

Relevant Environmental Factors

The following environmental factors were identified from the consideration and assessment of the impacts of the proposal on System Six areas M91 and M92.

Relevant factor	EPA Objective
Landform	• Protect the representative land systems
Terrestrial Vegetation Communities	• Maintain the abundance, diversity, geographic distribution and productivity of the vegetation community type

With respect to landform and aesthetic value, 40% of the Tamala limestone platform would be irretrievably lost by the proposal. This landform does not occur south of Perth and is rare in the metropolitan area. The other functions of the Reserve are ecological and scientific with respect to both vegetation and geomorphology, as well as being an integral part of a linked system (the coastal expression of a Spearwood Dune Ridge) which continues inland and incorporates wetlands. M91 has been Interim Listed on the Register of the National Estate by virtue of both its intrinsic value and its contextual value as part of an integrated ecological system with M92.

The proponent acknowledges the high conservation value of M91 with respect to landform.

The proponent maintains that a base set of fundamental elements of the flora is represented in all parts of the reserve, therefore, the ecological value of the area M91 is retained. However, information obtained to date indicates that the Reserve contains a number of different vegetation communities and assemblages. Data supplied in public submissions from a more detailed botanical survey (Semeniuk, 1997) indicates that at least three vegetation assemblages which occur in the northern area do not occur in the area to be retained. The proponent acknowledges that the vegetation that would be removed is of the best condition in the reserve.

The degree to which vegetation is represented in other locations is dependent upon the level of detail of the survey. While the three plant communities defined by Gibson et al (1984), are represented elsewhere, they do not occur together in a coastal community, and in association with the vegetation communities determined for M92. M91 therefore has additional conservation value as being a component of an east-west ecological system.

The proponent is of the view that the conservation value of the land would be enhanced due to the changed re-alignment of Cockburn Road. The initial alignment created substantial opposition as was considered to be environmentally unacceptable within both agency and public submissions, and hence the original PER alignment was withdrawn by the proponent. It is difficult to agree that the act of avoiding substantial impacts associated with the original alignment represents enhancement of the environment.

In 1993, the EPA highlighted the value of M91 and M92 reserves and advised that:

- the retention and implementation of the System 6 recommendations are its prime objective for regional conservation;
- the EPA will only recommend in favour of options for Kwinana that are proven to ensure that the System 6 areas remain viable and that further investigations into a long-term strategy for industrial development should consider other alternatives; and

- if in the face of a pressing need for industrial expansion, it is not possible for industry to comply with these environmental ground rules for the Kwinana Industrial Area, the Government should look to the rapid development of additional locations in the State suitable for heavy industry (EPA, 1993).

Conclusion

Reserve 24309 (M91) is a significant part of a regional system of protected areas. It represents a combination of landform (coastal cliffs and platform) and vegetation communities which are considered unique in the Perth Metropolitan Area. This is acknowledged by the proponent.

While the majority of the reserve will remain undeveloped, the portion affected by the proposal is an integral part of the regionally significant values of the Reserve. The EPA has previously stated that M91 and M92 should be protected from development, and remains of this view.

The EPA concludes that the conservation values that would be lost as a result of this proposal cannot be replaced as there are no equivalent sites that are not already protected in the Perth Metropolitan Area. Accordingly, the EPA is of the view that the proposal cannot be managed to meet EPA objectives for this issue.

3.6 Cockburn Road Realignment - impact on wetlands and drainage

Description

The PER proposed a preferred re-alignment of Cockburn Road through an existing road reservation identified in the MRS as the Fremantle - Rockingham Controlled Access Highway (CAH). The major impacts associated with that alignment (the "PER alignment") were related to the dissection of the System Six area M92 (Cockburn Wetlands - Western Chain) of the Beeliar Regional Park, including:

- disruption of a regionally significant east-west transect from the coast (M91) through to the hinterland and wetlands of M92;
- loss of vegetation;
- fragmentation of fauna habitat; and
- potential impacts on the wetlands.

As a result of a high level of community concern and government submissions, the realignment of Cockburn Road has been modified, and has been the subject of further investigations. Traffic is now proposed to be re-directed to avoid bisecting the Beeliar Regional Park (Figure 4).

The modified road alignment (the "Russell Road alignment") will re-direct the majority of north-south traffic from Cockburn Road along a modified and upgraded Russell Road to Rockingham/Stock Road. This will result in the closure of Cockburn Road in the vicinity of the Jervoise Bay Industrial Estate. The new road network plan includes construction of a lower standard distributor road along the eastern boundary of the Henderson Industrial Area and linking the old Cockburn Road south of Henderson. The modified alignment will pass to the east of M92 to Russell Road, then follow the original preferred alignment close to Lake Coogee.

An assessment of additional environmental impacts related to the modified alignment included the following:

- floristic study;
- specific searches for DRF and Priority flora;

- habitat assessment and comparison with previous fauna survey work for the PER;
- an assessment of impacts on wetlands;
- noise assessment; and
- Aboriginal and European Heritage

The floristic survey found 98 species, of which 50 were introduced. Nine vegetation associations were recorded. No DRF, priority flora or threatened ecological communities (Gibson et al, 1984) were found during the survey. The modified alignment will remove 14 ha of remnant vegetation south of Russell Road, with a further 2.4ha of introduced plantings (within the median strip of Rockingham Road). None of the vegetation to be cleared is within the Beeliar Regional Park.

The principal fauna habitats that may be affected by the Russell Road option are in the area west of the existing northbound carriageway and the M92 Henderson open space (containing Brownman Swamps and Lake Mt Brown). Survey for the PER determined significant quenda (*Isoodon obeselus*) populations in this area.

Brownman Swamp, Lake Mt Brown and Lake Coogee are protected by the Environmental Protection (Swan Coastal Plain Lakes) Policy (EPP). At one location the alignment is constrained by the proximity of the Water Corporation wastewater infrastructure to the immediate west, resulting in the road being separated from Lake Coogee by a distance of 40m.

Drainage and road runoff is proposed to be directed towards Lake Coogee with "closed" drainage systems and vegetated detention basins, with direct overflow into the Lake during peak storm events.

Public And Agency Submissions

The public and agency submissions on the original PER alignment expressed a strong objection to the proposed alignment due to the impacts of bisecting the M92 component of the Beeliar Regional Park through Brownman Swamps and Mt Brown. A range of other options were presented as being preferred alignments.

The modified alignment is similar to the original to the north of Russell Road, however, due to the late modification of the route (after the pubic submission period), public review and the opportunity for comment on the Rockingham Road section has not occurred. Further advice on the modified alignment is presented in Section 6.

Public and agency submissions regarding the area north of Russell Road were mainly related to the potential impacts on Lake Coogee, and were not supportive of this alignment.

Submissions considered that the PER had not adequately addressed the environmental impacts resulting from the close proximity (40m) of the alignment to the western shore of Lake Coogee in relation to road runoff, deterioration in the water quality of the lake, impact on avifauna, and reduced amenity.

In particular, there was considerable comment regarding the proposal to direct stormwater drainage into the Lake. Comment indicated that Lake Coogee was saline and that stormwater runoff and peak flows would reduce water quality and affect natural salinity, as well as potentially impact the *Melaleuca cuticularis* vegetated fringe. The submissions also indicated that the PER referred to an old assessment category of "Resource Enhancement" (EPA 1983), rather than more recent assessment category of "Conservation" (Hill *et al*, 1996). The submissions also noted that the Lake is an EPP wetland and that it is an offence to directly or indirectly impact, including drain, into an EPP Lake.

Other concerns related to the lack of a survey for declared rare or priority flora along the alignment.

Commitments

The proponent has made the following commitments with respect to the proposed Cockburn road re-alignment:

- investigate options of reducing carriageway separations and other possible design mechanisms in an effort to improve the buffer widths at Lake Coogee at the time of detailed design;
- prepare and implement a detailed drainage design monitoring programme (as part of the Environmental Management Plan), prior to commencement of road construction, to protect Lake Coogee from further reductions in water quality due to the proximity of the highway. The drainage design and monitoring programme will include vegetated detention basins and a closed drainage system, and provide an entrapment to protect the Lake from accidental spillage;
- undertake DRF and Priority Flora surveys of the alignment route in spring, prior to commencement of vegetation clearing. Should DRF be detected, Ministerial approval will be sought to 'take rare flora' under Section 23 (f) of the Wildlife Conservation Act and a CALM sanctioned management and rehabilitation plan developed and implemented;
- prepare and implement a Rehabilitation and Landscape Plan as part of the Environmental Management Plan, including the planting of native vegetation within the buffer areas;
- prepare and implement a monitoring programme of water quality in Lake Coogee to include hydrocarbons, lead, nitrogen and phosphorus. Baseline data will be collected prior to the road alignment and control data obtained from other wetlands; and
- provision of community access via a dual use pathway and the provision of viewing platforms on the foreshore of Lake Coogee.

Assessment

The area considered for assessment is the modified re-alignment of Cockburn Road, between Mayor Road and Rockingham Road.

Relevant Environmental Factors

The following environmental factors were identified from the consideration and assessment of the impacts of the proposal on the proposed realignment of Cockburn Road, north of Russell Road.

Relevant factor	EPA objective
Wetlands	• Protect the integrity, functions and environmental values of wetlands
Terrestrial Vegetation Communities	• Maintain the abundance, diversity, geographic distribution and productivity of the vegetation community type

During the redesign of the project, the proponent proposed an alternative Cockburn Road realignment which avoids bisecting Beeliar Regional Park. This alternative alignment will link the new Cockburn Road via Russell Road.

Conservation Significance

Lake Coogee is a saline lake and has been categorised for conservation within the Water and River's Commission Wetland Atlas (Hill et al, 1996). The category is defined as C1* - 1st tier

recognised wetland at international, national or regional level <95% disturbed. Recent mapping indicates that the vegetation is 98% intact within the 50m buffer zone, and 75% intact with respect to the recommended 200m buffer zone. The management objective for the Lake with respect to management priorities is:

"to preserve wetland attributes and functions through reservation in National Parks, crown reserves, state owned land and protection under environmental protection policies".

In addition the Lake is protected by the Environmental Protection (Swan Coastal Lakes) Policy (1991). This statutory policy protects the environmental values of nominated lakes on the Swan Coastal Plain from a range of activities including filling, mining or excavation, pollution or drainage and states that "a person shall not cause or permit the construction or alteration of any system of drainage of water into or out of a lake unless a person is authorised under the act to do so".

Drainage and Water Quality

The PER acknowledges the EPP, however the road has been designed for stormwater runoff in peak flows to drain directly into the Lake. Within the Proponent's Response to Submissions (DCT, 1998), the proponent clarified the expectation that the EPA approval of the proposal through this assessment would provide the means to obtain the approvals required within the policy.

In providing information regarding the proposed drainage system and the potential to impact Lake Coogee, the proponent has indicated that:

- the stormwater runoff would be delivered via a kerbed road to a "closed" (subsurface pipe) drainage system;
- the stormwater runoff would be "treated" within a vegetated stormwater infiltration basins, which would periodically overflow into the Lake (1:10 year event with 72 hour detention);
- part of the northern detention basin would be located within 50m of the Lake (HGM, *pers. comm.);* and
- the water quality of the Lake would not be deleteriously impacted. The proponent quotes studies which indicate that the Lake is hydrologically linked to the ocean therefore stormwater runoff would be incapable of offsetting oceanic scale influences and diluting the Lake. In addition, the stormwater would be "treated" thereby removing other water quality concerns.

The EPA acknowledges the use of infiltration basins as a means of improving water quality of effluent. These are particularly useful in removing phosphorus when used in conjunction with high Phosphorus Retention Index soils, and in minimising hydrocarbon contamination. However, the basin may not be effective in removing soluble pollutants such as heavy metals etc, particularly if constructed over well drained limestone sands, as is the case at Lake Coogee. The distance of the detention basin from the functional area of the lake is therefore the most significant element with respect to the indirect drainage into the Lake.

In the case of peak flows, the quality of the stormwater runoff which has been designed to overflow into Lake Coogee will likely to be of better quality than the subsurface infiltration, due to the high level of dilution at those times. Impacts would be reduced further by the commitment to significant plantings within the buffer zone.

However, Lake Coogee is considered to be saline, and the input of freshwater may result in change to the saline ecosystem of the Lake. The proponent's implication that the ocean influences the major groundwater source for the lake water, and therefore will not be affected by the input of fresh water, is questioned. Recent studies (unpublished) indicate that the lake may be perched and isolated from any groundwater lens. The system is reliant on rainfall during

winter and becomes increasingly saline in summer due to evaporation. This would mean that the Lake is adapted to seasonal changes in salinity, and the impacts of the peak stormwater flows would therefore be less significant.

Buffer Width

At one point Lake Coogee is separated from the modified alignment by 40m. At this point the alignment is constrained by the Water Corporation's wastewater infrastructure to the west.

Functional buffer widths may vary in response to conservation significance of the wetland and the adjacent landuse/potential source and loading of pollutants, and range from 50m as a minimum, up to 1km (Davies and Lane, 1997). In general, the minimum width for a fully vegetated buffer is 50m, with 200m indicated as a secondary zone of influence which should be considered for defining buffer widths for wetlands of high conservation significance (Hill *et al*, 1996).

However, the EPA considers that while 40m is a significant reduction in the absolute minimum buffer requirement for surface and subsurface pollutants, the impacts of a road carriageway would be minimal and could be managed within a fully vegetated buffer.

Nonetheless, the EPA would need to be satisfied that either direct or indirect drainage into the lake is the only design option available. The proponent has not provided this information.

Conclusion

The EPA acknowledges and supports the deletion of the portion of Cockburn Road along the Fremantle-Rockingham CAH route south of Russell Road. This provides significant protection to Brownman Swamps and Lake Mt Brown.

Lake Coogee is protected by the Environmental Protection (Swan Coastal Plain) Policy. The proponent recognises its conservation value and has made commitments to manage impacts, especially drainage and buffers.

The EPA concludes that, subject to he development of a comprehensive design and management programme, the Cockburn Road realignment segment of the proposal is capable of being managed to meet the EPA's objectives.

3.7 Noise and dust - impacts associated with construction of the harbour and road realignment

Description

During the construction of the Jervoise Bay Southern Harbour development and associated roads, noise and dust may be generated.

One area of particular concern relates to the construction of Russell Road near the South Coogee Primary School.

Agency and public comments

Submissions expressed concern that air pollution will increase over the whole metropolitan region through increased vehicular traffic, that contamination from atmospheric pollutants from the proposed road realignment has been completely ignored and that no reference has been made to the Kwinana Air Quality Buffer Zone policy.

Commitments

The proponent has made commitments to:

- prepare an Environmental Management Plan for the construction phase of the project, before commencement of construction that will include plans to manage dust and noise during construction, on advice of the City of Cockburn, Town of Kwinana and the DEP;
- to minimise dust noise and traffic during construction to avoid undue disturbance to local residents and traffic movement during construction. This is to be incorporated within the Environmental Management Plan. The Environmental Management Plan will also include the designated transport route and hours of work for the breakwater limestone supply; and
- to comply with Environmental Protection (Noise) Regulations 1997.

Assessment

The area considered for assessment of this factor is the area west of Rockingham Road between Woodman Point and Mt Brown.

Relevant environmental factors

The following environmental factors were identified from the consideration of the issues.

Relevant factor	EPA objective
Noise	• Protect the amenity of nearby residents from noise and vibration impacts resulting from activities associated with the proposal by ensuring that noise and vibration levels meet statutory requirements and acceptable standards.
Dust	• Ensure that dust levels generated by he proposal do not adversely impact upon welfare and amenity or cause health problems by meeting statutory requirements and acceptable standards.

The EPA notes that the proposed realignment of Cockburn Road into the designated Fremantle - Rockingham Highway reservation as per the MRS has been reviewed by the proponent and that Cockburn Road will now be realigned via Russell Road, which avoids bisecting Beeliar Regional Park.

This has implications for South Coogee Primary School, especially in relation to noise, vibration and dust. The EPA notes that management approaches adopted by Main Roads include the use of open graded asphalt and the construction of a one metre high barrier at a maximum distance of two metres from the nearest carriageway.

The EPA also considers that the sourcing of limestone for the project has the potential to impact on local residents in relation to road traffic noise. However it is noted that the proponent has committed to designating a transport route and hours of work in their Environmental Management Plan for the project and that this will be undertaken in consultation with the City of Cockburn and the Town of Kwinana.

The proponent has committed to complying with the *Environmental Protection (Noise) Regulations 1997* and Land Development Sites and Impact on Air Quality Guidelines (DEP, 1996).

In addition to the above, the EPA considers that the proponent should undertake a Noise Management Plan for road construction and operations. This is detailed further in Appendix 3.

The EPA also notes that although the Jervoise Bay Infrastructure Facility is located within the Kwinana Air Quality Buffer Area, projects likely to be undertaken at the facility will be engineering construction activities and therefore are unlikely to be contributors in terms of the EPP. Industry at the site will need to comply with the EPP.

Conclusion

Having considered submissions and the PER response to submissions, the EPA considers that in view of:

(a) the proponent's commitments, and

(b) preparation of a noise management plan

the proposal can meet the EPA's objectives for noise and dust.

3.8 Heritage - impact on sites of cultural significance

Description

The proposal will result in the substantial alteration of 80ha of land, including the removal of 10.5ha of a coastal limestone feature, and disturb areas related to the proposed Cockburn Road re-alignment.

As part of the planning process for the proposal for the original PER, an Aboriginal heritage, archaeological and ethnographic survey was undertaken.

Additional survey work was also performed to assess the modified Cockburn Road alignment. Two sites of Aboriginal ethnographic significance have been identified within the Southern Harbour location. The first is the nearshore waters and the chain of islands extending to Rottnest and including Cockburn Sound. The second is the limestone ridge running parallel to the coast through the proposed Industrial Estate (HGM, 1997).

In relation to the realignment of Cockburn Road, both surveys documented three sites of archaeological significance within the project development area (HGM, 1997).

With regard to European heritage, the Russell Road realignment will result in the removal of Sawle House, adjacent to the existing Russell Industrial Estate on Russell Road. Sawle House is not a listed heritage site with the Australian Heritage Commission or the WA Heritage Council, but does appear on the municipal inventory of the City of Cockburn.

Public And Agency Submissions

The Aboriginal Affairs Department indicated in its submission that the proponent will need to address the probable presence of subsurface artefactual and skeletal material prior to and during development.

Commitments

The proponent has committed to developing and implementing a strategy for the treatment of subsurface artefactual or skeletal material as part of the Environmental Management Plan for construction and roadworks. This will be completed prior to commencement of the construction or roadworks and is to meet the requirements of the Department of Aboriginal Affairs. This will involve an archaeologist being present during construction activities to recover materials.

Assessment

The area considered for assessment of this factor is the area west of the Controlled Access Highway between James Point and Woodman Point and land adjoining Russell Road.

Relevant Environmental Factors

The following environmental factors were identified from the consideration and assessment of the impacts of the proposal on Aboriginal and European Heritage.

Relevant factor	EPA objective
Heritage	• To ensure that changes to he biophysical and physical environment resulting from the project do not adversely affect cultural associations with the area.

The EPA notes that additional survey work (ie Aboriginal ethnographic assessment and archaeological survey) is being undertaken for the modified alignment of Cockburn Road. The archaeological survey has been completed and preliminary assessment indicates that the three isolated finds are not regarded to be of significance (DCT, 1998).

The EPA notes that the Aboriginal ethnographic assessment for the Rockingham Road section is still being conducted, and consequently was not available at the time of this assessment.

Given that this survey has yet to be completed, the EPA would expect the ethnographic survey to meet the requirements of the *Aboriginal Heritage Act 1972*. It is also noted that Cockburn Sound's nearshore waters and the associated coastal lands are subject to several overlapping native title claims.

On advice from the proponent, the EPA notes that the proponent has liaised with the City of Cockburn in regard to Sawle House and that the City of Cockburn has indicated that it is of relatively low significance. However, prior to demolition, a collection of photographic records would be required. Accordingly, the EPA would expect the proponent to seek approval from the City in relation to he demolition of Sawle House and to undertake a photographic record.

Conclusion

Having particular regard to the:

- proponent's commitment to comply with the *Aboriginal Heritage Act 1972*; and
- proponent undertaking a photographic record of Sawle House;

it is the EPA' s opinion that the proposal can be managed to meet the EPA's objective with regard to Heritage.

3.9 Recreation - loss of open water and access to the coast; public health and safety

Description

Cockburn Sound is the most intensively used marine embayment in Western Australia and provides one of the most significant multiple-use recreational water bodies in Western Australia.

Through the implementation of the proposal there will be a loss of more than 200ha of open water and 11 hectares of coastline. The proposal will result in the creation of approximately 11ha of new rock (artificial reef) habitat, through construction of the breakwaters.

Public access to the harbour will be controlled during the movement of large vessels into and out of the harbour, primarily for safety reasons. The taking of edible shellfish and other filter feeding marine life will be prohibited from harbour waters and signs to this effect will be erected.

As indicated in the SMCWS (DEP, 1996), high levels of TBT were found to occur within the marina and boat harbour in Jervoise Bay. Based on the findings of studies undertaken, the concentrations of TBT in mussels indicate possible contamination and that the consumption of mussels may be a human health risk. The primary source of TBT in mussels is associated with the use and maintenance of large vessels. The study also concluded that the concentrations of aluminium, arsenic, copper, iron, manganese and zinc in mussels are generally higher near harbours and marinas. Concentrations of zinc exceed the values as indicative of 'contamination' at the majority of sites within Cockburn Sound and the concentrations of heavy metals surveyed were below the draft criteria for the maintenance of aquatic life for human consumption) at all sites sampled.

Agency and public comments

Submissions expressed concern in relation to the issue of beach access, the loss of coastline areas, the displacement of recreational uses (ie fishing and boating) and the loss of Parks and Recreation. The public were also concerned that the southern harbour would become an exclusion zone prior to the completion of the consultation process outlined in the SMCWS on EQOs and EQCs and Exclusions Zones.

Commitments:

Following consideration of public submissions, the proponent has altered commitments made in PER with regard to recreation to the following:

- only control access to the harbour waters by the general public during the movement of large vessels. This is to protect the public from risk and will be addressed in the Environmental Management Plan for construction and operations;
- to ensure safe passage for shipping and small craft to avoid to avoid impact on commercial and recreation vessel movements; and
- to erect signs at the commencement of construction that the taking of edible shellfish and other filter feeding marine life will be prohibited from harbour waters.

Assessment

The area considered for assessment of this issue is the eastern margin of Cockburn Sound between Woodman Point (to the north) and James Point (to the south).

Relevant environmental Factors

The following environmental factors were identified from the consideration of the issues.

Relevant factor	EPA objective
Recreation	• To maintain the quality of the broader area in relation to boating, fishing, swimming and coastal use.
Public health and safety	• Risk should be as low as is reasonably achievable.

In the proponent's response to submissions, the proponent clarified that it has no intention to make the new Southern Harbour an 'exclusion zone'. Instead the proponent has indicated that the public will be allowed controlled access to the southern harbour, and that public access to the facility will be controlled during the movement of large vessels into and out of the harbour for safety reasons.

The EPA notes that although the proposed development will not remove any recreational beaches, the proponent has:

- recently initiated the provision of additional public open space and recreational facilities at Robb Jetty including 2km of beachfront; and
- initiated plans to upgrade the recreational facilities at Woodman Point.

In response to concerns relating to social impact within the Fremantle-Rockingham region, the EPA recognises that this area has been experiencing significant residential and industrial development pressure over the past decade. However as part of the Fremantle Rockingham Industrial Area Regional Strategy (FRIARS), which was initiated by the WAPC to provide a framework to guide future planning and development in the area, it is understood that a social impact analysis will be commissioned, and that this will involve community sectors with an interest and involvement in the area.

The EPA considers that public access to the mainland foreshores and beaches of Cockburn Sound have been severely restricted due to incremental industrial development. Government and proponents should recognise the legitimate expectation of the community in regard to continued recreational use of the beaches and the Sound.

As mentioned in Section 3.4 of this report, the sediments in the vicinity of the MSF have very high TBT levels. Although the use of the proposed harbour may not significantly increase these levels, they represent a potential human health risk (DEP, 1996). As a consequence, the public should be cautioned against the taking of mussels from within the harbour.

Conclusion

Having particular regard to:

(a) the public being allowed controlled access to the southern harbour;

(b) the proponent erecting signs, to notify the public, that the taking of shellfish and other filter feeding marine life is prohibited for human health reasons;

(c) the fact that no recreational beaches will be removed as part of the proposal; and

(d) the creation of approx 11ha of new rock (artificial reef) habitat;

it is the EPA's opinion that the proposal can meet the EPA's objectives for recreation.

4. Decision making by Government in relation to Environmental Gain if the Proposal is to be implemented

The EPA has set out in its Strategic Environmental Advice on Cockburn Sound (EPA, 1998b), that the role of EPA was to provide the best environmental advice available but it was the role of Government to make decisions. The EPA went on to say:

> *"Decision-making about developments in the Sound needs to take into account (i) the historical events that have affected marine water quality and marine habitat, (ii) the contemporary community and Government views of the kind of waterway Cockburn Sound should be, (iii) the potential impact of each development, both in isolation and cumulatively, and (iv) the response initiatives available and deliverable which can assist in ameliorating adverse environmental impacts"* (EPA, 1998b p21-22).

The EPA has a responsibility to provide advice to assist Government in relation to environmental response initiatives at the State, Sound and project level.

In providing advice on the Industrial Infrastructure and Harbour Development proposal that may assist in ensuring its overall environmental acceptability, the EPA is aware that this cannot be achieved by the proponent within the context of its project area. However, the Government as a whole can provide the means to mitigate environmental impacts.

Accordingly, the EPA is of the view that if the proposal is to be implemented, in addition to the actions that Government should take in relation to Cockburn Sound, specifically the on-going research and the formation of a management structure, the Government should develop an overall package of environmental protection or enhancement measures that will deliver a net environmental gain.

A very broad view could be taken by Government in this regard, whereby environmental gains can be made to other initiatives throughout the State, such as the implementation of Perth's Bushplan.

5. Conclusions

The EPA has considered the issues which have arisen as a consequence of the proposal, and has concluded that three issues are fundamental to this assessment: water quality, marine flora and the "A" Class Reserve 24309 (termed M91 in System Six).

The overriding environmental issue is water quality in that the proposal is likely to reduce flushing times in an area where the nutrient levels and chlorophyll a are too high. The proposal is likely to lead to an increase in chlorophyll a and an increased frequency of algal blooms. Within the context of the current water quality, the EPA has concluded that the proposal is unable to be managed to meet the EPA objectives.

The marine flora issue has been focussed through the loss of seagrass. Although the amount of seagrass loss would be relatively small, nevertheless it needs to be considered within the context of the historical loss since the 1960's during which time about 80% of the seagrass meadows have been lost as a result of changing water quality. Although the project would result in the removal of only about 2 ha of seagrass meadows, the EPA has concluded that within the context of the historical loss of seagrass, the proposal is unable to be managed to meet the EPA objectives.

The removal of part of the "A" Class Reserve 24309 (M91 of System Six) would result in there being a significant loss of representative coastal landform and associated vegetation from the Beeliar Regional Park. As it appears unlikely that this complex could be replaced by reservation in another area, the EPA has concluded that the proposal is unable to be managed to meet the EPA objectives.

As set out in the EPA's Strategic Environmental Advice on Cockburn Sound (EPA, 1998b), it is the role of the EPA to provide the best environmental advice to assist Government in the decision-making process, but it is the role of Government to make decisions as to whether or not a project should be implemented.

If a decision is taken that the proposal is to be implemented, the EPA has a responsibility to provide advice on the Conditions and Procedures to which that proposal should be subject. Some of that advice results from the commitments given by the proponent following discussions with the Department of Environmental Protection, acting on behalf of the EPA, and some results from EPA advice given as Other Advice in this report and in the Cockburn Sound Strategic Environmental Advice (EPA, 1998b).

The EPA has a responsibility to provide advice to assist Government in relation to environmental response initiatives aimed at ensuring overall environmental acceptability of projects. The EPA is aware that this may not be able to be achieved by the proponent within the context of the project area. Accordingly, the EPA proposes that a very broad view be taken by Government whereby environmental gains can be made through other initiatives throughout the State.

A decision by Government to implement the proposal should be accompanied by a broad-based environmental response but which includes a commitment to an on-going programme of research and investigation aimed at providing information on which to base environmental management decisions as well as the establishment of a management structure which can bring about management to ameliorate the environmental impacts.

6. Conditions

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

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

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

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

Having considered the proponent's commitments and the information provided in this report, the EPA has developed a set of conditions which the EPA recommends be imposed if the proposal by the Department of Commerce and Trade in association with LandCorp and Main Roads WA to construct industrial infrastructure and a harbour development in Jervoise Bay is approved for implementation. These conditions are presented in Appendix 3. Matters addressed in the conditions include:

(a) the proponent shall fulfil the commitments in the Consolidated Commitments statement set out as an attachment to the recommended conditions in Appendix 3;

(b) in order to manage the environmental impacts of the project, and to fulfil the requirements of the conditions and procedures in this statement, prior to construction, the proponent shall demonstrate to the requirements of the Environmental Protection Authority on advice of the Department of Environmental Protection that there is in place an environmental management system which includes the following elements:

- environmental policy and commitment;
- planning of environmental requirements;
- implementation and operation of environmental requirements;
- measurement and evaluation of environmental performance; and
- review and improvement of environmental outcomes.

(c) project specific conditions relating to:

- seagrass;
- water quality;
- a dredging and spoil management plan;
- a reserve replacement plan;
- a public access management plan; and
- a noise management plan.

7. Other Advice

The EPA has recently considered the implications of possible future developments in Cockburn Sound. In its report entitled "The Marine Environment of Cockburn Sound - Strategic Environmental Advice" (EPA, 1998b), the EPA has outlined its position on a number of environmental and management issues.

Cockburn Sound is the most intensively used marine system in the State. Cockburn Sound is a special area combining recreational and industrial pursuits. Decisions taken today may determine the type of waterway Cockburn Sound becomes in the future and could either enhance or foreclose other current uses and future opportunities. Decisions can be guided by a knowledge of the state of the environment, the decision options available and their potential impacts on the environment, and the actions proposed so as to ameliorate, as best we can, any impacts which may arise from these decisions.

The EPA has pointed out that development of new projects both in terms of siting and design should avoid or minimise environmental impact and should be consistent with the ecological sustainability and the long-term community vision for the Sound (EPA, 1998b).

There is a need for a workable and clear mechanism for marine-use planning and management in Cockburn Sound that is ecosystem-based and takes into account multiple-use and equity issues (among users and generations). Also, terrestrial planning needs to give adequate consideration to the links between land-based activities and the quality of near-shore marine waters. Adequate statutory management arrangements to address multiple-use and environmental issues affecting Perth's marine waters, particularly Cockburn Sound, must be considered in parallel with this proposal.

In its Strategic Environmental Advice the EPA has pointed to a number of issues which need to be addressed through coordinated management actions. These are:

- continued reductions of waste inputs from point sources direct to the Sound;
- reduction in catchment point sources which have the potential to reach Cockburn Sound via groundwater outflow or surface drainage;

  improvements in catchment land-use to reduce diffuse catchment sources, bearing in mind (i) the direct inflow of surface drainage and groundwater to the Sound, and (ii) the movement of nutrient-rich outflows from the Swan-Canning and Peel-Harvey estuaries into Cockburn Sound;
- need to incorporate marine environmental constraints in planning and management, including planning conditions for no discharge either via groundwater or directly to the Sound;

- improved measures to prevent waste inputs from ship-related activities; and
- the need for an ongoing programme of research, investigation and monitoring of the ecological response of Cockburn Sound to human-use pressures, developments and natural variation, in order to assist in broad decision making and to provide the basis for implementing management action to maintain and enhance the values and uses of the Sound (EPA, 1998b).

These actions, which support previous management responses, are required to progress further water quality improvement in Cockburn Sound. Given the current poor water quality in Jervoise Bay, these actions will also address the direct and indirect causes of those current conditions. This particularly applies to indirect sources of nutrients within the catchment of Jervoise Bay.

The EPA has included recommended environmental Conditions and Procedures in Appendix 3 which relate to actions that the proponent should also take to address a range of environmental issues resulting from the proposal. These include seagrass revegetation, water quality monitoring and management, dredge spoil management, replacement of the developed portion of System 6 M91, public access to the harbour, and noise management.

Prospecting Licence Applications

The EPA is aware that four Prospecting Licence Applications (PLAs) have been applied for over M91 and M92. While these are only applications and have yet to be granted, the EPA would be most concerned if they were granted and mining was to occur.

Mining of M91 and M92 would be inconsistent with the position put by the EPA in this report and would clearly affect an area of regional conservation value. Further it would undermine the substantial change made to this proposal to avoid constructing Cockburn Road through M92.

The Minister for the Environment is encouraged to advise the Minister for Mines that granting of these PLAs such that mining in M91 and M92 could occur would be environmental unacceptable.

Rockingham Road

One of the consequences of the revised alignment of Cockburn road along Russell Road is that the section of Rockingham Road between Fanstone Avenue and a point south of Wattleup requires upgrading. The proponent has outlined the reasons for and the environmental implications of this in Appendix 2 of the Response to Submissions (DCT, 1998).

Although the MRWA has sought assessment of this upgrade, the EPA considers that this is a change that was not described in the PER, has not been subject to public review and comment, and not all relevant environmental information is available at this time. However, to assist the progressing of this upgrading, the EPA provides the following comment and advice.

The modified alignment will remove 14 ha of remnant vegetation, with the most affected vegetation associations being 7.1ha of *Open Tuart Woodland*, 2.3ha of Dense acacia shrubland and 2.5ha of *Melaleuca huegelii* heath. None of the vegetation to be cleared is within the Beeliar Regional Park as it is understood to be entirely within the existing road reserve. All of these vegetation associations are reported to be in good to relatively good condition. Information regarding the regional and local landscape values of this vegetation has not been provided.

Apart of loss of vegetation, a key environmental issue relates to protection o the adjoining wetlands. Appendix 2 of the Response to Submissions indicates that drainage management similar to that proposed for Lake Coogee is proposed to be implemented for Lake Mt Brown and Brownman Swamp. Provided riparian vegetation and water quality associated with the wetlands are protected, the EPA considers that these can be managed.

Shifting of Rockingham Road to the west, away from Wattleup, may improve noise conditions experienced in the settlement. At the same time, there may be dislocation associated with commercial operators. The EPA considers that these impacts are likely to be manageable, but require public consultation and appropriate management commitments.

8. Recommendations

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

The EPA submits the following recommendations to the Minister for the Environment:

1. That the Minister considers the report on the relevant environmental factors of marine flora, marine fauna, landform, shoreline, seabed, vegetation communities, terrestrial fauna, wetlands, marine water quality, public health and safety, noise and vibration, dust and particulates, heritage and recreation as set out in Section 3.

2. That the Minister notes that in relation to marine water quality, the EPA has concluded that:

   (i) the chlorophyll a levels are above the nutrient related environmental quality criteria set out in the Southern Metropolitan Coastal Waters Study;

   (ii) the impact of the proposal is likely to lead to a further increase in the chlorophyll a levels; and

   (iii) that within the context of (i) and (ii), the proposal is not able to be managed to meet the EPA's objectives.

3. That the Minister notes that in relation to seagrass as part of marine flora, the EPA has concluded that:

   (i) while the amount of seagrass being considered in relation to the proposal is not large, the EPA's advice needs to take into account the historical reduction in seagrass abundance;

   (ii) the impact of the proposal will be to further reduce the seagrass abundance and potential habitat; and

   (iii) within the context of (i) and (ii), the proposal is not able to be managed to meet the EPA's objectives.

4. That the Minister notes that in relation to Reserve A 24309 System Six M91, as part of landform and vegetation communities, the EPA has concluded that the landform and conservation values which would be lost through the impact of the proposal on a portion of the Reserve would not be able to be replaced, and thus the proposal is not able to be managed to meet the EPA's objectives.

5. That the Minister notes that the summary situation is that the proposal cannot be managed to meet the EPA's objectives in relation to the issues of water quality, marine flora and Reserve 24309, but the proposal can be managed to meet the EPA's objectives for the other environmental factors.

6. That when considering this assessment report, the Minister also considers the advice provided in the Cockburn Sound Strategic Environmental Advice as set out in Bulletin 907 as well as the Other Advice provided in Section 6 of this report.

7. That the Minister recommends to Government that it provide a commitment to an ongoing programme of research and investigation in Cockburn Sound to assist in broad decision-making, as a basis for the consideration of management action over time aimed at ameliorating both the specific and cumulative impacts on the marine environment arising from existing and future developments.

8. That the Minister requests the EPA to provide a report outlining an ongoing programme of management-oriented research and investigation, taking into account information requirements, the proposed co-ordination arrangements for that research, and the benefits in terms of management action which could result from the research undertaken for Cockburn Sound.

9. The Minister recommends to Government that it establish a management structure, to include representatives of Government, business and community sectors, to coordinate environmental management within Perth's marine coastal waters, including Cockburn Sound, and between these waters and their land catchments.

10. That the Minister notes that if the Minister, in consultation with decision-making authorities, decides to allow the project to proceed, the Government should be encouraged to consider an environmental response that would result in a net gain to the environment which need not be limited to the Cockburn Area, but could be in a State wide context.

11. That the Minister notes that the EPA has provided in Appendix 3, a set of Conditions and Procedures to which the project should be subject if a decision is taken that the proposal may be implemented.

12. That the Minister impose the Conditions and Procedures set out in Appendix 3 if the proposal is to be implemented.

Appendix 1

List of submitters

SUBMISSIONS

Eight One submissions were received by the Department. In addition to this, forty three form letters were also received.

Organisations:

- Aboriginal Affairs Department
- City of Cockburn
- City of Fremantle
- City of Rockingham
- Coastal Waters Alliance
- Cockburn Power Boats Association Inc.
- Coogee Beach Progress Association Inc.
- CSIRO
- Coolbellup Community Association Inc.
- Coolbellup Fifty Plus Leisure Club
- Conservation Council of Western Australia
- Department of Conservation and Land Management
- Department of Environmental Protection (Environmental Systems Division)
- Department of Transport
- Environment Australia
- Fisheries Western Australia
- Kwinana Industries Council
- Ministry for Planning
- Naval Base Holiday Centre Association
- Recfishwest
- Regional Recreational Fishing Advisory Committee Western Australia
- Spearwood District Residents' Association
- South West Group
- The Hope Valley Progress Association
- Town of Kwinana
- Transport Action Coalition
- Water and Rivers Commission
- Waterbird Conservation Group Inc.
- Wattelup Citizens' Association Inc.
- West Australian Mussel Producers Association Inc.
- Wetlands Conservation Society Inc
- Yangebup Progress Association

Individual:

- Mr and Mrs A & D Alfirevich
- Ms K Bacich
- Mrs H.J. Barrett
- Mr k Bartlett
- Ms E Bosco
- Ms C Broickew
- Mr and Mrs Cook
- Mrs D Chaplin
- Mr and Mrs K and M Day; Mr and Mrs T and P Mofflin; Mr and Mrs K and W; Mr and Mrs C and D Williams; Ms C and Mr D Williams
- Ms D Davies
- Mr N Dragicevich
- Mr D Edwards
- S Edwards
- Ms C Heal
- Dr H Henderson
- Mrs D Hesse
- Mr R Hesse
- Mr A Hill
- Ms S Jennings
- Ms I Kitching
- Ms L Marsh
- B.D McGowan
- Mr K McLean
- Ms M Nelson
- Ms B Parker
- Ms J Parker
- D.R Phillips
- Mrs G Pickford
- Ms S Platten
- Ms G.M Ridgen
- Mr V Santaromita
- Mr J Scott MLC
- T.L Scarlett
- Ms M Separovich
- K.L & L Senior
- Ms M Slyth
- Mr J Smedley
- Mr and Mrs P and A Smith
- Mr J Spencer
- Mr L Thompson
- Ms P Townshend
- Ms A Travia, Mr S Travia, Mr D Carrick & Mr P Vesslaugh
- Mr R Tuckey
- B Whitely
- Mrs V Williams
- Mr and Mrs A and R Wills
- Mr D Winter
- Ms N Young

Appendix 2

References

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Appendix 3

Recommended Environmental Conditions and Proponent's Consolidated Commitments

Statement No.

RECOMMENDED ENVIRONMENTAL CONDITIONS

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

INDUSTRIAL INFRASTRUCTURE AND HARBOUR DEVELOPMENT, JERVOISE BAY

Proposal: To construct Industrial Infrastructure and a Southern Harbour in Jervoise Bay south of the Northern Harbour precinct and including the Marine Support Facility as documented in Schedule 1 of this statement.

The proposal involves reclamation of waterfront land for construction of berths, wharves and onshore fabrication areas including associated servicing; construction of an island breakwater, dredging of an approach channel and harbour basin; clearing and excavation of land either side of Cockburn Road to provide freehold lots for development of support industry inclusive of associated services; and the realignment of Cockburn Road via Russell Road.

Proponent: Department of Commerce and Trade

Proponent Address: P O Box 7234, Cloisters' Square, PERTH, WA 6850

Assessment Number: 1091

Report of the Environmental Protection Authority: Bulletin 908

The proposal to which the above report of the Environmental Protection Authority relates may be implemented subject to the following conditions and procedures:

1 Implementation

1-1 Subject to these conditions and procedures, the proponent shall implement the proposal as documented in Schedule 1 of this statement.

1-2 Where the proponent seeks to change any aspect of the proposal as documented in schedule 1 of this statement in any way that the Minister for the Environment determines, on advice of the Environmental Protection Authority, is substantial, the proponent shall refer the matter to the Environmental Protection Authority.

1-3 Where the proponent seeks to change any aspect of the proposal as documented in schedule 1 of this statement in any way that the Minister for the Environment determines, on advice of the Environmental Protection Authority, is not substantial, those changes may be effected.

2 Proponent Commitments

2-1 The proponent shall implement the consolidated environmental management commitments documented in schedule 2 of this statement.

2-2 The proponent shall implement subsequent environmental management commitments which the proponent makes as part of the fulfilment of conditions and procedures in this statement.

3 Environmental Management System

3-1 In order to manage the environmental impacts of the project, and to fulfil the requirements of the conditions and procedures in this statement, prior to construction, the proponent shall demonstrate to the requirements of the Environmental Protection Authority on advice of the Department of Environmental Protection that there is in place an environmental management system which includes the following elements:

1 environmental policy and commitment;

2 planning of environmental requirements;

3 implementation and operation of environmental requirements;

4 measurement and evaluation of environmental performance; and

5 review and improvement of environmental outcomes.

3-2 The proponent shall implement the environmental management system referred to in condition 3-1.

4 Seagrass

4-1 Within the 10 year period following the commencement of construction, the proponent shall revegetate with *Posidonia sinuosa* or other appropriate seagrass species an area within Cockburn Sound that has a reasonable chance of survival and is equivalent to the area of seagrass that will be lost as a direct consequence of the proposal (ie 2.1ha) to the requirements of the Environmental Protection Authority on advice of the Department of Environmental Protection.

4-2 In consultation with the Department of Environmental Protection, the proponent shall identify an appropriate area within Cockburn Sound for the revegetation of seagrass referred to in condition 4-1.

4-3 Within 12 months following the formal authority issued to the decision-making authorities under section 45(7) of the *Environmental Protection Act 1986*, the proponent shall prepare a Seagrass Management Plan outlining how conditions 4-1 and 4-2 will be complied with, to the requirements of the Minister for the Environment on advice of the Environmental Protection Authority.

4-4 The proponent shall implement the Seagrass Management Plan required by condition 4-3, to the requirements of the Environmental Protection Authority on advice of the Department of Environmental Protection.

5 Water Quality

5-1 Prior to and during construction, and during operation, the proponent shall monitor water quality both within and outside the harbour (including Jervoise Bay), to demonstrate compliance with water quality criteria as they are developed over time to the requirements of the Environmental Protection Authority on advice of the Department of Environmental Protection.

5-2 The proponent shall prepare a Water Quality Contingency Plan which identifies measures to be taken to improve water quality in the event that monitoring referred to in condition 5-1 demonstrates that water quality criteria are exceeded or are likely to be exceeded as result of the harbour's construction and operation, to the requirements of the Environmental Protection Authority on advice of the Department of Environmental Protection.

5-3 The proponent shall implement the Water Quality Contingency Plan required by condition 5-2.

6 Dredging and Spoil Management Plan

6-1 At least three months prior to commencement of dredging between -12m and -14.7m Chart Datum, the proponent shall prepare a Dredging and Spoil Management Plan, to the requirements of the Environmental Protection Authority on advice of the Department of Environmental Protection and the Fremantle Port Authority.

This Plan shall address:

1 alternative dredging methods;

2 alternative spoil containment and or disposal options; and

3 sediment, turbidity, and spoil return water control.

6-2 The proponent shall implement the Dredging and Spoil Management Plan required by condition 6-1.

7 Reserve Replacement

7-1 Within 12 months following the formal authority issued to the decision-making authorities under section 45(7) of the Environmental Protection Act 1986, the proponent shall identify land that has high environmental value, in consultation with the Department of Environmental Protection and the Department of Conservation and Land Management, to replace that portion of System 6 M91 (Reserve 24309) excised as a consequence of the proposal, to the requirements of the Minister for the Environment on advice of the Environmental Protection Authority.

7-2 Within two years following the formal authority issued to the decision-making authorities under section 45(7) of the Environmental Protection Act 1986, the proponent shall ensure that the land identified according to the requirements of condition 7-1 is incorporated within the Crown conservation estate.

8 Public Access Management Plan

8-1 Prior to commencement of construction, the proponent shall prepare a Public Access Management Plan which makes provision for public access to the breakwaters and

harbour waters, subject to public safety, to the requirements of the Environmental Protection Authority on advice of the Department of Environmental Protection and the Fremantle Port Authority.

8-2 The proponent shall implement the Public Access Management Plan required by condition 8-1.

9 Noise Management Plan

9-1 Prior to construction of the Cockburn Road realignment, the proponent shall prepare a Noise Management Plan to protect the amenity of nearby residents and other sensitive sites (eg South Coogee Primary School) from noise and vibration impacts resulting from activities associated with construction and operation, by ensuring that noise levels comply with or are consistent with the Environmental Protection (Noise) Regulations 1997, to the requirements of the Environmental Protection Authority on advice of the Department of Environmental Protection.

This Plan shall address:

1 the location, dimensions and form of noise barriers to be constructed if appropriate;

2 the sound power levels for equipment to be used, and details of acoustical treatment to be applied;

3 special procedures necessary to restrict activities under weather conditions which increase noise levels in the residential area; and

4 routine operating procedures to be adopted for particular operations to control noise.

9-2 The proponent shall implement the Noise Management Plan required by condition 9-1.

9-3 The proponent shall make the Noise Management Plan required by condition 9-1 available for public comment for a period of two weeks prior to the Environmental Protection Authority finalising its consideration of the Plan.

10 Performance Review

10-1 Each six years following the commencement of construction, the proponent shall submit a Performance Review to the Department of Environmental Protection:

- to document the outcomes, beneficial or otherwise;
- to review the success of goals, objectives and targets; and
- to evaluate the environmental performance over the six years;

relevant to the following:

1 environmental objectives reported on in Environmental Protection Authority Bulletin 908;

2 proponent's consolidated environmental management commitments documented in schedule 2 of this statement and those arising from the fulfilment of conditions and procedures in this statement;

3 environmental management system environmental management targets;

4 environmental management programs and plans; and/or

5 environmental performance indicators;

to the requirements of the Environmental Protection Authority on advice of the Department of Environmental Protection.

Note: The Environmental Protection Authority may recommend changes and actions to the Minister for the Environment following consideration of the Performance Review.

11 Proponent

11-1 The proponent for the time being nominated by the Minister for the Environment under section 38(6) or (7) of the Environmental Protection Act 1986 is responsible for the implementation of the proposal until such time as the Minister for the Environment has exercised the Minister's power under section 38(7) of the Act to revoke the nomination of that proponent and nominate another person in respect of the proposal.

11-2 Any request for the exercise of that power of the Minister referred to in condition 11-1 shall be accompanied by a copy of this statement endorsed with an undertaking by the proposed replacement proponent to carry out the proposal in accordance with the conditions and procedures set out in the statement.

11-3 The proponent shall notify the Department of Environmental Protection of any change of proponent contact name and address within 30 days of such change.

12 Commencement

12-1 The proponent shall provide evidence to the Minister for the Environment within five years of the date of this statement that the proposal has been substantially commenced.

12-2 Where the proposal has not been substantially commenced within five years of the date of this statement, the approval to implement the proposal as granted in this statement shall lapse and be void. The Minister for the Environment will determine any question as to whether the proposal has been substantially commenced.

12-3 The proponent shall make application to the Minister for the Environment for any extension of approval for the substantial commencement of the proposal beyond five years from the date of this statement at least six months prior to the expiration of the five year period referred to in conditions 12-1 and 12-2.

12-4 Where the proponent demonstrates to the requirements of the Minister for the Environment on advice of the Environmental Protection Authority that the environmental parameters of the proposal have not changed significantly, then the Minister may grant an extension not exceeding five years for the substantial commencement of the proposal.

13 Compliance Auditing

13-1 The proponent shall submit periodic Performance and Compliance Reports, in accordance with an audit program prepared in consultation between the proponent and the Department of Environmental Protection.

13-2 Unless otherwise specified, the Chief Executive Officer of the Department of Environmental Protection is responsible for assessing compliance with the conditions, procedures and commitments contained in this statement and for issuing formal clearances.

13-3 Where compliance with any condition, procedure or commitment is in dispute, the matter will be determined by the Minister for the Environment.

Schedule 1

The Proposal

The proposal consists of the development of Industrial Infrastructure and a Southern Harbour in Jervoise Bay, south of the existing Northern Harbour precinct and including the Marine Support Facility.

Key Characteristics Table

Proposal Characteristic	Description
Breakwaters	• Offshore breakwater approx 2.05km long. • Southern breakwater approx 1.25 km long. • Total material approx 1.3 million cubic metres. • Material will be sourced from excavation operations during construction of the onshore industrial estate together with local quarry sources.
Marine structures	• 350m long wet berth, piled with concrete deck. • 80m long load out wharfs, sheet piled.
Dredging works	• Channel - 2.8km length, 164m wide, depth -14.7m CD (although dredging will initially only be to -12m CD). • Channel area - 46ha. • Entrance basin depth -14.7m CD. • Wharf area depth -12.0m CD. • Total dredge material approx 6.2 million cubic metres (for land reclamation).
Harbour	• Enclosed water volume 14.5 million cubic metres. • Water surface area of 131 ha. • Southern entrance approx 300m wide. • Northern entrance approx 180m wide. • Marine ship lift facility included within harbour.

Reclamation of waterfront land	• Approx 60ha in area, extending over 900m coastline south from existing offshore construction yard and up to 950m offshore. • Approximately 7.5 million cubic metres of fill required for reclamation of waterfront land for construction of berths, wharves and onshore fabrication areas. This fill will comprise approx 4.0 million cubic metres of excavated material from the onshore industrial estate with the remainder of fill to come from dredging activities. • The reclaimed area will be levelled and compacted, grading from a waterfront elevation of 3.5m AHD to approx 5.0m AHD at the landward extent of the common user area.
Onshore land development	• Approx 80 ha. • Clearing, excavation and contouring of land immediately east of the reclaimed waterfront area for development of associated onshore industrial lots. • Excavation material approx 4 million cubic metres.
Activities	• Provision of a sheltered waterway for companies operating on the common-user shorefront area and adjacent freehold sites. Type of activity anticipated is the supply of modules and manufactured components to the oil, gas and resource industry sectors. There is the potential for six loadouts per year. involving a large barge or heavy lift vessel, accompanied by four tugs, in the harbour for approximately three days. • Facilitation of the fitout or refit contracts on Floating Production Storage and Offtake (FPSO) vessels. • The proposal does not include a future dry dock, a casting basin for concrete gravity structures or "scrape and paint" jobs on vessels.
Realignment of Cockburn Road	• Initially, single carriage upgrade of Russell Road, construction of single carriage Henderson perimeter/ southern link road and construction of new carriageway on Rockingham Road. Ultimately construction of dual carriageway between Mayor Road and Rockingham Road via Russell Road.
Restricted access to waterway	• The public will have restricted access for approximately 18 days of the year during loadouts.

Zoning	• Metropolitan Region Scheme (MRS) Amendment 1001/33 South West Districts Omnibus (No. 3A). The amendment proposes the following specific changes to the zones and reservation in the MRS: • Southern Harbour: the transfer of a portion of Reserve 24309 Cockburn Road, Henderson from 'Parks and Recreation' reservation to 'Industrial' zone and part of Cockburn Sound from 'Waterways' reservation to 'Industrial' zone. • Southern Link Road: the transfer of vacant Crown land and portion of Reserves 39455 and 39584 Cockburn Road, Henderson and a portion of Cockburn Road reserve from 'Parks and Recreation' reservation to 'Industrial' zone and portion of Lot 2 Cockburn Road, Henderson from 'Industrial' zone to 'parks and Recreation' reserve. • Russell Road: the transfer of a portion of Lot 9 Cockburn Road from public Purposes (WSD) reservation to Important Regional Roads reservation and Industrial zone, transferring a portion of Lot 5 Russell Road and a portion of Russell Road reserve from Important Regional roads reservation to Industrial zone and a portion of Cockburn Road reserve from Public Purposes (WSD) reservation to Industrial zone.

Summary of Proponent's Commitments for Marine and Land Development Works

Commitment	Objective	Action	Timing	Whose Advice	Measurement/ Compliance Criteria
1. Prepare and implement an Environmental Management Plan (EMP) for construction phase of the project.	To manage the marine construction works, land clearing, excavation and reclamation so as to minimise environmental impact.	By addressing all issues of construction which potentially impact on the environment including: • noise • dust • turbidity • spoil return water • A risk assessment and management approach will be incorporated in the EMP (Construction).	Completion and approval of the EMP (Construction) before commencement of construction.	Department of Environmental Protection (DEP) City of Cockburn (CoC) Town of Kwinana (ToK)	Acceptance of EMP (Construction). Performance and Compliance Report.
2. Prepare and implement a dredge management plan.	To manage the impact of turbidity on seagrasses	To prepare and implement a dredge management plan. The plan should include options for spoil disposal.	Prior to commencement of construction.	DEP	
3. Undertake further wave modelling studies prior to construction, of the island breakwater.	To ensure that no adverse effect on coastal processes and beach stability on Woodman Point are experienced.	To modify design of breakwaters if required	Prior to commencement of construction.	DEP DoT CoC	
4. Minimise dust, noise and traffic during construction.	To avoid undue disturbance to local residents and traffic movement during construction.	Preparation of plans within the EMP (Construction) for management of dust, noise and traffic throughout the construction period. The EMP (Construction) will also include the designated transport route and hours of work for the breakwater limestone supply. These will also be incorporated in the limestone supply contract.	Completion and approval of the EMP (Construction) before commencement of construction.	DEP CoC ToK	Performance and Compliance Report.
5. Prepare Environmental	To manage the ongoing	By addressing all operational issues including:	Completion and	DEP	Acceptance of EMP

Summary of Proponent's Commitments for Marine and Land Development Works

Commitment	Objective	Action	Timing	Whose Advice	Measurement/ Compliance Criteria
Management Plan (EMP) for the day to day operations of the harbour and the shorefront industrial estate.	operation of the harbour and the shorefront industrial estate in a manner which results in minimum environmental impact.	• monitoring requirements; • clean-up and containment procedures; • stormwater and waste management; • breakwater maintenance; • navigation issues; and • erosion. The stormwater containment measures will include permeable drainage pits with access points for cleaning and inspection. A regular stormwater system maintenance schedule will be implemented and direct discharge of any other form of waste stream into the harbour will be prohibited. A risk assessment and management approach will be incorporated into the EMP (Operations) which will include: • AQIS ballast water management procedures; • contingency plan for the treatment and clean up of oil and other spills to control and mitigate possible degradation in water and sediment quality; • a coastal monitoring plan outlining options for any sand bypassing remedial work; and • annual reviews of aerial photographs taken by	approval of the EMP (Operations) before commencement of the harbour and shorefront industrial estate operations.	Department of Transport (DoT) Fremantle Port Authority (FPA) CoC	(Operations) Performance and Compliance Report for 5 year post-construction Annual Monitoring Reports

Summary of Proponent's Commitments for Marine and Land Development Works

Commitment	Objective	Action	Timing	Whose Advice	Measurement/ Compliance Criteria
		the Department of Land Administration to determine any trends in erosion or accretion.			
6. Monitor marine water quality in the Jervoise Bay region.	To assess the impact of the proposal on marine water quality in the Jervoise Bay region.	The proponent will undertake a water quality monitoring programme. The programme will be designed to measure the impact of the harbour on the water quality of the region. The programme will include sampling for, or measurement of: • light penetration; • phytoplankton (including screening for toxic phytoplankton species) • total nitrogen; • dissolved inorganic nitrogen; • chlorophyll a; • dissolved oxygen concentration; and • temperature and salinity profiles. Monitoring surveys should be conducted over the summer months. The programme will be detailed in consultation with the DEP as part of the preparation of the marine Environmental Management Plan. The target water and sediment quality criteria for the harbour will be determined in consultation with the DEP when the substantially revised ANZECC water and sediment quality guidelines are released (due late 1998).	Programme to commence prior to construction and ongoing through the first five years of operations.	DEP	Annual monitoring reports, for 5 years post-construction. Immediate reporting of significant changes.
7. Monitor sediment	To assess the impact	Implementation of a sediment quality monitoring	Programme to	DEP	Annual monitoring

Summary of Proponent's Commitments for Marine and Land Development Works

Commitment	Objective	Action	Timing	Whose Advice	Measurement/ Compliance Criteria
quality in the Jervoise Bay region, including the harbour.	of the proposal on sediment quality in the Jervoise Bay region.	programme which includes annual measurements of: • heavy metals; • tributyltin (TBT) compounds: and • organic content.	commence prior to construction and ongoing through the first five years of operation.		reports, for 5 years post-construction. Immediate reporting of significant changes.
8. To adopt best practise in respect of management of TBT.	To reduce potential impacts associated with shipping activities.	Preparation of specific management plans for control of TBT accordance with the latest ANZECC guidelines.	Complete management plan before commencement of harbour operations.	DEP FPA	Acceptance of reports.
9. To erect signs at the commencement of construction that the taking of edible shellfish and other filter feeding marine life will be prohibited from harbour waters.	To protect the public from the risk of eating contaminated shellfish.	Erection of signs prior to and immediately following construction.	Signs to be erected prior to commencement of development and following breakwater and reclamation construction.	CoC Health Dept	Performance and Compliance Report.
10. Control access to harbour waters by general public.	To protect general public from risk during the movement of large vessels.	Preparation of harbour management plan as part of EMP (Operations). Access to the harbour waters by the general public will be controlled during the movement of large vessels. This is to protect the public from risk and will be addressed in the Environmental Management Plan for construction and operations.	Completion and approval prior to commencement of harbour operations.	FPA DoT	Acceptance of EMP (Operations).
11. Provide appropriate management to ensure	To avoid impact on commercial and	By management of construction, dredging works and harbour operations.	Navigation measures and equipment to be in	FPA DoT	Acceptance of EMP (Construction)

Summary of Proponent's Commitments for Marine and Land Development Works

Commitment	Objective	Action	Timing	Whose Advice	Measurement/ Compliance Criteria
safe passage for shipping and small craft.	recreation vessel movements.		place during construction and harbour operations.		Acceptance of EMP (Operations)
12. Prepare Environmental Management Plan (EMP) for construction phase of the revised road network.	To manage the road construction works, land clearing and drainage so as to minimise environmental impact.	By addressing all issues of construction which potentially impact on the environment.	Completion and approval of the EMP before commencement of the road construction.	DEP Conservation and Land Management (CALM) CoC ToK	Acceptance of EMP. Performance and Compliance Report.
13. Seek to progress transport corridor planning in the locality with the aim of ensuring isolated bushland contiguous with Beeliar Regional Park is available for consolidation into the Park.	To improve the area to boundary ratio of Beeliar Regional Park and to allow land currently zoned for industrial use adjacent to Mt Brown to be consolidated into the Park for conservation purposes.	Further liaison with LandCorp, Alcoa, Department of Transport, LGAs and other interested stakeholders.	To be finalised by the completion of the road construction.	DEP DoT CoC ToK	Performance and Compliance Report.
14. Initiate the incorporation of areas of the highway reservation south of Russell Road into the Beeliar Regional Park.	To identify areas of the highway reservation, surplus to requirements for the Henderson southern link and perimeter road as detailed in the	Formal amendment of the MRS reservation and Land Act/ CALM Act reservation	Within two years of commencement of construction.	EPA DEP WAPC DoT CALM	Performance and Compliance Report.

Summary of Proponent's Commitments for Marine and Land Development Works

Commitment	Objective	Action	Timing	Whose Advice	Measurement/ Compliance Criteria
	revised proposal, and incorporating surplus reserve land into the adjacent Beeliar Park.				
15. Investigate, during detail design, options of reducing carriageway separations and other design mechanisms to improve buffer widths at Lake Coogee.		Review and implement design which achieves best buffer widths to Lake Coogee	Prior to commencement of construction.	DEP MRWA CALM	
16. Comprehensive landscaping and rehabilitation of the surplus highway reserve land.	To improve the ecological capacity of the surplus reserve, reduce weed infestation and improve condition of existing vegetation after construction is complete.	Rehabilitation and Landscape plan to be prepared as part of the EMP for road construction management. Provision of community access via a dual use pathway and the provision of viewing platforms on the foreshore of Lake Coogee.	Completion and approval of EMP before commencement of road construction. To be implemented after road construction is complete.	DEP CALM ToK CoC	Performance and Compliance Report
17. Lake Coogee to be protected by closed drainage system and a water quality monitoring.	To protect Lake Coogee from further reductions in water quality due to the proximity of the highway.	Detailed drainage design, monitoring and mitigation programme to be documented in the Environmental Management Plan. The drainage design and monitoring programme will include vegetated detention basins and a closed drainage system, and provide an entrapment to protect the Lake from	Completion and approval of EMP prior to the commencement of road construction.	DEP	Performance and Compliance Report.

Summary of Proponent's Commitments for Marine and Land Development Works

Commitment	Objective	Action	Timing	Whose Advice	Measurement/ Compliance Criteria
		accidental spillage. Baseline data will be collected prior to the road alignment and control data obtained from other wetlands. A mitigation management plan will be included to address adverse impacts of construction or operation related to Lake Coogee.			
18. Drainage controls to be put in place in the Henderson southern link and perimeter road and new Rockingham Road carriageway.	To protect Brownman Swamps and Lake Mt. Brown from reductions in water quality due to the proximity of the roads.	Detailed drainage design and monitoring programme to be documented in the EMP.	Completion and approval of EMP prior to the commencement of road construction.	DEP Water and Rivers Commission DoT	Performance and Compliance Report.
19. Declared rare flora (DRF) survey to be carried out in spring prior to any vegetation clearing and management and rehabilitation plan prepared as required.	To ensure that the conservation status of any DRF species is not diminished by the development.	Complete DRF survey then, as required, obtain Ministerial approval to "take" rare flora under Section 23 (f) of the Wildlife Conservation Act 1950 and develop/implement a management and rehabilitation plan as required.	Prior to commencement of vegetation clearing.	CALM DEP	Performance and Compliance Report.
20. Develop and implement a strategy for the treatment of subsurface artefactual or skeletal material.	To respond in an appropriate way to the uncovering of any subsurface artefactual or skeletal material	Develop and implement the strategy as part of the EMP (Construction) and the EMP for roadworks.	Completion and approval of the EMP's prior to commencement of construction or	Department of Aboriginal Affairs	Performance and Compliance Report.

Summary of Proponent's Commitments for Marine and Land Development Works

Commitment	Objective	Action	Timing	Whose Advice	Measurement/ Compliance Criteria
	during onshore earthworks		roadworks.		
21. Catchment management		DCT participate with DEP and WRC in consultation with local government to develop and implement a catchment management strategy for reducing contaminants (ie nutrients) in groundwater.			
22. DRF management plan (genetic material).		DCT in consultation with CALM and the City of Cockburn will recover significant genetic material (eg seeds) from the portion of M91 to be developed, for use in other portions of M91 or M92 as appropriate.			
23. MRWA criteria.		Cockburn Road realignment will comply with appropriate MRWA criteria.			