

Long-Term Shellsand Dredging, Owen Anchorage

Cockburn Cement Limited

**Report and recommendations
of the Environmental Protection Authority**

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Summary and recommendations

Cockburn Cement Limited (CCL) has been dredging shellsand from Owen Anchorage since 1972. CCL now proposes to dredge shellsand in the long-term (to 2034) from additional specific locations on Success Bank, Parmelia Bank and West Success Bank, Owen Anchorage. The proposal comprises Stage 1 (2002-2014) on Success and Parmelia Bank and Stage 2 (2015-2034) on West Success Bank. CCL has proposed dredging a total area of 783ha which comprises 168.5ha of seagrass and 614 ha of unvegetated habitat. This report provides the Environmental Protection Authority's (EPA's) advice and recommendations to the Minister for the Environment and Heritage on the environmental factors relevant to the proposal.

The EPA has previously undertaken assessments on CCL's short and medium term dredging proposals. The EPA in its assessment of the medium-term proposal in Owen Anchorage recommended that proposals involving the further removal of seagrass and potential seagrass habitat in the long-term for shellsand should be recognised as 'environmentally unreasonable' (EPA, 1996a). The challenge for CCL, in its application for the long-term dredging proposal involving further seagrass removal, was to provide additional information which could lead the EPA to the view that the further removal of some seagrass and potential seagrass habitat was environmentally reasonable.

Section 44 of the *Environmental Protection Act 1986* requires the EPA to report to the Minister for the Environment and Heritage 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.

Relevant environmental factors

In the EPA's opinion, the following are the environmental factors relevant to the proposal, which require detailed evaluation in the report:

- (a) biodiversity – including loss of seagrass, loss of potential seagrass habitat and ecosystem function;
- (b) seagrass rehabilitation – feasibility and success;
- (c) wave climate, sediment movement and shoreline stability – the effects of continued dredging on Success and Parmelia Banks and the coast; and
- (d) recreation – impact on recreational fisheries.

Conclusion

The EPA has considered the proposal by CCL to dredge shellsand in the long-term from specific locations on Success Bank, Parmelia Bank and West Success Bank, Owen Anchorage.

The EPA acknowledges that the long-term proposal has been developed from a very substantial base of new knowledge and that although some direct loss of biodiversity will occur in the vicinity of dredging in terms of seagrass, dependent fish, epiphytes and invertebrates, no species will be lost as habitat types exist elsewhere.

In terms of cover, seagrass in Owen Anchorage was more extensive in 1999, even accounting for previous dredging losses, than at any earlier mapping period.

The EPA recognises the important role that seagrass plays as a primary producer and a habitat and considers it is an important principle to retain seagrass in Owen Anchorage wherever possible. The EPA also recognises that Parmelia Bank borders Cockburn Sound, which has already lost 80% of its seagrass.

The EPA notes that whilst seagrass rehabilitation is possible, it is not currently practicable at a scale comparable to the rate of loss proposed through dredging, but that the necessary technology may be developed in the future. It is also noted that seagrass distribution in Owen Anchorage is dynamic and seagrasses can establish naturally on shallow bare sand habitat.

The EPA notes the proponent has now identified additional resources of shellsand on West Success Bank with no seagrass cover. The EPA considers that dredging of unvegetated shellsand can be carried out in an environmentally acceptable manner.

The EPA notes that as a result of expert advice, the expert manner in which the proponent has undertaken its research as part of the EMP studies, and the utilisation of internal and external review systems it appears to the EPA that there is now sufficient information to enable the EPA to make a decision about the further dredging of seagrass from the Owen Anchorage area.

The EPA is of the view that CCL has provided sufficient new information to enable the EPA to conclude that further limited removal of some seagrass from Owen Anchorage can now be considered environmentally reasonable.

Whilst the EPA considers that a limited loss of additional seagrass in Owen Anchorage could occur without inducing a significant impact, it wishes to ensure that any additional loss is strictly constrained. Accordingly, the relocation of CCL's dredging operations to unvegetated areas on West Success Bank should occur as quickly as practicable and in considerably less time than the 12 years as originally proposed by CCL for Stage 1 of the proposal.

The proponent should thus prepare for Government consideration a timetable for moving from Success Bank and Parmelia Bank to West Success Bank as quickly as practicable.

The EPA notes that the proposal will result in minor hydrodynamic changes to the wave climate in Owen Anchorage and Cockburn Sound, and will allow wave energy from Owen Anchorage to penetrate deeper into Cockburn Sound. The EPA considers that the altered wave regime may result in some coastal structures experiencing increases in wave height during severe storms and minor changes to rates of sediment transport and shoreline orientation. However, based on CCL's commitments, including management measures for foreshore restoration, the EPA considers that hydrodynamic changes arising from the proposal can be managed.

The EPA notes the different views held in relation to the importance of seagrasses for fish, but concludes that it is unlikely that the abundance of fish of commercial and recreational importance will be significantly affected by the proposal.

The EPA also considers that there is an opportunity to address the issue of wider habitat protection. Such protection can be affected through changes to the State Agreement Act, with CCL to relinquish the right to dredge in those parts of the Agreement Act area which are not part of this

proposal, by extension of the Shoalwater Islands Marine Park and by protection of terrestrial limestone habitats at Caraban and Ridges, north of Perth.

In conclusion the EPA:

- (a) recognises the important role that seagrass plays as a primary producer and a habitat;
- (b) recommends the relocation of dredging operations to areas of West Success Bank, where there is no seagrass, as soon as practicable, and that this be achieved in considerably less time than the 12 years as originally proposed by CCL for Stage 1 of the proposal;
- (c) agrees that the balance of scientific advice indicates that some limited further removal of seagrass would be unlikely to have a significant environmental impact in Owen Anchorage;
- (d) notes that, while the proponent prepares to relocate to West Success Bank, it would be sensible for any dredging which may be authorised to link the previously dredged areas in Parmelia and Success Banks, along the alignment of the second shipping channel in Owen Anchorage;
- (e) considers the management commitment made by CCL to deal with foreshore restoration issues arising from any hydrodynamic changes to be important;
- (f) considers that, on balance, commercial and recreational fisheries are unlikely to be significantly compromised by the proposal; and
- (g) supports the protection of seagrass on the balance of East Success Bank and Parmelia Banks, an extension to the Shoalwater Islands Marine Park and protection of terrestrial limestone habitats at Caraban and Ridges.

The EPA considers that it is unlikely that the EPA's objectives would be compromised, provided the above issues are addressed and there is satisfactory implementation by the proponent of the proponent's commitments and the recommended conditions set out in Appendix 6 and summarised in Section 4.

Recommendations

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

1. That the Minister notes that:
 - (a) the proposal being assessed is for long-term shellsand dredging (from 2002 to 2034) from specific locations on Success Bank, Parmelia Bank and West Success Bank, Owen Anchorage; and
 - (b) the proposal comprises two stages: the first being for 12 years in the general area previously dredged on Success and Parmelia Banks and impacting on some seagrass; and the second stage for 20 years in a new unvegetated area on West Success Bank mostly outside the current State Agreement Act area.
2. That the Minister considers the report on the relevant environmental factors as set out in Section 4.
3. That the Minister notes that the EPA has concluded that the removal of some seagrass from Success and Parmelia Banks during a reduced Stage 1 operation would be unlikely to have a significant environmental impact in Owen Anchorage.

4. That the Minister notes that the EPA has concluded that CCL should relocate its dredging operations to areas of West Success Bank, where there is no seagrass, as soon as practicable, and that this be achieved in considerably less time than the 12 years as originally proposed.
5. That the Minister liaise with the Minister for State Development to agree upon a programme for the timely relocation of dredging operations from Success and Parmelia Banks to West Success Bank and that this relocation occurs in considerably less time than 12 years.
6. That the Minister notes that the EPA has concluded that it is unlikely that the EPA's objectives would be compromised, provided there is satisfactory implementation of points 4 and 5 above and implementation by the proponent of the recommended conditions set out in Appendix 6, and summarised in Section 4, including the proponent's commitments.
7. That the Minister imposes the conditions and procedures recommended in Appendix 6 of this report.
8. That the Minister notes the EPA's advice that, based upon the provision of long-term access to shellsand, in accordance with the recommendations in this report, mining tenements held by CCL north of Perth at Caraban and Ridges, be added to the conservation estate.
9. That the Minister notes the advice of the EPA that there is an opportunity to address the issue of wider seagrass protection through changes to CCL's State Agreement Act and extension of the Shoalwater Islands Marine Park.

Conditions

Having considered the proponent's commitments and information provided in this report, the EPA has developed a set of conditions which the EPA recommends be imposed if the proposal by CCL to dredge shellsand in the long-term from specific locations on Success and Parmelia Banks, Owen Anchorage is approved for implementation. These conditions are presented in Appendix 6. Matters addressed in the conditions include the following:

- (a) the proponent shall fulfil the commitments set out as an attachment to the recommended conditions in Appendix 6;
- (b) a Dredging and Environmental Management Plan for Success and Parmelia Banks should be prepared and implemented to the requirements of the Minister for the Environment and Heritage and the Minister for State Development on advice of the Environmental Protection Authority, the Department of Environmental Protection, the Department of Conservation and Land Management, the Fremantle Port Authority, the Department of Mineral and Petroleum Resources, and the Department of Fisheries.
- (c) a Seagrass Research and Rehabilitation Plan should be prepared and implemented to the requirements of the Environmental Protection Authority, on advice of the Department of Environmental Protection, the Department of Conservation and Land Management and the Department of Fisheries.

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1. Introduction

This report provides the advice and recommendations of the Environmental Protection Authority (EPA) to the Minister for the Environment and Heritage on the environmental factors relevant to the proposal by Cockburn Cement Limited (hereafter referred to as CCL) to dredge a 1.5 km wide Seaway through Success and Parmelia Banks in Owen Anchorage and to dredge an area of West Success Bank in the Mewstone area (see Figure 1).

The long-term dredging proposal is being assessed as an Environmental Review and Management Programme (ERMP). The ERMP (CCL, 2000) was released for a twelve week public review period between 27 November 2000 and 19 February 2001.

CCL has been dredging shellsand on Success and Parmelia Banks in Owen Anchorage since 1972, operating under the terms of the *Cement Works (Cockburn Cement Limited) Agreement Act* 1971, as amended 1986. The scheme of the Agreement Act, effective to 2011 with provision to extend to 2021, entitles CCL to access shellsand sediment within a five mile (8km) radius of a point on Coogee Beach, north of Woodman Point.

The EPA has previously assessed CCL's short-term and medium-term dredging operations in Owen Anchorage (EPA, 1994 and EPA, 1999 respectively). Between 1972 and 1981, CCL dredged shellsand from Parmelia Bank. Dredging then moved north to Success Bank. Since 1981 dredging has had the effect of establishing a second shipping channel alignment eastward of the Fremantle Port Authority (FPA) shipping channel.

The bulk of the shellsand sediment from Success Bank averages 92% calcium carbonate which is the preferred grade set by CCL for its quicklime manufacturing operations.

The ERMP (CCL, 2000) and the Summary of Submissions and Proponent's Response to Submissions (CCL, 2001a) are provided on a CD at the back of this document accompanying this report. In addition, the proponents response to queries raised by the Department of Environmental Protection (DEP) on the proponents responses to submissions is also provided on this CD. This document is entitled 'Responses to Responses' (CCL, 2001c). These documents are provided as a matter of information only and do not form part of the EPA's report and recommendations. Issues arising from the submission process and which have been taken into account by the EPA appear in this Bulletin. The list of submitters appears in Appendix 1.

2. The proposal

CCL's long-term shellsand dredging proposal involves the continuation of shellsand extraction from specific locations on Success Bank, Parmelia Bank and West Success Bank, Owen Anchorage (see Figure 1). CCL intends to implement the proposal in two stages.

Stage 1, as proposed, would create a 1.5km wide by 15m deep seaway through Success and Parmelia Banks by 2014 (see Figure 2). This stage would require the removal of 168.5ha of seagrass and 264.5ha of shallow bare sand, which can be potential seagrass habitat, to recover 30 million tonnes (mt) of shellsand.

Shellsand would be recovered at the rate of 800 tonnes per hour by the use of a water jet suction dredge. The dredged shellsand would be transferred from the dredging site via three split hopper bottom opening barges which travel to CCL’s jetty at Woodman Point and discharge their load on the seabed alongside. This material can be dredged with CCL’s existing facilities, however, some of this resource will require beneficiation. No assessment of the beneficiation process has yet been undertaken.

Stage 2 would require the dredging of about 350ha of shallow bare sand on West Success Bank, east and north of the Mewstone area, over an additional 20 years to recover 60 mt of shellsand. This shellsand will require beneficiation and CCL will need to replace its dredging plant, given the higher wave energies in the area. Shellsand proposed to be dredged from within this notional area is shown in Figure 3.

It should also be noted that CCL has already previously dredged some areas on Success and Parmelia Banks. These areas include a site on Parmelia Bank that was dredged between 1972 and 1981, the almost completely dredged second shipping channel through Success Bank, that was dredged between 1981 and 1994 and surrounding areas dredged between 1994 and the present (see Figures 2 and 3).

The key characteristics of the proposal, as originally proposed in the ERMP, are summarised in Table 1 below. A detailed description of the proposal is provided in Sections 1 and 2 of the ERMP (CCL, 2000). The EPA notes that CCL would require an amendment to the State Agreement Act to facilitate this proposal. It is also noted that while the notional Stage 2 area comprises potential seagrass habitat, CCL has committed to avoid any existing seagrass in this area.

Table 1: Summary of Key Proposal Characteristics as Originally Proposed in the ERMP (CCL, 2000)

Stage	Element	Characteristics
Stage 1	Dredging	<ul style="list-style-type: none"> A 1500m wide seaway dredged through Success and Parmelia Banks.
	Duration	<ul style="list-style-type: none"> Mid 2002-end of 2014 (12.5 years).
	Volume	<ul style="list-style-type: none"> Approximately 30,500,000 tonnes. This material can be dredged with CCL’s existing facilities. Some of this resource will require beneficiation.
	Area of disturbance	<ul style="list-style-type: none"> The seaway as proposed would be 1.5km in width, 3.3km in length through Success Bank and 2.5km in length through Parmelia Bank. The area proposed to be dredged is 433ha, comprising 168.5ha of seagrass and 264.5 ha of unvegetated seabed some of which may be viable seagrass habitat.
Stage 2	Dredging	<ul style="list-style-type: none"> Shellsand is proposed to be dredged from West Success Bank (the Mewstone area). CCL will need to replace its dredging plant, given higher wave energies in the area.
	Duration	<ul style="list-style-type: none"> 2015 to approximately 2034 (20 years).
	Volume	<ul style="list-style-type: none"> Approximately 60,000,000 tonnes. This material will require beneficiation.
	Area of disturbance*	<ul style="list-style-type: none"> The area to be dredged is approximately 350 ha. The dredging is proposed to occur in areas of little or no seagrass and be at least 750m from reefs and islands.

* - The final configuration and dredging depth for the Stage 2 area has yet to be finalised, and will depend on refinement of information on the depth and grade of shellsand resource, the capabilities of the new dredge that CCL will be required to purchase for this area, and the need to avoid reefs and areas of seagrass.

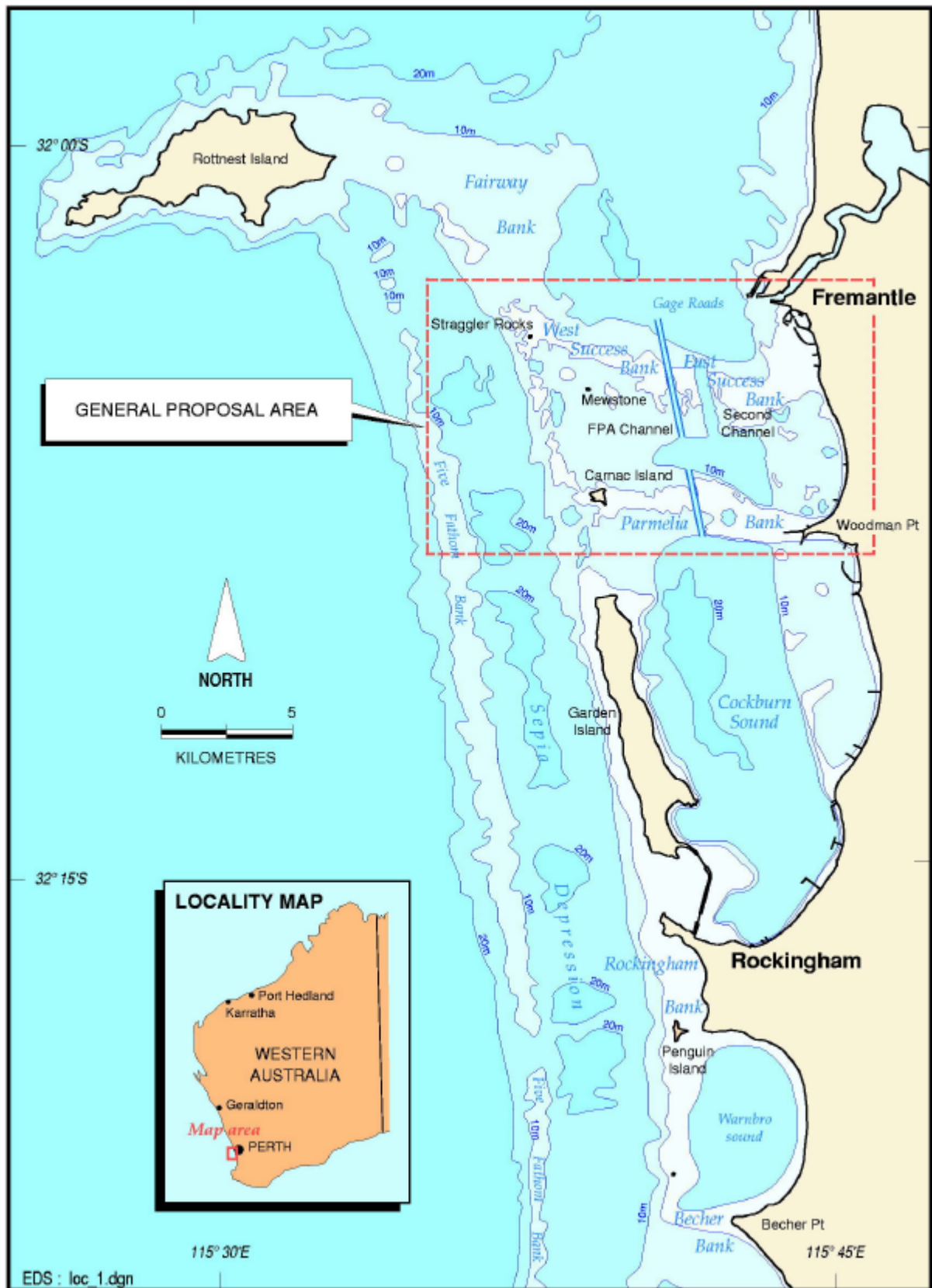


Figure 1: Success and Parmelia Banks, Owen Anchorage (CCL, 2000)

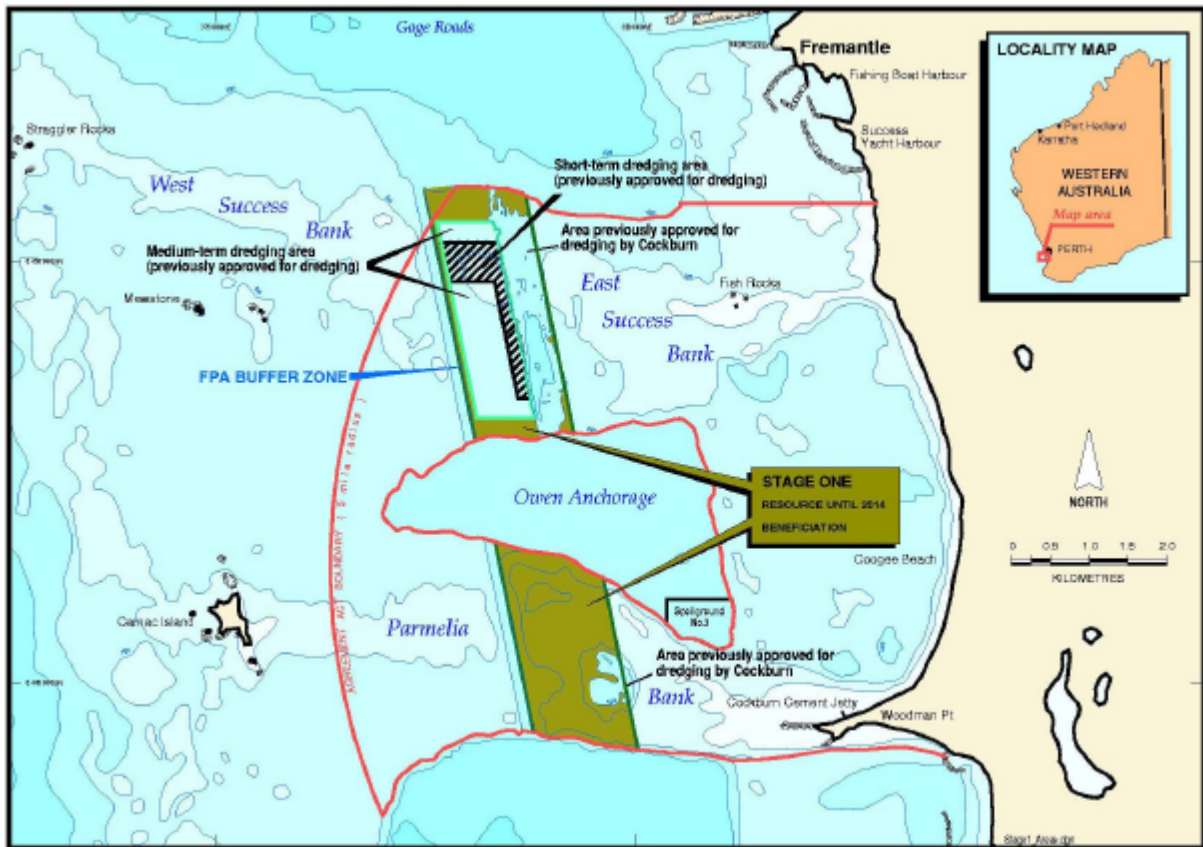


Figure 2: Stage 1 - proposal for long-term shellsand dredging, Owen Anchorage (CCL, 2000)

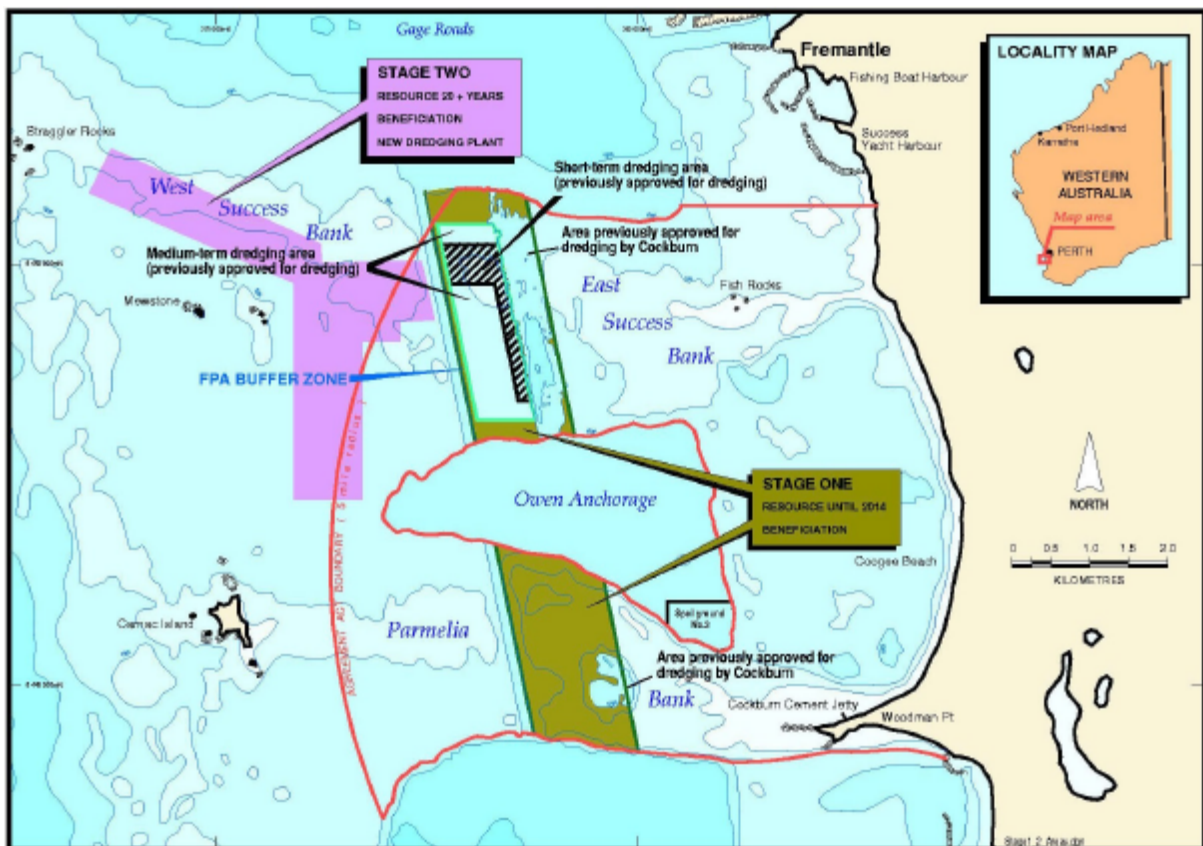


Figure 3: Stage 2 - Proposal for long-term shellsand dredging, Owen Anchorage (CCL, 2000)

The construction of a beneficiation plant will be subject to a separate referral to the EPA, when required.

Section 2 of the ERMP sets out CCL's shellsand resource requirement, the availability of the material and alternatives to the long-term proposal. In summary, the existing Munster plant shellsand requirement for the period 2001-2021 is approximately 55 Mt (CCL, 2000).

CCL's analysis of the availability of alternative resources to meet their requirements for raw materials over the next 20 years or more has concluded that there are no known resources of calcium carbonate available to CCL that could be accessed commercially, outside of Owen Anchorage (CCL, 2000).

3. Background

3.1 Context to the proposal

CCL manufactures quicklime and cement and operates under the *Cement Works (Cockburn Cement Limited) Agreement Act 1971*. This Act was substantially amended in 1986 to require, among other matters, that the Company comply with the State's environmental laws, and to submit a 'dredging management programme' (DMP) every two years for approval. The Minister for State development has responsibility for the administration of the Agreement Act and for approving the DMPs tendered in accordance with it.

The scheme of the Act, effective to 2011 with provision for extension to 2021, entitles CCL to access shellsand sediment within a five mile (8km) radius of a point on Coogee Beach, north of Woodman Point. It also obliges the State to "use every endeavour to find other shellsand within a reasonably economic distance from the jetty, and if other shellsand is not available, then other equivalent material."

Dredging Operations

Between 1972 and 1981 CCL undertook dredging on Parmelia Bank, offshore from Woodman Point, and then moved to Success Bank in 1981 for reasons of resource quality.

The dredging that took place between 1981 and early 1994 formed part of the proposed second shipping channel through Owen Anchorage. Since 1994, CCL has been dredging shellsand from an area on Success Bank between the FPA shipping channel and the proposed second shipping channel, known as the short and medium-term dredging areas.

Dredging Management Plans

Under the Agreement Act, environmental matters related to CCL's dredging were managed through a 10-year Dredging Management Plan (DMP) which are reviewed every two years. The purpose of each DMP was to describe CCL's proposals for dredging operations and for monitoring protection and management of the environment for the ensuing 10 year period.

A committee was set up under the State Agreement Act to advise the Minister for Resources Development (now Minister for State Development) in his consideration and approval of CCL's 10 year DMP. Ultimately the committee was unable to reach agreement. The EPA maintained that no more seagrass should be lost, while the company and the Department of Resources Development

(DRD) (now Department of Mineral and Petroleum Resources) maintained that the State was committed, under the Agreement Act, to allow dredging to continue.

The first DMP was issued in December 1986 (for the period 1987-1996) and the second DMP for the period 1989-1998. Both were approved. When submitting DMP 3 in 1990, CCL was contemplating expansion of its lime production and was requested to include a 30 year Concept Plan. The Concept Plan centred on the eastern part of Success Bank. The EPA expressed concern regarding loss of seagrass meadows and the DMP was only approved for two years. DMP 4 submitted in 1992 was also only approved for two years.

Thus while the 1986 amendments to the Agreement Act provided for a 10 year planning horizon, this had not been achieved after 1988 making it difficult for CCL to plan future operations. Therefore in December 1993, CCL requested the Western Australian Government to resolve the matter.

Short-term and medium-term assessments

The EPA undertook assessments on CCL's short-term and medium-term dredging proposals (Bulletins 739 and 901 respectively). In August 1994, the Minister for the Environment approved the short-term continuation of shellsand dredging on Success Bank (1994 - 1996), with further dredging in the medium-term being conditional on CCL developing an acceptable Environmental Management Programme (EMP). However, the Supreme Court in 1996 overturned Bulletin 739, and by association, the August 1994 Ministerial approval. A further report by the EPA on the short-term proposal of November 1996 (Bulletin 833, EPA 1996a) led to a Ministerial Statement dated 23 February 1998.

In August 1998, the EPA assessed the medium-term proposal and approval was issued on 10 February 1999. The EPA in its assessment for the medium-term proposal in Owen Anchorage recommended that "the Minister notes that the EPA has formed the view that proposals involving the further removal of seagrass and potential seagrass habitat in the long-term for shellsand should be recognised as environmentally unreasonable" (Bulletin 901). The challenge for CCL, in its application for the long-term dredging proposal involving further seagrass removal, was to provide additional information which could lead the EPA to the view that the further removal of some seagrass and potential seagrass habitat was environmentally reasonable.

As part of the short and medium-term dredging proposals, an EMP was formulated to facilitate detailed research aimed at providing information necessary to assist the proponent to minimise the adverse impacts of CCL's continuing dredging operations on Success Bank in Owen Anchorage and to resolve the issue of long-term access to shellsand.

The full history of dredging on Success and Parmelia Banks, and the statutory approvals process relevant to that activity, is complex. A chronology of events in relation to the approval process for CCL's short-term, medium term operations is presented in Appendix 3.

3.2 The EMP

In 1995, CCL prepared a Shellsand Dredging Environmental Management Programme (EMP) as part of its short-term dredging proposal (CCL, 1995a).

The EMP was formulated to incorporate detailed research (commitments) aimed at deriving information necessary to minimise the adverse impacts of CCL's continuing dredging operations on Success Bank in Owen Anchorage and to resolve the issue of long-term access to shellsand. CCL also undertook to submit its proposal for long-term access to shellsand not less than 15 months before depletion of the medium-term resource. The medium-term resource is expected to last until mid 2002.

The EMP was based on the principle that the long-term shellsand dredging operations and rehabilitation should maintain ecological function and result in a net environmental benefit in the Cockburn Sound/ Owen Anchorage area. In order to meet this principle, the EMP outlined a number of studies into ecological significance and seagrass rehabilitation. One of the parts of the EMP was to demonstrate the ability to successfully relocate and also rehabilitate seagrasses. By relocating seagrasses from areas to be dredged to barren areas, it may be possible to maintain the abundance and productivity of the seagrasses.

The EMP consisted of 12 main study components to address:

- evaluation of the ecological significance of seagrass;
- development of methods for seagrass rehabilitation;
- determination of effects of dredging on wave climate, sediment transport and shoreline stability;
- development of methods for beneficiation of lower quality shellsand; and
- evaluation of alternative raw material sources for lime and cement production.

CCL established a three level management structure for the purpose of conducting investigations and for reviewing and interpreting scientific outcomes. The structure comprised:

- (i) a study team to carry out scientific literature reviews and conduct field and laboratory investigative studies;
- (ii) a Technical Advisory Group to co-ordinate and integrate study methodologies and interpret results; and
- (iii) an International Peer Review Group (IPRG) and an Environmental Management Advisory Board (EMAB) for the Implementation of the EMP – to review the methodologies and to interpret scientific findings within an international scientific context and to provide Cockburn with advice on the direction and meaning of the research.

The IPRG comprises six scientific specialists of international repute with expertise in one or other of the fields of investigation set out in the EMP. The EMAB consists of six members, three from CCL and three scientifically eminent persons independent of the company.

The overall co-ordination of the research effort and integration between the three tiers is administered through a Project Manager, who is a consultant to the company.

The research effort has led to a number of significant findings. The principal aspects of the research and results relevant to the assessment of the long-term proposal are summarised below.

Effects of wave climate on sediment movement and shoreline stability

This study was a multi-component investigation aimed at understanding the ambient wind, wave and swell conditions of Owen Anchorage and farther offshore, and to establish a numerical simulation model of these characteristics. It was also aimed at determining the bathymetry of surrounding waters, the movement of entrained sediment and the shape and stability of the adjacent coast. To accompany this work, the sedimentology of Success and Parmelia Banks was reviewed to determine the age and source of shellsand material (EPA, 1998a). Two additional objectives were to ensure that the dredging eastward of the FPA Shipping Channel did not compromise navigation along it, and to provide information useful in the interpretation of the ecological significance of seagrasses.

A mathematical wave climate model has been finalised and calibrated to simulate present-day wave conditions, and it has been run to predict the likely effects upon sea conditions following the short, medium and long-term dredging of Success Bank. For the coast, comparisons between historical aerial photographs have been made to indicate the dynamic shape of the shoreline, and beach profiles have been measured and routinely monitored. The data have been inter-compared with information from shoreline surveys since 1976 and earlier coastal vegetation surveys.

The main elements of this combined study are complete, with shoreline monitoring continuing on a two yearly basis. In summary the following EMP findings (CCL, 2000) relevant to this assessment (Section 4.3) are that:

- the banks are composed mainly of geologically 'recent' calcium carbonate sediment (mostly of organic origin) derived from farther offshore and driven shoreward, with the larger volume of sediment being transported by swell waves;
- Success and Parmelia Banks are 6,000-7,400 years old and their formation is linked to sea level changes that caused the submergence and subsequent erosion of the Garden Island Ridge;
- calcareous organisms in seagrass meadows on the Banks have contributed less than 15% of calcium carbonate to the overall sediment store (calcareous sand) to Success and Parmelia Banks;
- dredge slopes undergo some erosion, with a maximum regression of 50m. Dredge slopes are then stable after three years;
- historical surveys show that dredging on Success Bank by Cockburn has not affected the stability of the beaches of the Owen Anchorage area;
- the modelling indicates that the wave characteristics following the short-and medium term dredging will not be significantly different from the conditions now prevailing, thus the overall sediment contribution will be largely uninterrupted, but within the dredged basin sediment movement will be significantly less;
- the shoreline of Owen Anchorage is substantially modified by developments, including the WAPET Groyne extending seaward off Woodman Point. These developments have affected sediment movement, particularly longshore drift, and to an extent the present shape of the coast which is generally accreting at an average rate of 40,000m³/year; and
- the short and medium-term dredging has had little effect on sediment patterns on beaches.

Seagrass distribution and function

As part of the EMP, studies were undertaken to map the habitat and extent of the seagrasses of Owen Anchorage, to determine their functional attributes and quantify the loss or replacement of their functional role arising from the removal of seagrass by dredging and relocation of some seagrasses.

In summary CCL's research findings relevant to this assessment were:

- new and technically rigorous methods have been developed for seagrass mapping. These methods, combined with comprehensive field work, have shown that meadows of *Amphibolis* species and *Posidonia coriacea* are dynamic, with continuous active colonisation, recession and changes in seagrass cover and species composition;
- seagrass meadows in Owen Anchorage are mainly utilised by species of fish that spend their entire life cycle there, or migrate there as mature adults;
- few commercially and recreationally important species of fish are abundant in seagrass meadows in Owen Anchorage, either as juveniles or adults;
- a method has been developed to define, map and quantify biodiversity and ecological significance;
- Owen Anchorage is a relatively high-energy environment for seagrasses. Meadows of *Amphibolis* species and *Posidonia coriacea* have little effect on sediment accumulation and stabilisation, wave energy and water turbidity over regional and annual scales;
- present bare sand on Success and Parmelia Banks has provided habitat for seagrass from time to time, and bare sand remains a substrate available for seagrass colonisation;
- the seagrasses are capable of recolonisation under natural conditions by the lateral extension of existing clumps, or through fruit settlement and seedling germination (in particular *Posidonia coriacea* is shown to propagate from seedlings, a finding regarded as a major advance in the knowledge of seagrasses in wave-dominated environments);
- seagrass cover in Owen Anchorage was more extensive in 1999, even accounting for previous dredging losses, than at any earlier mapping period;
- seagrass wrack and associated detritus is accumulating in the dredged basin and establishing a new localised habitat for marine plants and animals; and
- seagrass distribution and density on the banks surrounding Owen Anchorage has changed measurably over the last 30 years.

Seagrass transplantation/ rehabilitation

Studies undertaken as part of the EMP, have been twofold:

- literature and desk reviews into the feasibility of in situ propagation of seagrasses; and
- field testing the transplanting of mechanically excavated seagrass clumps, incorporating the plant canopy and sediment substrate (known as 'sods'), following the transplantation of those clumps to a recipient site.

The regrowth of seagrass species, including propagation studies and the transplanting of sprigs or cores containing some plants, has been trialed in Australia and elsewhere with limited success. However, large scale subsurface physical excavation of seafloor substrate and associated plants and their relocation, effectively involving the transplanting of seagrass, is a new initiative. This has been the direction pursued by CCL. Experiments have centred on the design and operation of two prototype harvesters known as ECOSUB 1 and ECOSUB II.

The objective of the seagrass rehabilitation programme for the short and medium-term dredging proposals was “to demonstrate that long-term replacement of the ecological and functional roles of seagrasses lost by dredging on Success Bank is technically, environmentally and economically feasible”. The specific criteria were to (CCL, 1995b):

- demonstrate that the success of rehabilitation can be measured by area and density of seagrass generated, and that this is a quantitative measure;
- demonstrate 15 months prior to depletion of the medium term resource (target date is March 2001) that rehabilitation techniques are developed and implemented, that have rehabilitated 1-3 ha with an array of seagrasses with evidence of greater than or equal to 12 months of survival, and have rehabilitated 0.1ha with evidence of greater than or equal to 3 years survival; and
- demonstrate 15 months prior to the depletion of the medium term resource, that long-term broadacre rehabilitation, at a rate required by the proposed long-term dredging programme, is both technically and economically feasible.

Field trials have been underway since February 1996 and seagrasses for transplantation have been taken from areas in the short and medium-terms areas prior to dredging. Transplantation has occurred into recipient sites located on eastern Success Bank. When survival over the past five years is factored (to February 2001), the area of actual rehabilitated seagrass meadow was calculated to be 2,794m² (approx 0.28ha) comprising:

- 1,815m² for Recipient site 2 (the major transplant site for the rehabilitation programme), based on 60% sod survival; and
- 979m² for Recipient site 4, based on 89% sod survival (CCL, 2001a).

Based on the performance criteria, it can be concluded that CCL has demonstrated:

- that it has rehabilitated 0.1ha of seagrass for at least 3 years;
- that it has not met the second performance criterion – i.e. rehabilitated 1-3ha of seagrass with evidence of survival for at least 12 months; and that
- direct transplantation is slow (less than 1ha/year), not yet feasible at a rate required by the proposed long-term dredging programme, and costly.

Alternative measures and resources

Investigations within the framework of the EMP have been undertaken by CCL into a range of measures to determine whether shellsand from the current and proposed dredging operations can be substituted by other resources.

The objective was to resolve for CCL whether it is feasible to shift to other raw materials (such as terrestrial limesand and limestone) as feedstock for its manufacturing processes (EPA, 1998a). The work has been complemented by studies into the beneficiation of lower grade calcium carbonate shellsand.

In summary the findings to date are that:

- CCL requires a source of calcium carbonate of grade 92% or higher for the direct production of lime;
- while economic issues are not relevant for EPA's consideration, CCL notes there are no known resources of calcium carbonate that could be accessed commercially outside Success and Parmelia Bank. The EPA notes, however, that CCL has now identified significant resources at West Success Bank which were not previously known;
- beneficiation of lower grade shellsand to achieve a grade of around 92% calcium carbonate, and beneficiation of other calcium carbonate sources is being tested; and CCL has commenced production scale trials with electrostatic beneficiation units at Munster and Dongara;
- alternative land-based feedstock materials sufficient to meet the resource demand are considered by CCL to be unavailable or commercially unviable; and
- while operation of the suction dredge and the techniques employed in its use are being refined, technology is not available to markedly reduce impacts from dredging on the seagrass cover.

The EPA notes that a study carried out in 1991 by the former Department of State Development (cited in CCL, 2000) concluded that there are no available terrestrial deposits of limestone or limesand in the metropolitan region that could be considered as an equivalent material to shellsand dredged from Success Bank.

A review of limestone and limesand resources of Western Australia was undertaken by the Geological Survey of Western Australia (Abeyasinghe, 1998 cited in CCL, 2000). This report concluded:

- other than in Cockburn Sound (including Owen Anchorage) there are no identified resources of high quality carbonates in or near Perth. There are deposits of shellsand on Garden Island, with an estimated 8.8-12.2 million tonnes of high grade material and 15.7-21.8 million tonnes lower grade. Any future access to this resource will need to address both environmental as well as security issues, and it is unlikely that these resources will be exploited;
- along the west coast, limesands at Dongara provide one identified source of suitable quality resource for lime production. Cockburn currently operated a lime kiln in the area using this resource. In 1997, Westlime (WA) Limited also commissioned a lime kiln using this resource;
- some high quality limestone deposits have been found in the Dampier Archipelago. Conservation issues will strongly influence exploitation;
- the Cape Range has substantial deposits of high grade limestone. Exploitation will be heavily influenced by conservation issues and transport costs; and
- lime is produced in the Goldfields area using limestone quarried 400km east of Kalgoorlie at Loongana. Further development of this resource is limited to industrial expansion in the Goldfields area; transportation costs limiting use further afield.

Furthermore, the development of a lime strategy for Western Australia, which was released in May 2001 for stakeholder comment, concludes that "alternatives to the Owen Anchorage deposits have

been investigated, but other than the resource at Mewstone, none are likely to be economically viable. Other alternative sources pose major environmental and social problems” (DRD, 2001).

4. Relevant environmental factors

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

For this proposal the EPA has identified the relevant environmental factors, firstly by referring to a preliminary list of such factors as identified in the EPA’s guidelines and secondly from the proponent’s ERMP and from public submissions. In addition, where a proposal is a continuation of an earlier and similar development, the EPA may take account of the experience and effectiveness of current environmental investigation outcomes and management procedures in determining relevant environmental factors.

In light of research that has been undertaken as part of an EMP for the medium-term dredging proposal, the EPA has concluded that with respect to the long-term proposal, a tailored approach to the assessment, taking into account the EMP research, is warranted.

The EPA is aware of perceptions that members of the community may have about the EMP research. A perception may be held that the EMP research initiative was not independent because it was managed by CCL, although it was formulated in consultation with government, and because the full cost of the work was borne by CCL. The EPA is mindful of the potential for this perception and regards the advice of the IPRG and EMAB as most helpful with regard to the issue of independence.

The EPA has approached this assessment by accounting for research findings to date, and having full regard for the published opinions of both the IPRG and the eminent independent members of the EMAB.

In a signed statement, the EMAB endorsed the IPRG’s statement that, “...the research programme was well founded and that it produced credible results, which are sufficient to make a decision on the future of shellsand dredging on Success and Parmelia Banks” (CCL, 2001b).

The EPA has adopted the following environmental factors as being those particularly relevant to the long-term dredging proposal.

- (a) biodiversity – including loss of seagrass, loss of potential seagrass habitat and, ecosystem function;
- (b) seagrass rehabilitation – feasibility and success;
- (c) wave climate, sediment movement and shoreline stability – the effects of continued dredging on Success and Parmelia Banks and the coast; and
- (d) recreation – impact on recreational fisheries.

The identification process for the relevant factors selected for detailed evaluation in this report is summarised in Appendix 4. The reader is referred to Appendix 4 for the evaluation of factors not discussed in section 4 below. The summary of relevant factors is summarised in Appendix 5.

It should also be noted that given the proposal was modified, by dropping the proposed beneficiation plant, following the issuing of guidelines, some of the preliminary environment factors identified are no longer appropriate.

The environmental significance of the relevant issues of the proposal and their assessment are discussed in Sections 4.1-4.4 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.

4.1 Biological diversity

Description

The long-term shellsand dredging as proposed would result in the loss of 783ha of existing habitat (168.5ha of seagrass and 614ha of bare sand) as represented below.

Dredging Areas	Total Area (ha)	Seagrass (ha)	Seagrass Assemblage	Bare sand
Stage 1: Seaway				
Success Bank	121.0	35.2	Mainly mixed <i>Amphibolis griffithii</i> / <i>Posidonia coriacea</i> with some <i>Posidonia sinuosa</i>	85.8
Parmelia Bank	312.0	133.3	Mainly <i>Posidonia sinuosa</i> and sparse <i>Amphibolis griffithii</i> with some <i>Posidonia australis</i>	178.7
Total	433.0	168.5		264.5
Stage 2: West Success Bank				
West Success Bank	350.0	nil		350.0
Total	783.0	168.5		614.5

CCL has indicated (CCL, 2001a) that:

- historical mapping shows seagrasses on Success and Parmelia Banks to occupy 1242 ha in 1965, 1537 ha in 1972, 1611 ha in 1982, 1735 ha in 1995 and 1753ha in 1999;
- a total of 221.5ha out of an estimated 2,105ha of seagrass present in Owen Anchorage in 1999 will have been lost on completion of the short, medium and long-term dredging proposals;
- this represents 10.5% of an estimated 2,105ha of seagrass present in Owen Anchorage in 1999; and
- most of the notional Stage 2 area has not supported seagrass over the period for which photographic records are available (D.A. Lord and Associates., 2000).

CCL has also indicated the assemblages present in the alignment of the Seaway and the estimated area of each of these (see Table 2). Figure 4 shows an overlay of the proposed Stage 1 and notional Stage 2 areas on the 1999 seagrass assemblages map.

Table 2 Seagrass assemblages and estimated areas within alignment of proposed Stage 1 (based on 1999 mapping (DAL, 2000 in CCL, 2001c).

	Ag	Ag + Pc	Pa	Pc	Ps	Ps + Pa	TOTAL
SUCCESS BANK	-	22.6		5.6	7.0		35.2
PARMELIA BANK	37.5	7.3	5.2	1.3	70.1	10.1	133.3
TOTAL							168.5

Ag = *Amphibolis griffithii* ; Pa = *Posidonia australis*; Pc = *Posidonia coriacea*; Ps = *Posidonia sinuosa*

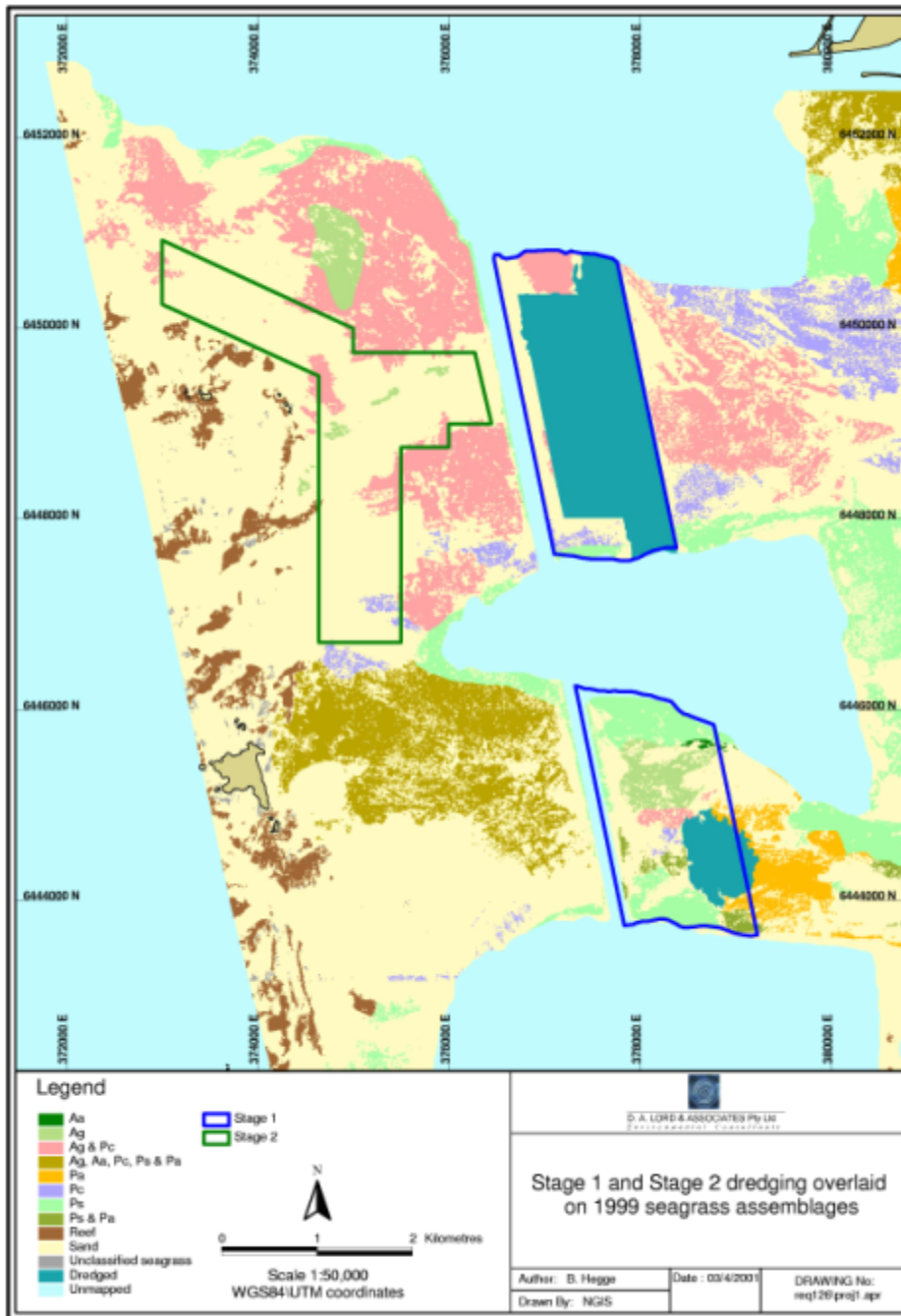


Figure 4: An overlay of CCL’s proposals for Stage 1 and notional Stage 2 areas on the 1999 seagrass assemblages map (CCL, 2001c). Note that seagrass would be avoided in Stage 2.

Key: Aa = Predominantly *Amphibolis griffithii* containing *Amphibolis antarctica* and *Posidonia coriacea*, Ag = *Amphibolis griffithii*; Pa = *Posidonia australis*; Pc = *Posidonia coriacea*; Ps = *Posidonia sinuosa*.

In terms of potential habitat losses in Owen Anchorage, the completion of Stage 1 would result in the loss of 433ha (6.2%) of potential seagrass habitat which represents a cumulative loss of 937ha (or 13.3%) since approximately 1950. The potential habitat remaining would be 6103ha (or 86.7%). At the end of Stage 2 an additional 350ha of potential seagrass habitat would be lost resulting in a cumulative loss of 1287ha (or 18.3%) with the potential habitat remaining being 5753ha.

The diversity of seagrass species in Perth coastal waters is the richest in the world with 13 species of seagrass out of a total of 50 worldwide. The seagrass, sand habitats and associated biota are widely distributed and are not rare or endangered. There will be no loss of species from the Owen Anchorage area due to the proposed dredging, but localised changes (gains and losses) in species composition and abundance will occur (CCL, 2000).

The ERMP identified that seagrass habitats are significant contributors to the biodiversity of the Owen Anchorage area as they support different, and in most cases richer, biological communities than unvegetated sand habitat, particularly sand in shallow waters. In addition to measuring the community structures of habitats in Owen Anchorage, an assessment of biodiversity was also undertaken as part of the ecological significance of seagrasses, based on the number of species present and community structure (CCL, 2000).

The ecological significance of seagrass was assessed by considering the collective evaluation of three factors – biodiversity (representing the attribute of biodiversity), socio-economic value (representing cultural attributes) and ecological value (incorporating the attributes of habitat complexity, biogeochemical cycling, primary production and secondary production).

Between 1972 and 1995 (prior to short-term dredging) significant increases in seagrass cover have occurred on Eastern Success Bank and Parmelia Bank, reflecting the large increase in cover of *Amphibolis griffithii* and *Posidonia coriacea* that have occurred over this time.

While there has been some natural redistribution of seagrass cover on West Success Bank over time, there has not been widespread cover in the Stage 2 area over the available period of records (D.A. Lord & Associates, 2000).

CCL has concluded that there will be changes in the habitat types (eg from seagrass to deep bare sand) and species assemblages such that there will be a 2% loss of the overall ecological value estimated for the Owen Anchorage area in 1995, which will slightly exceed the estimated overall value of ecological value in 1972, before CCL commenced operations in Owen Anchorage (CCL, 2000).

Submissions

Comments made in submissions focused on:

- the loss of seagrass distribution, abundance and diversity;
- the loss of potential seagrass habitat;
- cumulative loss of seagrass;
- previous statements made by the EPA in relation to seagrass loss;
- the close link between seagrass and fisheries;
- lack of research on impacts on aquatic fauna such as turtles which are endangered or of bottle nosed dolphins or sea lions;
- the concept of ecological value - the ecological value of a seagrass system cannot be considered as a sum of the ecological process attributes; the use of overall ecological value lacks validity; estimates of ecological value cannot be taken to represent comparisons of a particular ecological function such as secondary production;
- ecological value – concept, application, analysis;

- extending the marine reserve system to provide more secure conservation of seagrass remnants in the Cockburn Sound and Owen Anchorage areas;
- securing leases over limestone that CCL holds at Caraban, north of Wanneroo, and at Ridges, north of Yanchep National Park for the conservation estate;
- excising the remaining shallow waters of Parmelia and Success Banks from the State Agreement Act and gazettal as an “A” class reserve;
- the seagrass *Posidonia coriacea* is only found in the south-west of WA and continuous and spreading meadows of this species have only been found to date on Success Bank; and
- the reliability of fish production estimates are questionable.

Assessment

Biodiversity comprises a very complex set of components and relationships. The EPA has considered the biodiversity implications of the proposal in a number of ways. It recognises that biodiversity has two key aspects; its intrinsic value at the individual species, species assemblage and genetic levels, and its functional value at the ecosystem level.

As seagrass habitats are significant contributors to the biodiversity of the Owen Anchorage area, the EPA has focused its attention on the loss of seagrass and loss of potential seagrass habitat.

The areas considered for assessment are:

- the areas proposed for dredging (Success, Parmelia and West Success Banks); and
- the areas in the immediate vicinity of dredging, including Gage Roads, Owen Anchorage and Cockburn Sound.

The EPA’s environmental objectives for the factor of biodiversity are:

Factor	EPA Objectives
Biodiversity	<ul style="list-style-type: none"> • Maintain the ecological function, abundance, species diversity and geographic distribution of marine flora and fauna. • Maintain the diversity and relative proportions of substrates which occur in the area.

Given the EPA’s focus on seagrass, 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, 1996b). In addition they also play a part in stabilising the ocean floor (DEP, 1996b).

In the EPA’s Bulletin 901 on CCL’s proposal for Medium-Term Shellsand Dredging of Success Bank in Owen Anchorage (EPA, 1998a), the EPA concluded that “the completion of the medium-term proposal will provide two direct opportunities, firstly a reason to stop the further loss of seagrass by dredging, and secondly the focus to move to other resource acquisition options. Hence a longer-term proposal which would see the further removal of seagrass from the confines of Owen Anchorage should be recognised as environmentally unreasonable.”

Bulletin 901 was based on information available to the EPA at that time. The medium term proposal provided CCL the opportunity and time to find other long-term options that they could move to, to avoid seagrass in the long term. With this in mind, the EPA notes that significant alternative resources which are not covered by seagrasses are now known to exist at West Success Bank.

As part of the EPA's assessment, the ecological value analysis was independently reviewed, on behalf of the DEP, by Dr Denis Saunders of CSIRO, Sustainable Ecosystems Division. This was largely because reservations were made in submissions on the use of a 'single ecological value' for assessing the ecological significance of seagrasses.

Saunders also raised concerns in relation to the aggregation of attributes into a single value, and argues that this may be too simplistic and not an ecologically valid approach. In response CCL indicated that to allow a synthesis of the net effect of the changes in the four attributes, an aggregated ecological value term was used but that this must be interpreted alongside the changes in each of the attributes.

Further to this, the IPRG (CCL, 2001b) stated that the calculation of ecological values has been a complex undertaking with raw data from many studies distilled to a single value for the purposes of answering the question "will dredging lead to a net change in ecological significance in the area and the region?". The IPRG concluded that, following careful scrutiny of the derivation of ecological values this measure has adequately captured the major issues associated with Owen Anchorage, and can be used to assess the changes to ecological significance resulting from the various dredging configurations (CCL, August 2001).

The EPA notes that as a result of expert advice, the expert manner in which the proponent has undertaken its research as part of the EMP studies, and the utilisation of internal and external review systems it appears to the EPA that there is now sufficient information to enable the EPA to make a decision about the further dredging of seagrass from the Owen Anchorage area.

The EPA recognises the important role that seagrass plays as a primary producer and a habitat and considers it is an important principle to retain seagrass in Owen Anchorage wherever possible. The EPA also recognises that Parmelia Bank borders Cockburn Sound, which has already lost 80% of its seagrass.

The EPA acknowledges that the long-term dredging proposal has been developed from a very substantial base of knowledge. The EPA also notes that although some direct loss of biodiversity will occur in the vicinity of the dredging in terms of seagrass, dependent fish, epiphytes and invertebrates, no species will be lost as habitat types exist elsewhere. Impacts on the various attributes comprising the analysis of ecological value vary, with the maximum impact being to the attribute of "habitat complexity" which is closely related to the presence of seagrass. Accordingly, a simple and conservative way of viewing the impact of dredging is to consider the area of seagrass lost.

The EPA considers that since an alternative resource has been identified that is devoid of seagrass, CCL should move to this area as soon as practically possible, to minimise the loss of seagrass on Success and Parmelia Banks. Linking those areas of Success and Parmelia Banks that have already been previously dredged should be designed to reduce the amount of seagrass lost to dredging while CCL make the transition to West Success Bank. Such a strategy may provide the opportunity to effectively create a second shipping channel without the level of seagrass loss contemplated in the ERMP proposal.

The EPA notes that the FPA in its submission indicated that “a seaway as wide as proposed by CCL is not essential for continued safe and efficient shipping operations in the Fremantle Outer Harbour”.

The EPA notes the proponent has now identified an alternative shellsand resource at West Success Bank which is devoid of seagrass and considers that CCL should prepare for Government a timetable for moving from Success and Parmelia Banks to West Success Bank (Stage 2 of the long-term proposal) as quickly as practicable.

Accordingly, the EPA recommends that the proponent prepare and implement a Dredging and Environmental Management Plan for Success and Parmelia Banks which would see CCL move its dredging operations to West Success Bank as soon as practicable (Recommended Environmental Condition 6). While the EPA considers that the loss of a limited amount of additional seagrass in Owen Anchorage will not be environmentally significant, it wishes to ensure that any additional loss is strictly constrained. Accordingly, the move to West Success Bank should be made as soon as practicable and in considerably less time than the 12 years as originally proposed by CCL for Stage 1 of the proposal. While not an environmental issue, it is considered likely that development of the necessary equipment to access the rougher waters of West Success Bank could be achieved in considerably less than 12 years.

In addition, the EPA also considers that there is an opportunity to address the issue of wider seagrass protection through mechanisms such as changes to the State Agreement Act, extension to the Shoalwater Islands Marine Park and protection of terrestrial limestone habitats at Caraban and Ridges, north of Perth. This would see CCL relinquishing its rights to mine in these areas. These issues are addressed under Other Advice in Section 6.

The EPA notes the following proponent commitments to:

- (i) Measure the distribution of marine habitats in Owen Anchorage, including the western side of Success Bank and Parmelia Banks that:
 - identifies the nature and distribution of seagrass, reef and sand habitats; and
 - determines the nature, abundance and distribution of flora and fauna associated with these habitats (Commitment 7).

- (ii) Prepare (36 months prior to the commencement of Stage 2 of the long-term dredging) and implement a detailed Dredging and Environmental Management Programme for dredging West Success Bank. The DEMP will address:
 - dredging schedules;
 - dredging management including turbidity;
 - monitoring of sensitive marine habitats;
 - monitoring of wave climate and shoreline processes;
 - habitat rehabilitation;
 - mine closure plans and schedules; and
 - contingency planning for issues such as hydrocarbon spills and contaminated sediments (Commitment 11).

- (iii) Only dredge in areas on West Success Bank where there is no seagrass (Commitment 12).

The EPA notes that in relation to the selection of the area on West Success Bank to be dredged, CCL will take into account the results of the mapping of seagrasses in this area to ensure that dredging in Stage 2 will only occur in areas devoid of seagrass. The EPA also notes that this mapping has already commenced and will be undertaken regularly at least until a DEMP is submitted for Stage 2. The EPA also understands that the selection of the area for Stage 2 dredging will take into account information gained on:

- the effects of Stage 2 dredging on wave climate;
- recreational and commercial fishing activities in the area in association with the Department of Fisheries; and
- any additional information of relevance, such as experience with seagrass rehabilitation.

Summary

Having particular regard to:

- (a) research undertaken to date, combined with expert advice and internal and external reviews indicating that there is no sufficient information available to enable the EPA to make a decision about further dredging of seagrass from the Owen Anchorage area;
- (b) the distribution of seagrasses being dynamic;
- (c) research showing that ecological attributes of the area would be altered by a variable but generally small amount;
- (d) no species will be lost as a result of dredging;
- (e) significant alternative resources which are not covered by seagrasses are now known to exist at West Success Bank;
- (f) Recommended Environmental Condition 6; and
- (g) the proponents commitments;

it is the EPA's opinion that a modified approach to the proposal whereby dredging is transferred to West Success Bank as soon as practicable, would allow this proposal to be managed to meet the EPA's environmental objectives for this factor.

4.2 Seagrass Rehabilitation

Description

As part of the short and medium-term dredging proposals, performance criteria were developed to provide a target, that if achieved, would provide the EPA with a better basis on which to assess the likelihood of long-term success of seagrass transplantation and the ability to successfully rehabilitate all areas dredged.

In terms of the performance criteria (see Section 3 above), CCL has demonstrated:

- that it has rehabilitated 0.1ha of seagrass for at least 3 years;
- that it has not met the second performance criterion – i.e. rehabilitated 1-3ha of seagrass with evidence of survival for at least 12 months (at June 2001, 0.3ha of seagrass (mainly *Posidonia* with some *Amphibolis*) had been rehabilitated); and that
- direct transplantation while possible is slow (less than 1ha/year) and costly and cannot yet match the rate of dredging.

The EPA does not see these as “pass/fail” criteria. It considers that the criteria have served the purpose of driving successful rehabilitation research. Accordingly the EPA has now considered the issue of seagrass loss and replacement on the basis of all the data now available, not just on the attainment or otherwise of these criteria.

Submissions

Main comments raised in submissions focused on:

- whether the performance criteria established in 1995, as part of the EMP, for seagrass rehabilitation have been met;
- the fact that CCL has not been able to carry out seagrass rehabilitation at a rate even approaching the rate of dredging;
- seagrass transplantation and survival;
- transplantation of seagrass being expensive, slow and causing damage to donor beds;
- the need for CCL to make a commitment to permanently restore as much seagrass as is to be lost by dredging on completion of the proposal; and
- it being unacceptable that a mining company should be allowed to mine in a high quality marine area without rehabilitating it, just as they are required to do in terrestrial areas.

Assessment

The area considered for assessment is Owen Anchorage.

The EPA’s environmental objectives for the factor of seagrass rehabilitation is:

Issue	EPA Objectives
Seagrass Rehabilitation	<ul style="list-style-type: none"> • To demonstrate that long-term replacement and sustainability of the ecological and functional roles of seagrasses lost by dredging on Success and Parmelia Banks is environmentally possible and can be practically affected.

The EPA notes that seagrass transplantation trials have demonstrated that seagrass can be successfully transplanted, although this is slow and expensive. It is also noted that CCL has undertaken to continue developing seagrass rehabilitation techniques.

The EPA recognises current knowledge confirms that seagrass distribution in Owen Anchorage is dynamic and seagrasses can establish naturally on shallow bare sand habitat, although actual seagrass habitat lost to dredging cannot be practically rehabilitated.

The EPA acknowledges that rehabilitation is not currently practicable on an operational scale and more time is required to produce the necessary technology. The EPA also acknowledges that seagrasses may re-establish naturally elsewhere in Owen Anchorage but cannot practicably be artificially rehabilitated at present, although techniques do now exist to transplant small areas.

The EPA notes the proponents commitments to:

- (i) continue to conduct a programme of research and development into seagrass revegetation that:
- develops techniques for the rehabilitation of seagrasses, which are ecologically sound and economically feasible; and
 - includes a programme of study of the factors affecting natural recruitment and propagation of seagrass (Commitment 9).

It is also noted that as part of this research, the proponent has identified specific objectives to:

- within 10 years develop techniques for the rehabilitation of seagrasses, particularly seagrasses of the species *Posidonia* and *Amphibolis*; and
- within 3 years:
 - develop techniques for the growth of multiple planting units of the seagrasses *Posidonia* and *Amphibolis*;
 - develop techniques for the extraction of planting units (mainly sprigs, cores) from healthy seagrass meadows, with no lasting donor bed damage;
 - develop techniques for the mechanical planting of planting units into a range of habitats and conditions;
 - develop techniques for measuring return/ maintenance of ecological function; and
 - establish and provide a major contribution to a collaborative Seagrass Rehabilitation and Management Programme between CCL and the Department of Trade and Commerce (DCT) (now Department of Industry and Technology), which will also seek additional external funds (CCL, 2001c).

With regard to the last point, the EPA notes that the collaborative effort is consistent with Ministerial commitments applied to the Southern Harbour development in Cockburn Sound. It is also noted that CCL will commit a total of \$3.5 million over the next ten years (average \$350,000 per year) to support the collaborative Seagrass Rehabilitation and Management Programme, subject to the approval of its long-term dredging proposal. With commitments from DCT of \$100,000 for this programme for the year 2002/2003, the budget for 2002/2003 is now \$450,000 (CCL, 2001c).

- (ii) Only dredge in those areas where there is no seagrass on West Success Bank (Commitment 12).

Although the EPA notes that CCL has made a commitment to conduct a programme of research into seagrass revegetation, the EPA considers that this should be incorporated within a Seagrass Research and Rehabilitation Plan. The EPA also considers that CCL should rehabilitate some of the areas in the vicinity that are shallow and unvegetated to mitigate some of the impacts of dredging. Accordingly, the EPA considers that the proponent should prepare and implement a Seagrass Research and Rehabilitation Plan (Recommended Environmental Condition 7) to address:

- the use of seagrass remaining in the proposal area where dredging for shellsand will occur for:
 - subsea mechanical transplanting experiments; and
 - rehabilitating areas in the vicinity that are shallow and unvegetated to mitigate the impacts of dredging;

- criteria on which to base performance;
- the programme of research and development on seagrass, consistent with Commitment 9;
- improving understanding of the determinants of seagrass establishment and regeneration under natural conditions;
- the use of findings from the research program to increase the rate of transplanting;
- the application of this research; and
- the effect of nutrient-enriched water passing from Cockburn Sound onto the seagrasses on *Parmelia* and Success Banks.

In its 1998 report (EPA 1998b), the EPA concluded that it is important to retain the sand banks and sandy margins of Cockburn Sound, where seagrass meadows once grew, so as not to lose future opportunities for seagrass re-establishment in the Sound. To do this, however, it is recognised that improved water quality and light conditions would need to be achieved and maintained if Cockburn Sound is to provide an environment suitable for seagrass restoration and recovery and that this would require improved management, retention of the shallow sandy margins, and the continued implementation of effective nutrient reduction strategies. The EPA considers that CCL should contribute knowledge, gained through its research, to help re-establish seagrass areas in Cockburn Sound.

In addition, the EPA notes that the IPRG (CCL, 2001b) indicated that it may be important to consider whether there would be an affect from nutrient-enriched water passing from Cockburn Sound via the proposed channel on the seagrasses on *Parmelia* and Success Banks, given:

- that the shipping channel will increase the exchange of water between Owen Anchorage, Cockburn Sound and Gage Roads by approximately 27% at the northern end of Cockburn Sound and improve the average flushing efficiency by 10%; and
- previous studies which indicated that nutrients lead to increased epiphyte growth on *Posidonia* before there was an effect on phytoplankton levels and light penetration.

Accordingly, the EPA considers that this should also form part of the seagrass management plan research programme.

Summary

Having particular regard to:

- (a) Recommended Environmental Condition 7; and
- (b) the proponents commitments,

it is the EPA's opinion that the proposal can be managed to meet the EPA's environmental objective for this factor.

4.3 Wave climate, sediment movement and shoreline stability

Description

Success and *Parmelia* Banks form the northern and southern sills of the Owen Anchorage Basin. Success Bank is the northern-most of the two banks, and extends in an east to west direction from Catherine Point to West Success bank and Straggler Rocks. *Parmelia* Bank extends in an east to

west direction from Woodman Point to Carnac Island. The banks are composed of geologically recent calcium carbonate material derived from farther offshore and driven shoreward, with the larger volume of sediment being transported by swell waves.

The wave climate of local coastal waters is dominated by a persistent low to moderate energy system which is more variable in winter than in summer. A mathematical wave model, was developed for CCL to estimate the influence of changes in bathymetry on the wave climate of the region, and to evaluate the effects of the changes in wave climate on shipping, coastal structures and the stability of the banks and the shoreline (MRA, 1997a in CCL, 2000).

CCL used the model to predict the effects of CCL's short-term and medium-term dredging proposals. Dredging of the short and medium-term areas was found to cause minor and localised changes in the wave conditions in Owen Anchorage, and that there would be little impact on shipping, coastal structures and the stability of the banks and nearby shoreline (CCL, 1999).

The shoreline of Owen Anchorage has been modified by developments such as groynes and breakwaters such as the WAPET Groyne extending seaward off Woodman Point. These developments have affected sediment movement, particularly longshore drift, and to an extent the present shape of the coast, which is generally accreting at an average rate of 40,000 m³/year (CCL, 2000).

The construction of a seaway 1.5km in width and 3.3km in length through Success Bank and 2.5km in length through Parmelia Bank, to a depth of 5-8 m to 15 m, as originally proposed, is likely to:

- modify the bathymetry of the Owen Anchorage seabed;
- marginally alter the wave climate in Owen Anchorage and Cockburn Sound; and
- allow wave energy from Owen Anchorage to penetrate deeper into Cockburn Sound

Submissions

Concerns expressed in submissions mainly focused on:

- potential changes to the shoreline due to accretion or erosion;
- mitigation measures proposed by the proponent as a result of changed wave climate;
- technical details relating to the wave model used to simulate wave conditions; and
- modelling undertaken to determine the impacts of the proposal on the shorelines of Owen Anchorage and Cockburn Sound, bank stability and sediment transport.

Assessment

The area considered for assessment includes:

- the areas proposed for dredging (Success Bank, Parmelia Bank and West Success Bank); and
- the areas in the immediate vicinity of dredging, including Gage Roads, Owen Anchorage and Cockburn Sound.

The EPA's environmental objectives for this issue are:

Issue	EPA Objectives
Wave climate, sediment movement and shoreline stability	<ul style="list-style-type: none"> • Maintain the stability of Success and Parmelia Banks. • Maintain the integrity, function and environmental values of the foreshore area.

The EPA notes that the potential effects of the long-term dredging proposal on wave climate, have been forecast by using the same sophisticated numerical model used to simulate wave conditions for the short and medium-term proposals. The wave model was used to simulate wave conditions prior to, and subsequent to the dredging of the seaway and the seaway plus West Success Bank. The findings from these studies indicate:

- for swell and seabreeze conditions the proposed dredging programmes are predicted to have a small effect on the wave climate within Owen Anchorage and Cockburn Sound. Most changes are localised to the dredge areas and along the banks of the surrounding dredge areas. The exception is the swell direction which is predicted to change by 5-20 degrees in Owen Anchorage and through to the southern extent of Cockburn Sound; and
- for moderate winter storm and severe storm events it is predicted that a small change in the wave conditions from the proposed dredging will be experienced to the southern extent of Cockburn Sound after the completion of the dredging schemes.

In relation to shoreline stability, detailed monitoring has been carried out since 1942 (MRA, 1995, 1998 and 2000a cited in CCL, 2000). Results show that the shoreline is generally quite stable or accreting. At places such as Quarantine Beach and near South Fremantle Power Station, the vegetation line is now more than 100m seaward of the position in 1942.

It is also noted that historical surveys show that the dredging on Success Bank by CCL since 1987 has not affected the stability of the beaches of the Owen Anchorage area. The only effect of CCL's operations is realignment and localised erosion of the beaches just north-east of the Woodman Point seawall (CCL, 2000).

Based on investigative studies, the EPA notes that the ERMP concludes that:

- the change in wave conditions indicate that the WAPET Groyne and the Jervoise Bay Northern Harbour Northern Breakwater will experience increased wave heights during a design storm of a 30 to a 100 year ARI as a result of dredging;
- the bank stability of Success and Parmelia Banks will be unaffected by dredging except in localised areas during severe storm events;
- the shorelines of Owen Anchorage and Cockburn Sound will undergo gradual reorientation and changes in degree of erosion or accretion; and
- the largest change in the longshore sediment transport rate will occur at Explosives Jetty (a decrease in the southwards transport of sediment by 800m³/annum), and will result in some realignment of the coastline and some erosion.

To manage the impact of the dredging programme, the EPA notes that the proponent has indicated in the ERMP that:

- a programme of wave climate measurement and continuing modelling will be needed to ratify or modify conclusions about changes in wave conditions, and allow mitigative measures to be implemented if required;
- a series of management options will be developed, to allow for mitigation should these forecasts change, or should effects be observed. These options include: modifying the dredge plan to reduce effects; shoreline protection and/ or nourishment; and the strengthening of structures; and
- the present programme of shoreline monitoring in Owen Anchorage will be expanded to include:
 - shoreline surveys along Owen Anchorage from Fremantle to Woodman Point;
 - shoreline monitoring of selected locations along Cockburn Sound; and
 - review opportunities for making realistic measurements of rates of sediment transport along the tops of the Banks.

The EPA also notes that the proponent has indicated that a combination of this information would allow CCL to regularly assess the effects of its dredging operations on the wave climate of the area, and attendant changes to features such as sediment transport, navigation and the integrity of coastal structures. A detailed review of all information that has been collected should occur each three years, and will allow an appropriate proactive modification of the dredging programme.

The EPA notes that the proponent has made a number of commitments to:

- (i) Prepare and implement a Wave Climate Measurement and Modelling Plan to address:
 - measurement of wave climate; and
 - validation/ modification of the model used to forecast changes in wave climate due to dredging (Commitments 1 and 2).
- (ii) Prepare and implement a shoreline Monitoring Plan for Owen Anchorage and Cockburn Sound that:
 - monitors shoreline position;
 - calculates changes in shoreline position;
 - determines rates of sediment transport along the shorelines of Owen Anchorage and Cockburn Sound; and
 - identifies sites of erosion/ accretion and their rates (Commitments 3 and 4).
- (iii) Prepare (within 24 months of commencement of long-term dredging) and implement a Banks and Shoreline Protection Management Programme that:
 - maintains shipping and navigation on the banks, protects coastal structures, and maintains shoreline stability;
 - identifies appropriate management actions and mitigation/protection options and techniques to protect these features; and
 - incorporates the results from Commitments, 1, 2, 3, 4 (coastal processes) and 7 (marine habitat monitoring) (Commitments 5 and 6).

The EPA considers that as the proposed dredging may result in some coastal structures experiencing increases in wave height during severe storms and even minor changes to rates of sediment transport and shoreline orientation can have significant consequences for coastal management, it is important that there be in place management measures to deal with foreshore restoration.

The EPA also notes comments from the IPRG which has urged the study group to utilise the wave climate model over time in helping to resolve biological questions as to the dynamics of seagrass. In particular, should a sudden loss of seagrass occur, the model should be run to determine the hydrodynamic factors operating at the time.

Having particular regard to:

- (a) the mathematical modelling which suggests that the long-term proposal will result in only minor hydrodynamic changes from ambient conditions, under expected scenarios (i.e. moderate swell to severe storm);
- (b) that under severe storm event conditions from the west an increase in wave height of up to 20% occurs in the region of Woodman Point resulting from the proposal;
- (c) there is no evidence that erosion of the inner Parmelia and Success Banks will be accelerated as a result of the proposed dredging and
- (d) the proponents commitments, including management measures for foreshore restoration,

it is the EPA's opinion that the proposal can be managed to meet the EPA's objectives.

4.4 Recreation

Description

The main use of the Owen Anchorage area is shore based recreation (especially at Woodman Point and the beaches to the north), fishing throughout Owen Anchorage and diving on the Garden Island reef chain (including Rowboat Rock, Seal Rock and Mewstone) (CCL, 2000).

CCL's dredging operations during Stage 1 will not alter the protected nature of the Islands or reefs of the Owen Anchorage area, or affect access to this area by recreational fishers (CCL, 2001a).

Submissions

Comments made in submissions focused on:

- the area where the proposed dredging will take place has a special value for recreational fishers;
- the statement that the seagrasses of Owen Anchorage do not support any commercial or recreational fishery and that the proposed dredging will not influence any commercial or recreational fishery in the area is incorrect and unable to be supported by the information presented in the ERMP;
- this study and that on fish and fisheries have revealed few economically and recreationally important fish species were found in abundance in, or were directly trophically dependent on, seagrass meadows. This has confirmed what previous Western Australian studies on coastal finfish species had suggested (Fisheries WA, now Department of Fisheries); and
- an impact from current dredging activities is the turbidity and the deposit of shellsand matter on Cockburn's beaches which reduces the social values of these beaches. Of particular concern is the dumping of shellsand near the coast before it is sucked away for processing.

Assessment

The area considered for assessment includes:

- the areas proposed for dredging (Success Bank, Parmelia Bank and West Success Bank); and
- the areas in the immediate vicinity of dredging, including Gage Roads, Owen Anchorage and Cockburn Sound.

The EPA's environmental objective for recreation is:

Factor	EPA Objectives
Recreation	<ul style="list-style-type: none">• Maintain the quality of the broader area in relation to boating, fishing, swimming and coastal use.

The EPA notes that as a result of studies undertaken by the proponent the ERMP concludes that:

- seagrass meadows in the Owen Anchorage area are not important habitats for either the juveniles or adults of commercially and recreationally important fish species;
- due to the limited scale of seagrass loss and gain in deep areas caused by CCL's long-term dredging proposal, no significant adverse effects on populations of commercially and recreationally important fish and invertebrate species in Owen Anchorage and Cockburn Sound and the Garden reef chain are expected; and
- the abundance of fish of commercial and recreational importance will not be significantly adversely affected.

The EPA also notes, however, that there is a general view that seagrasses provide important nursery habitats for the juveniles of many fish (including commercially important ones) before they emigrate with increasing size. The proponent, however, indicates that this does not apply to the fish communities in seagrasses on Success and Parmelia Banks that are commercially or recreationally important and that the majority of fish in seagrass habitats are species that either spend their entire life cycle in these habitats or immigrate there as mature adults.

In addition to this, the EPA is also aware that Fisheries WA (now Department of Fisheries) and Recfishwest have questioned the proponent's findings and argue that:

- survey techniques used in the studies were inappropriate and lack validity;
- the proponent has ignored the fact that many non-commercial fish utilise seagrass beds as habitat;
- the statement that the seagrasses of Owen Anchorage do not support any commercial or recreational fishery is incorrect;
- there is a close link between seagrass and fisheries; and
- CCL has downgraded the importance of seagrass meadows as an important habitat for all fish life.

In response, the proponent has indicated that a combination of sampling techniques were used to capture fish fauna (such as trawls and seine nets) and that survey results indicate that relatively high densities of fish do occur in seagrass assemblages in the Owen Anchorage region, but these densities and the faunas composition differ between different seagrass assemblages. The proponent also states that different configurations for dredging will influence different seagrass communities in varying

ways, and that the loss of *P. sinuosa* meadows in the Owen Anchorage region may produce a greater than simple proportional loss of those species that prefer this habitat, as some species occupy these meadows as juveniles before migrating to meadows of other seagrasses. In addition, it is also held that the detailed field studies showed that seagrasses in the Owen Anchorage region are dominated by fish species that spend their entire lifecycle in seagrass habitats, including the juvenile stage (CCL, 2001a).

Furthermore, the proponent has indicated that for the purposes of the ERMP, fisheries species were considered to be those fish species that are either commercially or recreationally important and that there is a link between seagrass and other fish species that are not economically important. These fish species are linked to the seagrass through the provision of shelter/habitat through the food web. In addition, a food web study carried out as part of the EMP (Smit et al 1999 in CCL, 2001) provided evidence that food webs in those seagrasses were driven by epiphytic algae rather than seagrass itself, and that wrack that accumulates in unvegetated areas, such as nearshore areas of beaches, have been shown to provide an important habitat for certain fish species including economically important species (CCL, 2001a). It is noted, however, that epiphytic algae depend on seagrass as a substrate.

The proponent concludes that given few commercially or recreationally important species were found to be abundant in the seagrasses of the Owen Anchorage region this would suggest that these habitats are not important for those species on a regional basis. CCL assert that the lack of a particular affinity to seagrass in the region is further supported by the fact that species such as Australian herring, sprats and cobbler are found in abundance in unvegetated areas in other parts of the coast in the Perth metropolitan region and further south (CCL, 2001a).

The EPA notes that the proponent has made a commitment to undertake a survey of commercial and recreational fisheries activity in West Success Bank and adjacent areas, on the advice of the Department of Fisheries and CALM, to determine commercial and recreational fishing catch and effort on West Success Bank, and to determine the significance of West Success Bank for commercial and recreational fisheries.

The EPA notes that the distribution of seagrass in Owen Anchorage is at an historic high and that the proposal, as described in the ERMP, if implemented, would see a reduction in the present area of seagrass of 168.5ha or 8.0% of the area present in 1999.

Based on the above, the EPA notes the different views held by the proponent, the Department of Fisheries and Recfishwest but considers that, on balance, commercial and recreational fisheries are unlikely to be significantly compromised by the long-term dredging proposal given the limited reduction in seagrass in Owen Anchorage.

A further consideration within this environmental factor, is the question of the continued use by CCL of the shellsand spoil dump on the north side of Woodman Point, and the discharge of cloudy reject water from the washing plant adjacent to the south-western extremity of Quarantine Beach. Implementation of the long-term proposal will result in a continuation of these activities.

Both the dumping of shellsand slurry from the hopper barges that transport the material from the dredge, and the washing plant reject water, cause localised turbidity. The seafloor in the vicinity is degraded. This is of concern to some beach users who complain of turbid water, and gritty sands where shelly material is washed ashore. This activity is subject to pollution licensing by the

Department of Environmental Protection. This activity will not increase as a result of this proposal and there will not therefore be a significant change in impact.

Summary

Having particular regard to:

- (a) research undertaken by the proponent;
- (b) the fact that it is unlikely that the abundance of fish of commercial and recreational importance will be significantly adversely affected by the proposal;
- (c) the proponents commitment to undertake surveys of commercial and recreational fisheries on West Success Bank and adjacent areas, on the advice of the Department of Fisheries; and
- (d) there will not be any increase in the impacts of turbidity at and around the Woodman Point Jetty,

it is the EPA's opinion that the proposal can be managed to meet the EPA's environmental objective for this factor.

5. Conditions and commitments

Section 44 of the *Environmental Protection Act 1986* requires the EPA to report to the Minister for the Environment and Heritage 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.

5.1 Proponent's commitments

The proponent's commitments as set in the ERMP and subsequently modified, as shown in Appendix 6, should be made enforceable.

5.2 Recommended conditions

Having considered the proponent's commitments and information provided in this report, the EPA has developed a set of conditions which the EPA recommends be imposed if the proposal by CCL to dredge shellsand in the long-term from specific locations on Success and Parmelia Banks, Owen Anchorage is approved for implementation. These conditions are presented in Appendix 6. Matters addressed in the conditions include the following:

- (a) the proponent shall fulfil the commitments set out as an attachment to the recommended conditions in Appendix 6;
- (b) a Dredging and Environmental Management Plan for Success and Parmelia Banks should be prepared and implemented to the requirements of the Minister for the Environment and Heritage and the Minister for State Development on advice of the Environmental Protection Authority, the Department of Environmental Protection, the Department of Conservation and Land Management, the Fremantle Port Authority, the Department of Mineral and Petroleum Resources and the Department of Fisheries; and
- (c) a Seagrass Research and Rehabilitation Plan should be prepared and implemented to the requirements of the Environmental Protection Authority, on advice of the Department of Environmental Protection, the Department of Conservation and Land Management and the Department of Fisheries.

6. Other Advice

Alternative resources

Investigations within the framework of the EMP have been undertaken by CCL into a range of measures to determine whether shellsand from the current and proposed dredging operations can be substituted by other resources (see Section 3).

The EPA considers that all reasonable alternatives to a proposal should be considered within social and environmental constraints. As part of this assessment, the EPA notes:

- there is limesand of suitable quality at Dongara, where CCL and Westlime already operate kilns. CCL's proven resource at Dongara is about 8 million tonnes. The balance of CCL's resource at Dongara is anticipated to approximate 40 million tonnes;
- other resources in the Dongara area exist, currently under the control of other companies;
- the draft State Lime Supply Strategy confirms that alternative sources of lime are available from Dongara. Whilst not an environmental issue for EPA consideration, the strategy notes that for the Perth and South West markets, "none are likely to be economically viable"; and
- no alternative proposals to the current proposal were put forward by CCL, therefore no comprehensive environmental information has been provided on which a comparative environmental assessment can be considered. It is likely, however, that an alternative based on the Dongara resource could be made to be environmentally acceptable as the existing Westlime and CCL operations at Dongara were referred to the EPA and neither required formal assessment.

The EPA considers that:

- unvegetated deposits on West Success Bank are a real alternative source of limesand to the resources known at the time the medium-term proposal was considered in Bulletin 901;
- alternative, high volume sources of limesand exist; and
- to limit the further removal of seagrass from Owen Anchorage, operations should be transferred to West Success Bank as soon as practicable.

Accordingly, the EPA believes it appropriate that CCL accelerate the development of potential alternatives to shellsand dredging on Success and Parmelia Banks and move to West Success Bank as soon as practicable and earlier than scheduled.

Seagrass Protection and Related Terrestrial Lime Resources

The EPA considers that there is an opportunity to address the issue of wider habitat protection through changes to the State Agreement Act, extension of the Shoalwater Islands Marine Park and protection of terrestrial limestone habitats north of Perth at Caraban and at Ridges.

(a) State Agreement Act Area

CCL has been dredging shellsand in the Owen Anchorage area since 1972 under the terms of the *Cement Works (Cockburn Cement Limited) Agreement Act 1971*, as amended 1986. The scheme of the Agreement Act, effective to 2011 with provision to extend to 2021, entitles Cockburn to access shellsand sediment within a five mile (8km) radius of a point on Coogee Beach, north of Woodman Point.

In order to reduce the amount of seagrass lost, the EPA considers that CCL should move as soon as practicable to West Success Bank and that the balance of the Agreement Act area (except those areas identified as part of the long-term dredging proposal) should be excluded from any future shellsand dredging for lime production. The EPA notes that this action has the potential to protect approximately 3,500ha of shallow marine habitat, that presently contains approximately 1,200ha of seagrasses.

The EPA notes that CCL has made a commitment to ensure that no dredging will occur outside the proposed Stage 1 and Stage 2 (West Success Bank) areas throughout the duration of the proposal, to minimise any further loss of seagrass and to manage effects of dredging on coastal processes. This complements CCL's commitment to the EPA that the nearshore areas of Success and Parmelia Banks will be protected from further dredging and that seagrass can be conserved by excluding shellsand dredging from within those parts of the State Agreement Act area which do not form part of this proposal, in consultation with the Department of Mineral and Petroleum Resources, upon approval of the long-term proposal.

(b) Shoalwater Islands Marine Park.

In 1994 the Marine Parks and Reserve Selection Working Group in the report "A Representative Marine Reserve System for Western Australia" (known as the Wilson Report) recommended that the Shoalwater Islands Marine Park be extended northward, in recognition of the increasing recreational use of the waters around Carnac and Garden Islands, and the importance of these areas for research and environmental education (CALM, 1994).

The former Minister for the Environment, through her decision on the short-term dredging programme by CCL in 1998, endorsed a proposal to extend the Shoalwater Islands Marine Park to include the seagrass meadows along the eastern shoreline of Garden Island and the area known as the 'Southern Flats'.

The EPA supported this recommendation in its report entitled 'The Marine Environment of Cockburn Sound' (EPA 1998b) and recommends that, as a matter of high priority, the seagrass meadows on the western side of Cockburn Sound be incorporated into the state system of marine conservation reserves and the Shoalwater Islands Marine Park be extended northwards.

(c) Terrestrial Lime Resources

The EPA notes that CALM, as part of its submission on the long-term dredging proposal, “acknowledges that the mining of alternatives to Owen Anchorage variously come with a high environmental cost and that any approval of Owen Anchorage would not necessarily lead to additional protection for these areas in the long or short term. For example:

- mining is proceeding in the northern Cape Range area near Exmouth with the potential for supply to the south west, a possible pelletising plant at Cape Preston and export markets;
- mining is proposed in the Cape Range proposed 5h reserve at Learmonth with similar supply scenarios;
- the proponent is in possession of mining tenements within the proposed Ridges extension to Yanchep National Park. These tenements will continue to stall the park extension;
- there is no agreed strategic approach to exploitation and protection of the vast limesand and limestone resource from Guilderton to Geraldton (Central West Coast). Large areas of sensitive vegetated coastal dunes and mobile sand sheets are under mining tenement application;
- limesand resources on Legendre Island in the Dampier Archipelago are considered potential resources by resource agencies;
- limesand at Boranup within Unallocated Crown Land on the Leeuwin Naturalist Ridge is considered a future source of industrial lime by the DRD (now Department of Minerals and Petroleum Resources). However, this should be limited to the supply of local agriculture’; and
- State forest previously proposed as a nature reserve at Caraban was changed to a proposed CALM Act 5h reserve (purpose of Limestone and Conservation) for CCL as a contingency that the offshore shellsand ceases to remain available. The future status of this area as a conservation reserve may need to be reconsidered if this proposal is approved”.

In its submission CALM also recommended that Government:

- adopt a strategic and planned approach to protection and exploitation of the Central West Coast limesand resources;
- afford a high level of environmental protection to those conservation resources on islands in the Dampier Archipelago and at Boranup;
- give favourable consideration to the establishment of a conservation reserve over the 5h limestone reserve at Caraban; and
- progress the lime strategy to include studies and planning for the transport of Nullabor resources via the standard gauge rail for both industrial and agricultural use.

Whilst the EPA notes that CCL has indicated that “at no time has land at Caraban been set aside for CCL as a contingency or for any other purposes” (CCL, 2001a), the EPA considers it important that should the implementation of the long-term dredging proposal in Owen Anchorage be approved, that mining tenements at Caraban and Ridges be protected from future disturbance of terrestrial limestone habitats and be added to the conservation estate.

7. Conclusions

The EPA has considered the proposal by CCL to dredge shellsand in the long-term from specific locations on Success Bank, Parmelia Bank and West Success Bank, Owen Anchorage.

The EPA acknowledges that the long-term proposal has been developed from a very substantial base of new knowledge and that although some direct loss of biodiversity will occur in the vicinity of dredging in terms of seagrass, dependent fish, epiphytes and invertebrates, no species will be lost as habitat types exist elsewhere.

In terms of cover, seagrass in Owen Anchorage was more extensive in 1999, even accounting for previous dredging losses, than at any earlier mapping period.

The EPA recognises the important role that seagrass plays as a primary producer and a habitat and considers it is an important principle to retain seagrass in Owen Anchorage wherever possible. The EPA also recognises that Parmelia Bank borders Cockburn Sound, which has already lost 80% of its seagrass.

The EPA notes that whilst seagrass rehabilitation is possible, it is not currently practicable at a scale comparable to the rate of loss proposed through dredging, but that the necessary technology may be developed in the future. It is also noted that seagrass distribution in Owen Anchorage is dynamic and seagrasses can establish naturally on shallow bare sand habitat.

The EPA notes the proponent has now identified additional resources of shellsand on West Success Bank with no seagrass cover. The EPA considers that dredging of unvegetated shellsand can be carried out in an environmentally acceptable manner.

The EPA notes that as a result of expert advice, the expert manner in which the proponent has undertaken its research as part of the EMP studies, and the utilisation of internal and external review systems it appears to the EPA that there is now sufficient information to enable the EPA to make a decision about the further dredging of seagrass from the Owen Anchorage area.

The EPA is of the view that CCL has provided sufficient new information to enable the EPA to conclude that further limited removal of some seagrass from Owen Anchorage can now be considered environmentally reasonable.

Whilst the EPA considers that a limited loss of additional seagrass in Owen Anchorage could occur without inducing a significant impact, it wishes to ensure that any additional loss is strictly constrained. Accordingly, the relocation of CCL's dredging operations to unvegetated areas on West Success Bank should occur as quickly as practicable and in considerably less time than the 12 years as originally proposed by CCL for Stage 1 of the proposal.

The proponent should thus prepare for Government consideration a timetable for moving from Success Bank and Parmelia Bank to West Success Bank as quickly as practicable.

The EPA notes that the proposal will result in minor hydrodynamic changes to the wave climate in Owen Anchorage and Cockburn Sound, and will allow wave energy from Owen Anchorage to penetrate deeper into Cockburn Sound. The EPA considers that the altered wave regime may result

in some coastal structures experiencing increases in wave height during severe storms and minor changes to rates of sediment transport and shoreline orientation. However, based on CCL's commitments, including management measures for foreshore restoration, the EPA considers that hydrodynamic changes arising from the proposal can be managed.

The EPA notes the different views held in relation to the importance of seagrasses for fish, but concludes that it is unlikely that the abundance of fish of commercial and recreational importance will be significantly affected by the proposal.

The EPA also considers that there is an opportunity to address the issue of wider habitat protection. Such protection can be affected through changes to the State Agreement Act, with CCL to relinquish the right to dredge in those parts of the Agreement Act area which are not part of this proposal, by extension of the Shoalwater Islands Marine Park and by protection of terrestrial limestone habitats at Caraban and Ridges, north of Perth.

In conclusion the EPA:

- (a) recognises the important role that seagrass plays as a primary producer and a habitat;
- (b) recommends the relocation of dredging operations to areas of West Success Bank, where there is no seagrass, as soon as practicable, and that this be achieved in considerably less time than the 12 years as originally proposed by CCL for Stage 1 of the proposal;
- (c) agrees that the balance of scientific advice indicates that some limited further removal of seagrass would be unlikely to have a significant environmental impact in Owen Anchorage;
- (d) notes that, while the proponent prepares to relocate to West Success Bank, it would be sensible for any dredging which may be authorised to link the previously dredged areas in Parmelia and Success Banks, along the alignment of the second shipping channel in Owen Anchorage;
- (e) considers the management commitment made by CCL to deal with foreshore restoration issues arising from any hydrodynamic changes to be important;
- (f) considers that, on balance, commercial and recreational fisheries are unlikely to be significantly compromised by the proposal; and
- (g) supports the protection of seagrass on the balance of East Success Bank and Parmelia Banks, an extension to the Shoalwater Islands Marine Park and protection of terrestrial limestone habitats at Caraban and Ridges.

The EPA considers that it is unlikely that the EPA's objectives would be compromised, provided the above issues are addressed and there is satisfactory implementation by the proponent of the proponent's commitments and the recommended conditions set out in Appendix 6 and summarised in Section 4.

8. Recommendations

Recommendations

The EPA has considered the proposal by CCL to dredge shellsand in the long-term from specific locations on Success Bank, Parmelia Bank and West Success Bank, Owen Anchorage.

The EPA has concluded that the proposal, modified according to points 4 and 5 below, can be managed in an environmentally acceptable manner such that it is most unlikely that the EPA's

objectives would be compromised, provided there is satisfactory implementation by the proponent of the recommended conditions set out in Section 4, including the proponent's commitments.

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

1. That the Minister notes that:
 - (a) the proposal being assessed is for long-term shellsand dredging (from 2002 to 2034) from specific locations on Success Bank, Parmelia Bank and West Success Bank, Owen Anchorage; and
 - (b) the proposal comprises two stages: the first being for 12 years in the general area previously dredged on Success and Parmelia Banks and impacting on some seagrass; and the second stage for 20 years in a new unvegetated area on West Success Bank mostly outside the current State Agreement Act area.
2. That the Minister considers the report on the relevant environmental factors as set out in Section 4.
3. That the Minister notes that the EPA has concluded that the removal of some seagrass from Success and Parmelia Banks during a reduced Stage 1 operation would be unlikely to have a significant environmental impact in Owen Anchorage.
4. That the Minister notes that the EPA has concluded that CCL should relocate its dredging operations to areas of West Success Bank, where there is no seagrass, as soon as practicable, and that this be achieved in considerably less time than the 12 years as originally proposed.
5. That the Minister liaise with the Minister for State Development to agree upon a programme for the timely relocation of dredging operations from Success and Parmelia Banks to West Success Bank and that this relocation occurs in considerably less time than 12 years.
6. That the Minister notes that the EPA has concluded that it is unlikely that the EPA's objectives would be compromised, provided there is satisfactory implementation of points 4 and 5 above and implementation by the proponent of the recommended conditions set out in Appendix 6, and summarised in Section 4, including the proponent's commitments.
7. That the Minister imposes the conditions and procedures recommended in Appendix 6 of this report.
8. That the Minister notes the EPA's advice that, based upon the provision of long-term access to shellsand, in accordance with the recommendations in this report, mining tenements held by CCL north of Perth at Caraban and Ridges, be added to the conservation estate.
9. That the Minister notes the advice of the EPA that there is an opportunity to address the issue of wider seagrass protection through changes to CCL's State Agreement Act and extension of the Shoalwater Islands Marine Park.

Appendix 1

List of submitters

State/ Local Government

City of Cockburn
City of Rockingham
Department of Conservation and Land Management
Department of Environmental Protection
Department of Resources Development
Department of Minerals and Energy
Fisheries Western Australia
Fremantle Port Authority

Organisations

Cockburn Power Boat Association
Com-Net
Conservation Council
Recfishwest

Individuals

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Plus one confidential submission

Appendix 2

References

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Appendix 3

A Brief History of Cockburn Cement Limited's Short and Medium-term Dredging Proposals

Proposal	Date	Chronology of events
Short term dredging proposal	Feb 1994	<ul style="list-style-type: none"> • A dredging proposal was submitted to the EPA for assessment as a Consultative Environmental Review entitled “Proposal to Continue Dredging of Shellsand on Success Bank (1994-1996)”. • The proposal involved dredging 67ha of seafloor from a battleaxe shaped segment between the two shipping channels.
	May 1994	<ul style="list-style-type: none"> • The EPA provided its report and recommendations to the Minister for the Environment on “The Proposed Short-term Continuation of Dredging Shellsand on Success Bank, Owen Anchorage; and proposed strategy to address the long-term environmental issues of shellsand dredging” (Bulletin 739, Assessment No. 859, Statement No. 360) (EPA, 1994). • During the EPA’s assessment, the EPA developed a plan which would ensure that CCL examine a range of options for obtaining raw material for its future operations. These were: <ul style="list-style-type: none"> • seek the resource elsewhere; • beneficiate lower grade sands with no seagrass cover; and • rehabilitate the seagrass in the dredged area and in other places, and better understand the importance of seagrass in the marine environment. • The EPA recommended in Bulletin 739 that: <ul style="list-style-type: none"> • shellsand dredging as proposed could continue on Success Bank provided dredging occurred in areas with less than 25% seagrass cover; and • CCL prepare an Environmental Management Plan (EMP) to investigate the environmental impacts from dredging in Owen Anchorage, the ecological significance of seagrasses in Owen Anchorage, seagrass rehabilitation, beneficiation of lower grade shell sand, and other sources of resource.
	4 Aug 1994	<ul style="list-style-type: none"> • Following appeals, the Minister for the Environment issued conditions under which the proposal could proceed. • In response to appeals, the Ministerial conditions did not impose the 25% restriction. Instead the condition gave approval for mining in the 67ha area, proposed in the company’s CER, which was mostly sparsely covered, but included 17ha with greater than 25% seagrass cover (subsequent remapping has shown this denser area to be only 6ha).
	August 1994	<ul style="list-style-type: none"> • The Coastal Waters Alliance made application to the Supreme Court for writs of <i>certiorari</i> against the EPA and Minister for the Environment, seeking that Bulletin 739 and the Ministers Statement of 4 August 1994 be quashed on the ground that Bulletin 739 was “invalid and <i>ultra vires</i> the statutory function or powers of the EPA pursuant to S44(1) of the Act”.
	13 Oct 1995	<ul style="list-style-type: none"> • The EPA published its Report and Recommendations on a Change to Environmental Conditions for the short-term dredging proposal under S46 of the Environmental Protection Act 1986 (Bulletin 792, Assessment No. 937, Statement No. 403) (EPA 1995a). • Whilst the 1994 Statement of approval required CCL to commit to detailed studies to investigate the feasibility of beneficiation of low-grade shellsand, it did not address from where, or how, shellsand to be used in these studies should be taken. CCL therefore sought modification to the statement to address these issues and proposed that 20,000t of material be dredged from Parmelia Bank for use in beneficiation studies (in an area <1% seagrass cover).
	5 Jan 1996	<ul style="list-style-type: none"> • Statement issued amending 1994 approval for beneficiation.
	Nov 1995	<ul style="list-style-type: none"> • The EPA provided its advice to the Minister in accordance with Ministerial Condition 5-1 for Short term continuation of dredging shellsand on Success Bank, Owen Anchorage (in relation to the EMP and supplement) and strategy to address the long term environmental issues of shellsand dredging (Bulletin 803, (EPA, 1995a).
	26 March 1996	<ul style="list-style-type: none"> • The Supreme Court found that the EPA in Bulletin 739 had erred in considering commercial/ economic issues when giving its advice, and that the advice of the EPA and subsequent approval of the Minister was therefore invalid. • As a result the Bulletin and Ministerial Conditions of 4 August 1994 were quashed.
	Nov 1996	<ul style="list-style-type: none"> • The EPA “reconsidered” the short-term dredging proposal and reported again to the Minister on “Short-term shell-sand dredging, Success Bank, Owen Anchorage” (Bulletin 833, Assessment No, 1022, Statement No. 468) (EPA, 1996a). During this reassessment, the DEP continued to advise that any shellsand dredging should be limited to areas with seagrass cover less than 25%. However, the EPA changed its position and recommended that the proposal as submitted by CCL could be managed to meet EPA’s objectives. i.e. it recommended that dredging of areas of seagrass with greater than 25% cover should be allowed to occur.

	12 Jan 1998	<ul style="list-style-type: none"> Following five appeals against the EPA's report and recommendations (Bulletin 833), the Minister allowed the appeals as follows: <ul style="list-style-type: none"> in order to mitigate the loss of seagrass on Success Bank, seagrass remaining in CCL's short-term area are to be used for replanting trials consistent with the EMP; in relation to the relevant area for consideration of seagrasses, the area should be Success Bank, Owen Anchorage and its surrounds which could extend to the adjacent Perth Metropolitan coast and Rottnest Island depending on the environmental factor under consideration; and in relation to cumulative impacts, the EPA should carry out environmental assessment of the likely cumulative impact of CCL's dredging plan. This work should form part of the environmental assessment of the medium-term shellsand dredging plan. As part of the strategy in dealing with loss of seagrass from Cockburn Sound, the Minister endorsed initiatives suggested by the DEP to: <ul style="list-style-type: none"> develop a long-term lime supply strategy for the State involving DRD and DME to review available alternatives with input from the DEP on environmental implications; and reduce nitrogen sources to the southern metropolitan coastal waters including: <ul style="list-style-type: none"> nutrient reduction programmes for urban drainage into Cockburn Sound and Owen Anchorage; the addition of nitrogen load reduction targets to the Peel Harvey EPP and the Swan Canning EPP; and designation of seagrass areas in marine reserves to provide more secure conservation of remnants in the Cockburn Sound and Owen Anchorage areas. Such an approach is consistent with a possible northward extension of Shoalwater Islands Marine Park, a draft proposal from Murdoch University for National estate listing and the Navy's interest in devolving responsibility to the State for near shore management of Garden Island.
	23 Feb. 1998	<ul style="list-style-type: none"> Minister for the Environment issued conditions on short-term proposal (i.e. revised Ministerial Statement – Statement 468).
Medium-term dredging	Aug 96-	<ul style="list-style-type: none"> The CER for the medium –term dredging proposal was released for public comment between 20 August and 23 September 1996.
	Aug 1998	<ul style="list-style-type: none"> The EPA assessed the medium-term proposal entitled “Medium-term shellsand dredging, Success Bank, Owen Anchorage). (Bulletin 901, Assessment No. 1027, Statement No. 494) (EPA, 1998a) The proposal involved dredging 99ha of Success Bank resulting in the removal of 18ha of shallow unvegetated sediment with seagrass cover less than 25%, 39ha of low density seagrass (25-50% cover), and 42 ha with high density seagrass (50-100% cover). The EPA formed the view in the medium term dredging that: <ul style="list-style-type: none"> development proposals should not adversely add to the gross changes that have already occurred. As seagrasses are the main biological element significantly impacted by the water quality change in Cockburn Sound it is paramount that there should not be any further losses; and the completion of the medium term proposal will provide two direct opportunities, firstly a reason to stop the further loss of seagrass by dredging and, secondly the focus to move to other resource acquisition options. Hence, a longer-term proposal which would see the further removal of seagrass from the confines of Owen Anchorage should be recognised as environmentally unreasonable. The medium-term proposal provided for: <ul style="list-style-type: none"> implementation of all of the programmes of scientific and technical investigation as outlined in the Shellsand Dredging EMP and Supplement (CCL, 1995a and 1995b); implementation of a detailed audit programme developed for the project; submission of CCL's long-term plan at least 15 months prior to the expected depletion of the medium-term resource; implementation of a dredging programme that prioritises dredging areas, gaining access to areas of lower seagrass cover first; the preparation and implementation of an EMS; and use of seagrass in the area to be dredged for transplanting trials, consistent with the commitments and research programmes listed in the EMP.
	10 Feb 1999	<ul style="list-style-type: none"> The Minister for the Environment issued approval for the medium –term dredging proposal.

Appendix 4

Identification of Relevant Environmental Factors

Preliminary Environmental factors	Proposal Characteristics	Government Agency and Public Comments	Identification of Relevant Environmental Factors
BIOPHYSICAL			
Biodiversity – <ul style="list-style-type: none"> • marine flora • marine fauna • marine conservation 	Stage 1 – Clearing of 168.5 ha of seagrass and 264.5 ha (total 433 ha) of bare, shallow sand (potential seagrass habitat) on Success and Parmelia Banks to produce 30 mt of limesand. Stage 2 – Dredging of 350 ha of bare sand east of the Mewstone to produce 60 mt of limesand.	Comments made in submissions were: <ul style="list-style-type: none"> • nothing in the research reported in the ERMP has provided any reason why the views of the EPA in Bulletin 901, viz “proposal(s) which would see the further removal of seagrass from the confines of Owen Anchorage should be recognised as environmentally unreasonable” should be altered; • the proposal would result in a loss of seagrass distribution, abundance and diversity; • the cumulative loss of seagrass represents 221 ha (53ha for the short and medium-term dredging areas and 168.5 ha for the long-term dredging areas) or 12.8 % of the seagrass remaining on Success and Parmelia Banks; • the cumulative loss of seagrass exceeds the EPA = 10% for reversible change draft criteria; <ul style="list-style-type: none"> • there would be loss of potential seagrass habitat; • the real issue is the habitat the seagrasses occupy rather than seagrass cover at any one time. Dredging removes the habitat (i.e. the shallow bank top sands) preventing recolonisation mainly because of increased depth; • the seagrass <i>Posidonia coriacea</i> is only found in the south-west of WA and continuous and spreading meadows of this species have only been found to date on Success Bank; • there has been no research on the impacts on aquatic fauna such as Loggerhead and Leatherback turtles which are endangered and are associated with seagrass communities, nor of bottle nosed dolphins or sea lions; • there is a close link between seagrass and fisheries; and • the remaining shallow waters of Parmelia and Success Banks should be excised from the State Agreement Act and gazetted as an “A” class reserve. CALM: <ul style="list-style-type: none"> • Government needs to consider the designation of seagrass areas to provide more secure conservation of remnants in the 	Biodiversity should be considered in the context of the amount of historic loss and the absolute loss of the remainder. Whilst there is some evidence for seagrass growth at the depth CCL will dredge to, at best, productivity will be less due to less light. Growth in the seaway is likely to be further compromised by turbidity and wake effects from large ships. It appears there are other areas of extensive <i>P. coriacea</i> meadows displaying significant changes in area over decadal timescales, most notably Two Peoples Bay near Albany (CCL, 2001a). As an integral part of the assessment Government needs to consider the designation of seagrass areas to provide more secure conservation or remnants in the Cockburn Sound and Owen Anchorage areas through extensions to the marine reserve system. CCL has proposed to give up the eastern part of its current Agreement Act area. This area and/or others could then be quarantined from future limesand proposals and secured with an appropriate form of tenure to facilitate sustainable environmental management. The further loss of seagrass as a result of this proposal is a significant issue, in the context of the losses from the region historically and the area of seagrass which will remain. Considered to be a relevant environmental factor

Preliminary Environmental factors	Proposal Characteristics	Government Agency and Public Comments	Identification of Relevant Environmental Factors
		<p>Cockburn Sound and Owen Anchorage areas through extensions to the marine reserve system.</p> <p>DEP:</p> <ul style="list-style-type: none"> • how much of each meadow type is currently contained in secure conservation reserves in similar environments? 	
<p>Ecosystem function</p> <ul style="list-style-type: none"> • ecological values/ functions 	<p>Stage 1 – Clearing of 168.5 ha of seagrass and 264.5 ha (total 433 ha) of bare, shallow sand (potential seagrass habitat) to produce 30 mt of limesand</p> <p>Stage 2 – Dredging of 350 ha of bare sand to produce 60 mt of limesand.</p>	<p>Comments made in submissions were:</p> <ul style="list-style-type: none"> • CCL has proposed alternative criteria based on ecological value. The ecological values for each habitat do not take into account relative abundance. The more common a unit, the less relative value it should have. In the analysis, the ecological value does not change as a habitat becomes less abundant (seagrass) or more abundant (deep sand); and • shallow sand habitat has a higher ‘potential’ conservation value than calculated, and calculations need to incorporate a means for evaluating ‘potential seagrass habitat’. <p>CALM and others:</p> <ul style="list-style-type: none"> • the ecological value of a seagrass system cannot be considered as a sum of the ecological process attributes; and • the relationship between the four ecological process attributes and actual ecosystem function/ complexity is vague, so the meaning of arithmetic calculations/ comparisons of ‘ecological value’ lacks clarity; actual variance in ecological function/ complexity is unknown. The validity of subsequent analysis hinges entirely on this surrogacy assumption which is unproven. <p>DEP:</p> <ul style="list-style-type: none"> • it is noted that CCL has done a large amount of research which underpins their use of ecological value as a means of quantifying ecosystem function. While this research is very valuable of itself, here is clearly still scientific debate over the use of ecological value as a means of determining whether or not reductions in function have occurred. While the peer review committee have reviewed the research which has contributed to this approach, the committee has not yet 	<p>In considering this preliminary factor it is noted that CCL in its response to submissions (CCL, 2001a) indicated that:</p> <ul style="list-style-type: none"> • it is concerned about the summation of ecological attributes but uses a summed value when concluding that the ecological value loss is estimated at 2%, and is within the natural range of values (pg 23); and • on an overall basis, the ecological value per unit area of seagrass meadows is about three times that of deep bare sand and six times that of shallow bare sand (p 56). <p>The loss of ecological value is greatest in the dredged areas but is low in sum across the region because of the limited area dredged and because other species colonise the deep sand and overlying water column, offsetting some of the loss of seagrass dependent species and productivity. While ecological values may not show great differences before and after dredging, the actual systems and species present change considerably (Tables 3,4 and 5 in CCL, 2001a) as would be expected when seagrass is replaced by deep sand.</p> <p>Considered to be a relevant environmental factor</p>

Preliminary Environmental factors	Proposal Characteristics	Government Agency and Public Comments	Identification of Relevant Environmental Factors
		<p>provided a published opinion on the final ERMP; that is, how this research has been used and the validity of the conclusions drawn and presented in the ERMP).</p> <p>Fisheries WA (now Department of Fisheries):</p> <ul style="list-style-type: none"> estimates of ecological value cannot be taken to represent comparisons of a particular ecological function such as secondary production; the use of overall ecological value as part of the assessment of the ecological significance of seagrass and other habitats lacks validity and cannot be employed for quantitatively determining the changes in ecological function resulting from the dredging; and with respect to estimates of [fish] production, it is doubtful that the assumptions underlying this technique are satisfied (as indicated by the authors). Thus Fisheries WA would have little confidence in relation to the reliability of such estimates. 	
<p>Seagrass Rehabilitation</p> <ul style="list-style-type: none"> marine flora 	<p>Stage 1 – Clearing of 168.5 ha of seagrass and 264.5 ha (total 433 ha) of bare, shallow sand (potential seagrass habitat) to produce 30 mt of limesand. 433ha deepened from ~9m or less to ~15m. Deepened habitat will remain.</p> <p>Stage 2 – Dredging of 350 ha of bare sand to produce 60 mt of limesand. 350 ha deepened from ~9m or less to ~15m. Deepened habitat will remain.</p>	<p>Points and questions raised in submissions included:</p> <ul style="list-style-type: none"> have the performance criteria established in 1995, as part of the EMP, for seagrass rehabilitation been met? seagrass cannot be successfully rehabilitated after dredging as the water is too deep and the light attenuation too great. In practice CCL has not been able to carry out seagrass rehabilitation at a rate even approaching the rate of dredging; it is not possible for the rate of seagrass transplantation as specified in the seagrass transplantation programme to match the proposed rate at which the seagrass is being dredged. To transplant one hectare will take 3-5 years whereas to dredge one hectare will take approximately 1 month; mechanical transplantation of seagrass sods has resulted in 70% survival rate. The survival of sods, however, is dependent on the species transplanted with only the Posidonia species surviving well. The transplantation of seagrass, as admitted in the ERMP, is expensive and slow and causes damage to the donor beds; while it is acknowledged that seagrasses can be transplanted to a similar bank top habitat, it is the loss of suitable habitat that 	<p>In considering this preliminary factor it is noted that CCL consider that in relation to the performance criteria developed as part of the EMP for the short term rehabilitation programme that:</p> <ul style="list-style-type: none"> it has met criterion 1 to demonstrate that 0.1 ha of seagrass can be rehabilitated with evidence that it can survive for at least three years (0.3 ha planted at Recipient 2 site over last 5 years has 60% survival); and it has not met criterion 2 to generate from 1-3 ha of seagrass through rehabilitation, with evidence of survival for at least 12 months (0.3 ha only established). <p>It is noted that:</p> <ul style="list-style-type: none"> seagrasses grow at depths up to 21 m in Gage Roads and have been transplanted and survive at 15m depth; and currently 0.3 ha has been rehabilitated, while an estimated total of 127 ha of seagrass has been removed through dredging since 1972. <p>While CCL makes a commitment to ongoing research on seagrass re-</p>

Preliminary Environmental factors	Proposal Characteristics	Government Agency and Public Comments	Identification of Relevant Environmental Factors
		<p>a similar bank top habitat, it is the loss of suitable habitat that is the issue;</p> <ul style="list-style-type: none"> • CCL should include a commitment to permanently restore as much seagrass as is to be lost by dredging on completion of the proposal; and • it is unacceptable that a mining company should be allowed to mine in a high quality marine area without rehabilitating it, just as they are required to do in terrestrial areas. <p>DEP:</p> <ul style="list-style-type: none"> • actual and potential seagrass habitat is lost to dredging and cannot be practically rehabilitated. <p>Fisheries WA (now Department of Fisheries):</p> <ul style="list-style-type: none"> • seagrass rehabilitation by transplantation will not offset the loss of seagrass caused by dredging. 	<p>establishment, there are no commitments to revegetate any dredged areas.</p> <p>It is not presently practical to transplant seagrasses at a rate commensurate with the area to be mined.</p> <p>Considered to be a relevant environmental factor</p>
<p>Wave climate, sediment and bank movement and shoreline stability</p> <ul style="list-style-type: none"> • banks • foreshore 	<p>Stage 1 - Dredging of seaway 1.5km wide and ~15m deep through Success and Parmelia Banks. 433ha deepened from approx 9m or less to 15m.</p> <p>Deepening increases the penetration of wave energy into Owen Anchorage and Cockburn Sound.</p> <p>Stage 2 – 350 ha deepened from approx 9m or less to 15m.</p>	<p>Questions and comments raised in submissions included:</p> <ul style="list-style-type: none"> • what is the potential cost to coastal values from erosion/accretion and who will bear this cost and the cost of mitigation measures? • was increased wave impact on Woodman Point considered during the hydrodynamic modelling? • will erosion of the inner Parmelia and Success Banks be accelerated as a result of the seaway construction? • various refinements could be made to the hydrodynamic model. 	<p>CCL in its response to submissions indicated that:</p> <ul style="list-style-type: none"> • CCL will undertake corrective action; • under severe storm event conditions from the west, an increase on wave height of up to 20% occurs in the region of Woodman Point; and • there is no evidence that erosion of the inner Parmelia and Success Banks will be accelerated as a result of seaway construction. <p>A comprehensive array of commitments has been made to monitor and model wave climate, sediment transport and coastal processes and prepare and implement management plans and corrective actions.</p> <p>Considered to be a relevant environmental factor</p>
POLLUTION			
<p>Water quality</p> <ul style="list-style-type: none"> • clarity • nutrients 	<p>Stage 1 – Dredging of seaway 1.5km wide and ~15m deep through Success</p>	<p>Questions and comments made in submissions focused on:</p> <ul style="list-style-type: none"> • if there is to be better through flushing with more waters coming into Cockburn Sound from the South, will some of the 	<p>CCL have indicated in its response to submissions that:</p> <ul style="list-style-type: none"> • additional hydrodynamic modelling and model interpretations were conducted in order to respond to the point raised and it was

Preliminary Environmental factors	Proposal Characteristics	Government Agency and Public Comments	Identification of Relevant Environmental Factors
	<p>and <i>Parmelia</i> Banks.</p> <p>Deepening increases through flushing.</p> <p>Stage 2 – Dredging of 350 ha of bare sand.</p>	<p>waters come from contaminated waters in the Sepia Depression as a result of the Cape Peron sewage outfall?;</p> <ul style="list-style-type: none"> will the seaway increase the light attenuation over the nearshore regions of Owen Anchorage?; and what impact will plumes from the dredge and the onshore washing plant have on the water clarity in Cockburn Sound? <p>DEP:</p> <ul style="list-style-type: none"> will the seaway increase or decrease the advection of water, nutrients and contaminants from Cockburn Sound along the near-shore zone of Owen Anchorage? 	<p>concluded that very small changes to current velocities and patterns of circulation are predicted in the vicinity of the causeway after dredging;</p> <ul style="list-style-type: none"> all changes in circulation are no greater than 1 cm/s; the increase in clarity ranges between 0 and 2%; and turbidity events are short-lived, due to the large particle size of the material. <p>Not considered to be a relevant environmental factor.</p>
Greenhouse gases	Continued operation of dredge fleet and wash plant	<p>One submission commented that:</p> <ul style="list-style-type: none"> the proponent should put in place any measures to reduce carbon dioxide production from current dredging activities plus any expected increases due to this proposal. 	<p>CCL is part of the Greenhouse Challenge programme. No significant increase in greenhouse gas output is expected.</p> <p>Not considered to be a relevant environmental factor</p>
SOCIAL SURROUNDINGS			
<p>Recreation</p> <ul style="list-style-type: none"> recreational fisheries 	<p>Stage 1 – Clearing of 168.5 ha of seagrass and 264.5 ha (total 433 ha) of bare, shallow sand (potential seagrass habitat) to produce 30 mt of limesand</p> <p>Stage 2 – Dredging of 350 ha of bare sand</p>	<p>Comments raised in submissions focused on:</p> <ul style="list-style-type: none"> the area where the proposed dredging will take place has a special value for recreational fishers; the statement that the seagrasses of Owen Anchorage do not support any commercial or recreational fishery and that the Seaway will not influence any commercial or recreational fishery in the area is incorrect and unable to be supported by the information presented in the ERMP; and an impact from current dredging activities is the turbidity and the deposit of shellsand matter on Cockburn's beaches which reduces the social values of these beaches. Of particular concern is the dumping of shellsand near the coast before it is sucked away for processing. What measures will be undertaken by the proponent to reduce this impact? <p>Fisheries WA (now Department of Fisheries):</p> <ul style="list-style-type: none"> this study and that on fish and fisheries have revealed that few economically and recreationally important fish species were found in abundance in, or were directly trophically dependent 	<p>In considering this preliminary factor, it is noted that CCL in its response to submissions indicated that:</p> <ul style="list-style-type: none"> studies indicate that the abundance of fish of commercial and recreational importance will not be adversely affected; and results indicate that relatively high densities of fish do occur in seagrass assemblages in the Owen Anchorage region. The ERMP states that the loss of <i>P. sinuosa</i> meadows in the Owen Anchorage region may produce a greater than simple proportional loss of those species that prefer this habitat <p>Considered to be a relevant environmental factor</p>

Preliminary Environmental factors	Proposal Characteristics	Government Agency and Public Comments	Identification of Relevant Environmental Factors
		<p>on, seagrass meadows. This has confirmed what previous Western Australian studies on coastal finfish species had suggested;</p> <ul style="list-style-type: none"> the ERMP states that seagrass habitat is not an important nursery area for commercial and recreational fish species. What data support this statement? What are the important habitats for juveniles of the important commercial and recreational fish species if these species are not dependent on seagrasses, as is commonly believed by anglers? 	
Aesthetics	<p>Stage 1 – Clearing of 168.5 ha of seagrass and 264.5 ha (total 433 ha) of bare, shallow sand (potential seagrass habitat) to ~15m depth</p> <p>Stage 2 – Dredging of 350 ha of bare sand to ~15m depth</p>	<p>One submission raised the point that:</p> <ul style="list-style-type: none"> there is a major value attached to the visually accessible shallow banks and seagrasses in contrast to the deeper waters including those which have been dredged. Deeper dredged waters offer no visual focal point. 	<p>The greater proportion of this mosaic will not be altered by CCL's proposal.</p> <p>Not considered to be a relevant environmental factor</p>
Aboriginal heritage	<p>Stage 1 – Clearing of 168.5 ha of seagrass and 264.5 ha (total 433 ha) of bare, shallow sand (potential seagrass habitat) to produce 30 mt of limesand</p> <p>Stage 2 – Dredging of 350 ha of bare sand</p>	<p>DEP:</p> <ul style="list-style-type: none"> is the Indian Ocean Aboriginal site S02169 likely to be affected by the proposal? 	<p>The Indian Ocean site concerns Aboriginal mythology about the creation of the islands. Appropriate surveys and consultations with interested Aboriginal groups and individuals will be undertaken regarding the proposed dredging areas prior to the commencement of dredging (CCL 2001a).</p> <p>Not considered to be a relevant environmental factor</p>
OTHER			
Alternative resources	<p>CCL proposes to mine a total of ~90mt of limesand at a rate of 1.9 to 3mt/year over ~32 years. Resources in this proposal are close to CCL's existing Munster plant.</p>	<p>Submissions focused on:</p> <ul style="list-style-type: none"> whether there are sufficient quantities of a resource of a lower quality elsewhere in Western Australia in an area of lower environmental significance; and development of a new dredge may take a year or two but should be feasible well before 2014 	<p>There is limesand of suitable quality at Dongara, where CCL and Westlime already operate kilns. CCL's proven resource at Dongara is about 8 million tonnes. The balance of (CCL's) resource at Dongara is anticipated to approximate to 40 million tonnes.</p> <p>Other resources in the Dongara area exist, under the control of other</p>

Preliminary Environmental factors	Proposal Characteristics	Government Agency and Public Comments	Identification of Relevant Environmental Factors
	<p>Munster plant.</p> <p>The proponent states that Stage 1 involves use of existing dredge on Success and Parmelia banks until 2014. Transition to waters east of the Mewstone from 2015 onwards would require development of a new dredge capable of handling the rougher seas and limestone pinnacles in the seabed there.</p>	<p>DEP:</p> <ul style="list-style-type: none"> • CCL was specifically asked to examine alternative resources and has evaluated offshore resources between Mandurah and Geraldton. CCL and others have identified large resources at Dongara and elsewhere onshore; and • what is the opportunity to use reserves at Dongara for a limited period of time while operations are transitioned into another, marine or other area where environment impacts would be lower than in Owen Anchorage? It is interesting to note that the additional annual cost of \$40m attributed to obtaining limesand from Dongara could be seen as a surrogate value of the environment in Owen Anchorage. <p>DRD (now the Department of Mineral and Petroleum Resources):</p> <ul style="list-style-type: none"> • CCL’s review of limestone and limesand resources has concluded that there are no known alternative resources of calcium carbonate between Augusta and Geraldton available to the company which are of sufficient volume that could be accessed commercially. This finding concurs with the draft State Lime Strategy. <p>CALM:</p> <ul style="list-style-type: none"> • should this proposal be approved, the issue of securing leases over limestone that CCL hold at Caraban, north of Wanneroo and at Ridges, north of Yanchep National park, should be considered. • it is recommended that the Government: <ul style="list-style-type: none"> • adopt a strategic and planned approach to protection and exploitation of the Central West Coast limesand resources; • afford a high level of environmental protection to those conservation resources on islands in the Dampier Archipelago and at Boranup; • give favourable consideration to the establishment of a 5h limestone reserve at Caraban; and 	<p>companies.</p> <p>The draft State Lime Supply Strategy confirms that alternative sources of lime are available from Dongara, but for the Perth and South West markets, “none are likely to be economically viable”. EPA cannot consider economic viability, only environmental factors.</p> <p>No alternative proposals to the current proposal were put forward by CCL, therefore no comprehensive environmental information has been provided on which a comparative environmental assessment can be considered. It is likely, however, that an alternative based on the Dongara resource could be made to be environmentally acceptable as the existing Westlime and CCL operations at Dongara were referred to the EPA and neither required formal assessment</p> <p>Conclusion – Alternative, high volume sources of limesand exist. While comprehensive environmental information has not been provide on these alternatives, it is likely that exploitation of unvegetated dunes at Dongara would involve lower environmental impacts than dredging in Owen Anchorage.</p> <p>Considered to be a relevant to the assessment. To be addressed under Other Advice.</p>

Preliminary Environmental factors	Proposal Characteristics	Government Agency and Public Comments	Identification of Relevant Environmental Factors
		<ul style="list-style-type: none">• progress the lime strategy to include studies and planning for the transport of Nullabor resources via the standard gauge rail for both industrial and agricultural use.	

Appendix 5

Summary of Relevant Environmental factors

Factors/ Issues	EPA Objective(s)	Summary of Government Agency and Public Comments	Co-proponents commitments and environmental management measures	EPA Assessment
BIOPHYSICAL				
Biodiversity – <ul style="list-style-type: none"> • marine flora • marine fauna • marine conservation • ecosystem function 	<ul style="list-style-type: none"> • Maintain biological diversity meaning the different plants and animals and the ecosystems they form, at the levels of genetic diversity, species diversity and ecosystem diversity. • Maintain ecological function, abundance, species diversity and geographical distribution of seagrasses. • Maintain the diversity and relative proportions of substrates which occur in the area. 	Comments made in submissions focused on: <ul style="list-style-type: none"> • the loss of seagrass distribution, abundance and diversity; • the loss of potential seagrass habitat; • cumulative loss of seagrass; • previous statements made by the EPA in relation to seagrass loss; • the close link between seagrass and fisheries; • lack of research on impacts on aquatic fauna such as turtles which are endangered or of bottle nosed dolphins or sea lions; • the concept of ecological value - the ecological value of a seagrass system cannot be considered as a sum of the ecological process attributes; the use of overall ecological value lacks validity; estimates of ecological value cannot be taken to represent comparisons of a particular ecological function such as secondary production; • securing leases over limestone that CCL holds at Caraban, north of Wanneroo, and at Ridges, north of Yanchep National Park; • excising the remaining shallow waters of Parmelia and Success Banks from the State Agreement Act and gazetted as an “A” class reserve; • the seagrass <i>Posidonia coriacea</i> is only found in the south-west of WA and continuous and spreading meadows of this species have only been found to date on Success Bank; • the reliability of fish production estimates are questionable; 	Environmental management commitments: <ul style="list-style-type: none"> • Measure the distribution of marine habitats in Owen Anchorage, including the western side of Success Bank and Parmelia Banks that: <ul style="list-style-type: none"> • identifies nature and distribution of seagrass, reef and sand habitats • determines the nature, abundance and distribution of flora and fauna associated with these habitats (Commitment 7); • Prepare (36 months prior to the commencement of Stage Two of the long-term dredging) and implement a detailed Dredging and Environmental Management Programme for dredging West Success Bank. The DEMP will address: <ul style="list-style-type: none"> • dredging schedules; • dredging management, including turbidity, • monitoring of sensitive marine habitats, • monitoring of wave climate and shoreline processes; • habitat rehabilitation; • mine closure plans and schedules; and • contingency planning for issues such as hydrocarbon spills, and contaminated sediments (Commitment 10). • Only dredge in areas on West 	The EPA notes: <ul style="list-style-type: none"> • significant alternative resources which are not covered by seagrasses are now known to exist at West Success Bank; • some direct loss of biodiversity will occur (less seagrass, less dependent fish, epiphytes and invertebrates), but, no species will be lost and habitat types exist elsewhere; • seagrasses may re-establish naturally elsewhere in Owen Anchorage but cannot practicably be artificially rehabilitated at present, although techniques do now exist to transplant small areas; and • potential habitat cannot practicably be re-established and is thus irreversibly lost. Having particular regard to: <ul style="list-style-type: none"> • research undertaken to date, combined with expert advice and internal and external reviews indicating that there is no sufficient information available to enable the EPA to make a decision about further dredging of seagrass from the Owen Anchorage area; • the distribution of seagrasses being dynamic; • research showing that ecological attributes of the area would be altered by a variable but generally small amount; • no species will be lost as a result of dredging; • significant alternative resources which are not covered by seagrasses are now known to exist at West Success Bank; • Recommended Environmental Condition 6; and • the proponents commitments; it is the EPA’s opinion that a modified approach to

Factors/ Issues	EPA Objective(s)	Summary of Government Agency and Public Comments	Co-proponents commitments and environmental management measures	EPA Assessment
		<ul style="list-style-type: none"> ecological value – concept, application, analysis; and extending the marine reserve system to provide more secure conservation of seagrass remnants in the Cockburn Sound and Owen Anchorage areas. 	<p>Success Bank where there is no seagrass (Commitment 12).</p>	<p>the proposal whereby dredging is transferred to West Success Bank as soon as practicable, would allow this proposal to be managed to meet the EPA's environmental objectives.</p> <p>The EPA considers that the proponent should prepare for Government consideration a timetable for moving from Success and Parmelia banks to West Success Bank as quickly as practicable and certainly before 2014.</p> <p>The EPA recommends that mining tenements held by CCL at Caraban and Ridges be added to the conservation estate (see Other Advice).</p>
Seagrass Rehabilitation	<ul style="list-style-type: none"> To demonstrate that long-term replacement and sustainability of the ecological and functional roles of seagrasses lost by dredging on Success and Parmelia Banks is environmentally possible and can be practically affected.. 	<p>Submissions focused on:</p> <ul style="list-style-type: none"> whether the performance criteria established in 1995, as part of the EMP, for seagrass rehabilitation have been met; the fact that CCL has not been able to carry out seagrass rehabilitation at a rate even approaching the rate of dredging; seagrass transplantation and survival; transplantation of seagrass being expensive, slow and causing damage to donor beds; the need for CCL to make a commitment to permanently restore as much seagrass as is to be lost by dredging on completion of the proposal; and it being unacceptable that a mining company should be allowed to mine in a high quality marine area without rehabilitating it, just as they are required to do in terrestrial areas; <p>DEP:</p>	<p>Environment commitment:</p> <ul style="list-style-type: none"> Conduct a programme of research and development into seagrass revegetation that: <ul style="list-style-type: none"> develops techniques for the rehabilitation of seagrasses, which are ecologically sound and economically feasible includes a programme of study of the factors affecting natural recruitment and propagation of seagrass. (Commitment 9). Only dredge in those areas where there is no seagrass on West Success Bank (Commitment 12). 	<p>The EPA notes that:</p> <ul style="list-style-type: none"> as part of the short and medium-term dredging proposals, an Environmental Management Plan (EMP) was formulated to incorporate detailed research aimed at providing information necessary to assist the proponent to minimise the adverse impacts of Cockburn's continuing dredging operations on Success Bank in Owen Anchorage and to resolve the issue of long-term access to shellsand; based on the performance criteria for the short and medium-term dredging proposals CCL has demonstrated: <ul style="list-style-type: none"> that it has rehabilitated 0.1ha of seagrass for at least 3 years; that it has not met the second performance criterion – i.e. rehabilitated 1-3ha of seagrass with evidence of survival for at least 12 months; and that direct transplantation is slow (less than 1ha/year), costly and cannot yet match

Factors/ Issues	EPA Objective(s)	Summary of Government Agency and Public Comments	Co-proponents commitments and environmental management measures	EPA Assessment
		<ul style="list-style-type: none"> actual and potential seagrass habitat is lost to dredging and cannot be practically rehabilitated. <p>Fisheries WA (now Department of Fisheries):</p> <ul style="list-style-type: none"> seagrass rehabilitation by transplantation will not offset the loss of seagrass caused by dredging. 		<p>the rate of dredging.</p> <p>The EPA recognised that current knowledge confirms that seagrass distribution in Owen Anchorage is dynamic and seagrasses can establish naturally on shallow bare sand habitat.</p> <p>Having particular regard to:</p> <ul style="list-style-type: none"> Recommended Environmental Condition 7; and the co-proponents commitments, <p>it is the EPA's opinion that the proposal can be managed to meet the EPA's objectives..</p>
Wave climate, sediment movement and shoreline stability	<ul style="list-style-type: none"> Maintain the integrity, function and environmental values of the foreshore area; Maintain stability of Success and Parmelia Banks. 	<p>Questions and comments raised in submissions included:</p> <ul style="list-style-type: none"> what is the potential cost to coastal values from erosion/accretion and who will bear this cost and the cost of mitigation measures? was increased wave impact on Woodman Point considered during the hydrodynamic modelling? will erosion of the inner Parmelia and Success Banks be accelerated as a result of the seaway construction? various refinements could be made to the hydrodynamic model. 	<p>Environmental commitments:</p> <ul style="list-style-type: none"> Prepare and implement a Wave Climate Measurement and Modelling Plan for Owen Anchorage and Cockburn Sound, which addresses: <ul style="list-style-type: none"> measurement of wave climate, and validation/ modification of models used to forecast changes in wave climate due to dredging (Commitments 1 and 2). Prepare, prior to the commencement of dredging, and implement a Shoreline Monitoring Plan for Owen Anchorage and Cockburn Sound that: <ul style="list-style-type: none"> monitors shoreline position; calculates changes in shoreline position; determines rates of sediment transport along the shorelines of 	<p>Having particular regard to:</p> <ul style="list-style-type: none"> the mathematical modelling which suggests that the long –term dredging will result in minor hydrodynamic changes from ambient conditions, under expected scenarios (ie moderate swell to severe storm); that under severe storm event conditions from the west, an increase on wave height of up to 20% occurs in the region of Woodman Point resulting from the proposal; there is no evidence that erosion of the inner Parmelia and Success Banks will be accelerated as a result of seaway construction; and the proponents commitments, including management measures for foreshore restoration, <p>it is the EPA's opinion that the proposal can be managed to meet the EPA's objectives.</p>

Factors/ Issues	EPA Objective(s)	Summary of Government Agency and Public Comments	Co-proponents commitments and environmental management measures	EPA Assessment
			<p>Owen Anchorage and Cockburn Sound, and</p> <ul style="list-style-type: none"> • identifies sites of erosion/accretion and rates (Commitments 3 and 4). • Prepare (within 24 months of commencement of long-term dredging) and implement a Banks and Shoreline Protection Management Programme that: <ul style="list-style-type: none"> • maintains shipping and navigation on the banks, protects coastal structures, and maintains shoreline stability; • identifies appropriate management actions and mitigation/ protection options and techniques to protect these features.(Commitments 5 and 6). 	
Recreation	<ul style="list-style-type: none"> • Maintain the quality of the broader area in relation to boating, fishing, swimming and coastal use. 	<p>Comments raised in submissions focused on:</p> <ul style="list-style-type: none"> • the value of the area for recreational fishers; • the statement that the seagrasses of Owen Anchorage do not support any commercial or recreational fishery and that the Seaway will not influence any commercial or recreational fishery in the area is incorrect and unable to be supported by the information presented in the ERMP; and • an impact from current dredging activities is the turbidity and the deposit of shellsand matter on Cockburn’s beaches which reduces the social values of these beaches. Of particular concern is the dumping of shellsand near the coast before 	<p>Environmental management commitment:</p> <ul style="list-style-type: none"> • Undertake survey of commercial and recreational fisheries activity in West Success bank and adjacent areas (Commitment 8). 	<p>Having particular regard to:</p> <ul style="list-style-type: none"> • research undertaken by the proponent; • the fact that it is unlikely that the abundance of fish of commercial and recreational importance will be significantly adversely affected by the proposal; • the proponents commitment to undertake surveys of commercial and recreational fisheries on West Success Bank and adjacent areas, on the advice of the Department of Fisheries; and • there will not be any increase in the impacts of turbidity at and around the Woodman Point Jetty, <p>it is the EPA’s opinion that the proposal can be</p>

Factors/ Issues	EPA Objective(s)	Summary of Government Agency and Public Comments	Co-proponents commitments and environmental management measures	EPA Assessment
		<p>it is sucked away for processing. What measures will be undertaken by the proponent to reduce this impact?</p> <p>Fisheries WA (now Department of Fisheries):</p> <ul style="list-style-type: none"> • this study and others on fish and fisheries have revealed that few economically and recreationally important fish species were found in abundance in, or were directly trophically dependent on, seagrass meadows. This has confirmed what previous Western Australian studies on coastal finfish species had suggested; and • the ERMP states that seagrass habitat is not an important nursery area for commercial and recreational fish species. 		<p>managed to meet the EPA's environmental objective for this factor.</p>

Appendix 6

Recommended Environmental Conditions and Proponents Consolidated Commitments

RECOMMENDED ENVIRONMENTAL CONDITIONS

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

LONG-TERM SHELLSAND DREDGING, OWEN ANCHORAGE

Proposal: The proposal is to dredge shellsand in the long-term from areas of Success Bank, Parmelia Bank and West Success Bank, as documented in schedule 1 of this statement.

Proponent: Cockburn Cement Limited

Proponent Address: Lot 242, Russell Road East, Munster WA 6166

Assessment Number: 1300

Reports of the Environmental Protection Authority: Bulletin 1033

The proposal referred to above may be implemented subject to the following conditions and procedures:

Procedural conditions

1 Implementation and Changes

- 1-1 The proponent shall implement the proposal as documented in schedule 1 of this statement subject to the conditions 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 and Heritage 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 and Heritage determines, on advice of the Environmental Protection Authority, is not substantial, the proponent may implement those changes upon receipt of written advice.

2 Proponent Commitments

- 2-1 The proponent shall implement the 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 Proponent Nomination and Contact Details

- 3-1 The proponent for the time being nominated by the Minister for the Environment and Heritage 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 and Heritage has exercised the Minister's power under section 38(7) of the Act to revoke the nomination of that proponent and nominate another person as the proponent for the proposal.
- 3-2 If the proponent wishes to relinquish the nomination, the proponent shall apply for the transfer of proponent and provide a letter with a copy of this statement endorsed by the proposed replacement proponent that the proposal will be carried out in accordance with this statement. Contact details and appropriate documentation on the capability of the proposed replacement proponent to carry out the proposal shall also be provided.
- 3-3 The nominated proponent shall notify the Department of Environmental Protection of any change of contact name and address within 60 days of such change.

4 Commencement and Time Limit of Approval

- 4-1 The proponent shall provide evidence to the Minister for the Environment and Heritage within five years of the date of this statement that the proposal has been substantially commenced or the approval granted in this statement shall lapse and be void.

Note: The Minister for the Environment and Heritage will determine any dispute as to whether the proposal has been substantially commenced.

- 4-2 The proponent shall make application for any extension of approval for the substantial commencement of the proposal beyond five years from the date of this statement to the Minister for the Environment and Heritage, prior to the expiration of the five year period referred to in condition 4-1. The application shall demonstrate that:

- environmental factors of the proposal have not changed significantly;
- new, significant, environmental issues have not arisen; and
- all relevant government authorities have been consulted.

Note: The Minister for Environment and Heritage may consider the grant of an extension of the time limit of approval not exceeding five years for the substantial commencement of the proposal.

Environmental conditions

5 Compliance Auditing and Performance Review

5-1 The proponent shall prepare an audit programme in consultation with and submit compliance reports to the Department of Environmental Protection that address:

- the implementation of the proposal as defined in schedule 1 of this statement;
- evidence of compliance with the conditions and commitments; and
- the performance of the environmental management plans and programmes.

Note: Under sections 48(1) and 47(2) of the *Environmental Protection Act 1986*, the Chief Executive Officer of the Department of Environmental Protection is empowered to audit the compliance of the proponent with the statement and should directly receive the compliance documentation, including environmental management plans, related to the conditions, procedures and commitments contained in this statement. Usually, the Department of Environmental Protection prepares an audit table that can be utilised by the proponent, if required, to prepare an audit program to ensure the proposal is implemented as required. The Chief Executive Officer is responsible for the preparation of written advice to the proponent, which is signed off either by the Minister or, under an endorsed condition clearance process, a delegate within the Environmental Protection Authority or the Department of Environmental Protection that the requirements have been met.

5-2 The proponent shall submit a performance review report every five years after the start of the operations phase to the requirements of the Minister for the Environment and Heritage on advice of the Environmental Protection Authority, which addresses:

- the major environmental issues with the project, the objectives for those issues, the methodologies used to achieve these, and the key indicators of environmental performance measured against those objectives;
- the level of progress in the achievement of sound environmental performance, including industry benchmarking and use of best available technology where practicable;
- significant improvements gained in environmental management, including the use of external peer reviews;
- stakeholder and community consultation about environmental performance and the outcomes of that consultation, including a report of any on-going concerns being expressed; and
- the proposed environmental objectives over the next five years, including improvements in technology and management processes.

6 Dredging and Environmental Management Plan – Success and Parmelia Banks

6-1 Prior to the commencement of dredging Stage 1 of this proposal, the proponent shall prepare a Dredging and Environmental Management Plan for Success and Parmelia Banks, to the requirements of the Minister for the Environment and Heritage and the Minister for State Development on advice of the Environmental Protection Authority, the Department of Environmental Protection, the Fremantle Port Authority, the Department of Conservation and Land Management, the Department of Fisheries and the Department of Mineral and Petroleum Resources.

The objectives of this plan are to:

- retain seagrass in Owen Anchorage wherever possible; and
- relocate dredging operations from Success and Parmelia Banks to West Success Bank, as soon as practicable.

This Plan shall address:

- 1 the configuration of dredging on Success and Parmelia Banks to:
 - ensure that any dredging on Success and Parmelia Banks limits the impact on seagrasses;
 - ensure that, if dredging is configured to create a second shipping channel, those areas that have been previously dredged on Success and Parmelia Banks are recognised and incorporated in such a way as to limit the impact on seagrasses;
 - 2 the relocation of dredging operations from Success and Parmelia Banks to West Success Bank as soon as practicable;
 - 3 the identification of seagrass areas and plans to limit impacts on seagrass;
 - 4 dredging schedules; and
 - 5 dredging management, including turbidity.
- 6-2 The proponent shall implement the Dredging and Environmental Management Plan required by condition 6-1 as specified in that plan.
- 6-3 The proponent shall make the Dredging and Environmental Management Plan required by condition 6-1 publicly available, to the requirements of the Environmental Protection Authority

7 Seagrass Research and Rehabilitation Plan – Stage 1

- 7-1 Prior to the commencement of dredging Stage 1 of this proposal, the proponent shall prepare a Seagrass Research and Rehabilitation Plan, to the requirements of the Environmental Protection Authority on advice of the Department of Environmental Protection, the Department of Conservation and Land Management and the Department of Fisheries.

The objectives of this plan are to:

- better understand the determinants of seagrass regeneration under natural conditions;
- encourage innovation in the development of practical technical solutions for the rehabilitation of the environment in Owen Anchorage and Cockburn Sound; and

- demonstrate that long-term replacement and sustainability of the ecological and functional roles of seagrasses lost by dredging on Success and Parmelia Banks is environmentally possible and can be practically affected.

This plan shall address:

- 1 the use of seagrass remaining in the proposal area where dredging for shellsand will occur, for:
 - subsea mechanical transplanting experiments; and
 - rehabilitating areas in the vicinity that are shallow and unvegetated to mitigate the impacts of dredging;
 - 2 criteria on which to base performance;
 - 3 development of seagrass revegetation techniques and technology, consistent with Commitment 9;
 - 4 improving understanding of the determinants of seagrass establishment and regeneration under natural conditions;
 - 5 the use of findings from the research program to increase the rate of transplanting;
 - 6 the application of research; and
 - 7 the effect of nutrient-enriched water passing from Cockburn Sound onto the seagrasses on Parmelia and Success Banks.
- 7-2 The proponent shall implement the Seagrass Research and Rehabilitation Plan required by condition 7-1 as specified in that plan.
- 7-3 The proponent shall make the Seagrass Research and Rehabilitation Plan required by condition 7-1 publicly available, to the requirements of the Environmental Protection Authority.

8 Decommissioning Plans

- 8-1 At least 12 months prior to completion of dredging of Success Bank and Parmelia Bank within the Stage 1 area and at least 12 months before the completion of dredging on West Success Bank, the proponent shall prepare Preliminary Decommissioning Plans which provide the framework to ensure that the site is left in a suitable condition, with no liability to the State, to the requirements of the Environmental Protection Authority on advice of the Department of Environmental Protection and the Fremantle Port Authority.

The Preliminary Decommissioning Plans shall address:

- 1 conceptual closure plans and schedules for, in turn, Success Bank, Parmelia Bank and West Success Bank once complete. These plans shall address the following issues:
 - future use of dredged areas for navigation and other users;
 - monitoring of slopes and edges of slopes to record stability of slopes and revegetation by seagrasses;
 - remedial actions, if required, to stabilise slopes; and
 - monitoring of changes in water quality prior to and after the completion of dredging.
 - 2 the conceptual plans for the removal or if appropriate the retention of plant and infrastructure and conceptual plans for its / their removal or, if appropriate, retention; and
 - 3 conceptual rehabilitation plans for all disturbed areas and a process to agree on the rehabilitation if any and end land use(s).
- 8-2 At least six months prior to the anticipated date of decommissioning for each of Success Bank, Parmelia Bank and West Success Bank, or at a time agreed with the Department of Environmental Protection, the proponent shall prepare Final Decommissioning Plans designed to ensure that the site is left in a suitable condition, with no liability to the State, to the requirements of the Environmental Protection Authority on advice of the Department of Environmental Protection and the Fremantle Port Authority.
- The Final Decommissioning Plans shall address:
- 1 dredge area closure for, in turn, Success Bank, Parmelia Bank and West Success Bank;
 - 2 removal or, if appropriate, retention of plant and infrastructure;
 - 3 rehabilitation if any of all disturbed areas to a standard suitable for the agreed new land use(s); and
 - 4 identification of contaminated areas, including provision of evidence of notification to relevant statutory authorities.
- 8-3 The proponent shall implement the Final Decommissioning Plan required by condition 8-2 until such time as the Minister for the Environment and Heritage determines that decommissioning is complete.
- 8-4 The proponent shall make the Final Decommissioning Plan required by condition 8-2 publicly available, to the requirements of the Environmental Protection Authority.

Procedures

- 1 Where the condition states “to the requirements of the Minister for the Environment and Heritage on advice of the Environmental Protection Authority”, the Chief Executive Officer of the Department of Environmental Protection will obtain that advice for the preparation of written advice to the proponent.
- 2 The Environmental Protection Authority may seek advice from other agencies, as required, in order to provide its advice to the Chief Executive Officer of the Department of Environmental Protection.

Note

- 1 The Minister will determine any dispute between the proponent and the Environmental Protection Authority or the Department of Environmental Protection over the fulfilment of the requirements of the conditions.
- 2 The proponent may be required to apply for a Works Approval and Licence for this Project under the provisions of Part V of the *Environmental Protection Act 1986*.
- 3 Compliance and performance reporting will endeavour to be in accord with the timing requirements of the State Agreement Act.

The Proposal

The long-term dredging of shellsand involves dredging shellsand from Success Bank, Parmelia Bank and West Success Bank, Owen Anchorage.

The key characteristics of the proposal are described in Table 1 below.

Table 1 – Key Proposal Characteristics

Stage	Element	Characteristics
Stage 1	Dredging	<ul style="list-style-type: none"> Shellsand will be dredged from Success Bank and Parmelia Bank. Dredging operations will be relocated to West Success Bank as soon as practicable, subject to Condition 6.
	Duration	<ul style="list-style-type: none"> Subject to Condition 6.
	Volume	<ul style="list-style-type: none"> Subject to Condition 6. Some of this resource will require beneficiation.
	Area of disturbance	<ul style="list-style-type: none"> Subject to Condition 6.
Stage 2	Dredging	<ul style="list-style-type: none"> Shellsand will be dredged from areas of West Success Bank where there is no seagrass.
	Duration	<ul style="list-style-type: none"> 20 years.
	Volume	<ul style="list-style-type: none"> Approximately 60,000,000 tonnes. This material will require beneficiation.
	Area of disturbance	<ul style="list-style-type: none"> The area to be dredged is approximately 350 ha. The dredging will occur in areas devoid of seagrass and be at least 750m from reefs and islands.

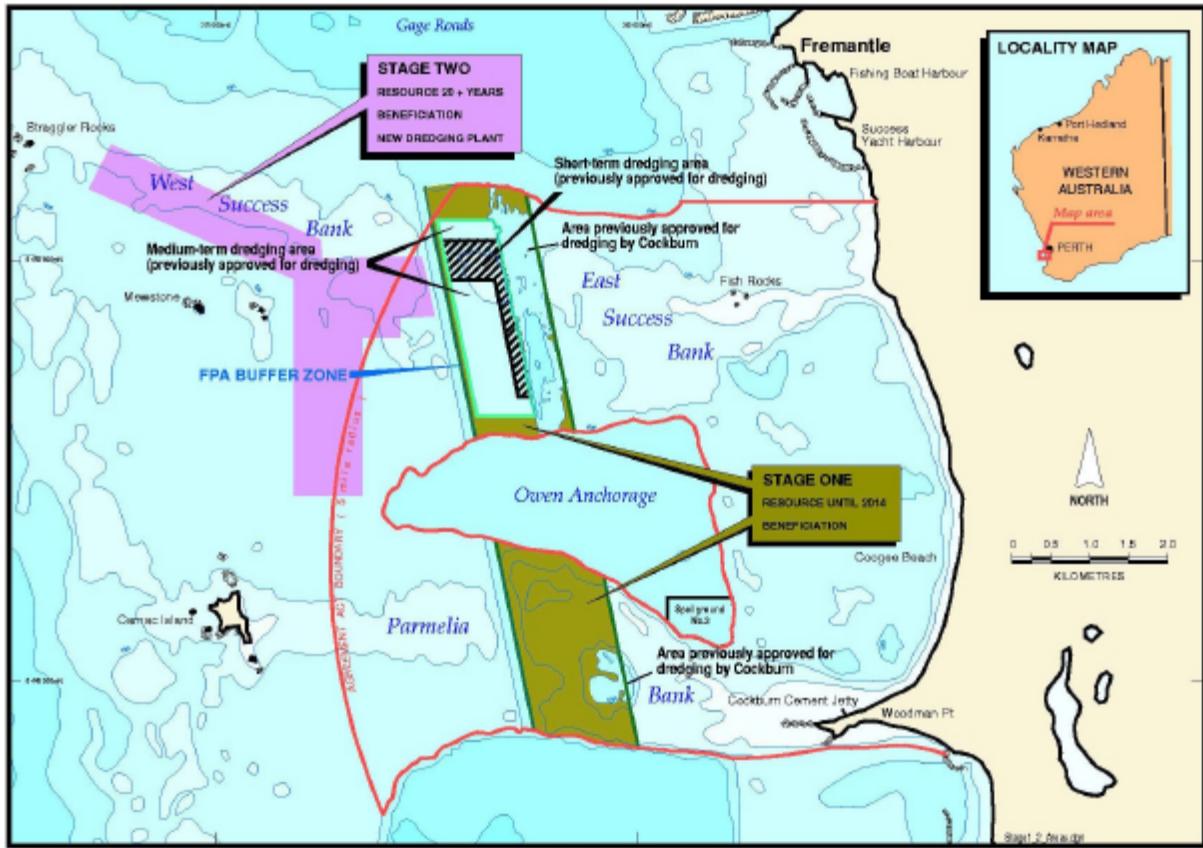
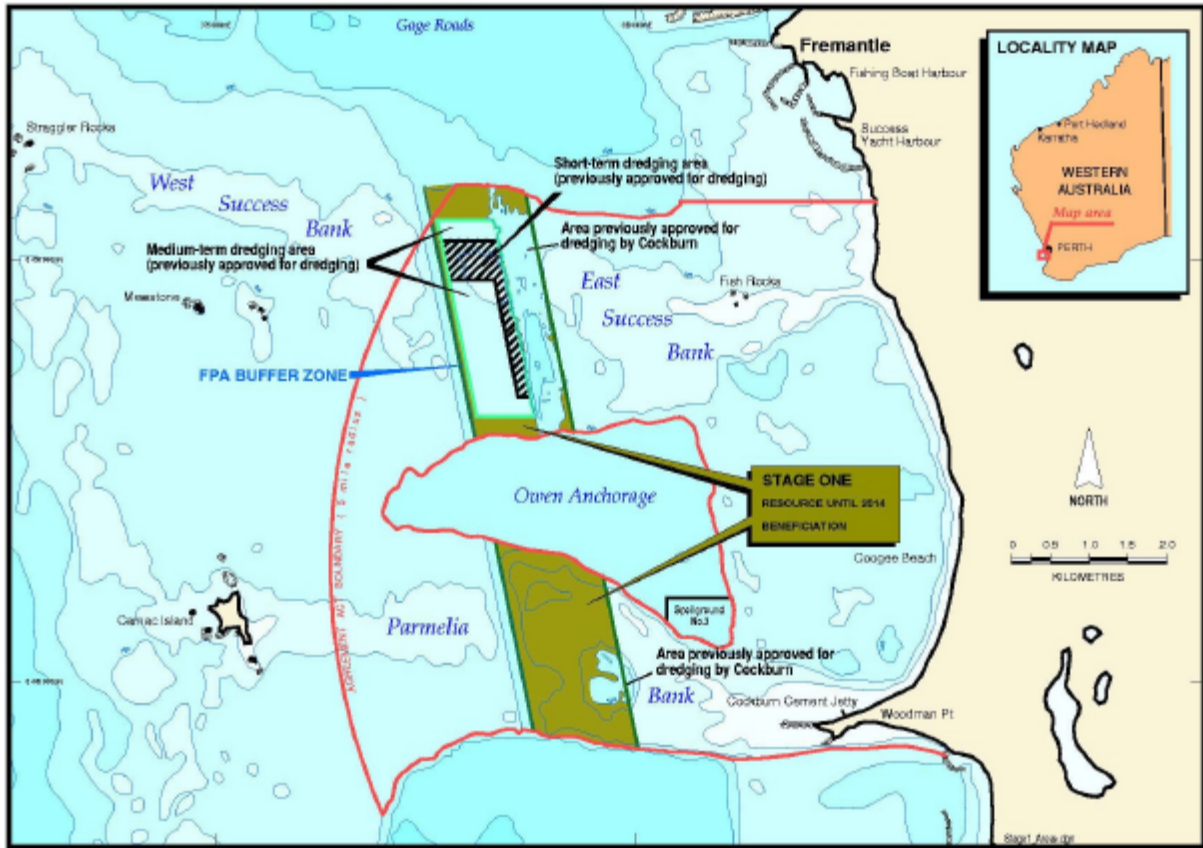


Figure 1: Indicative Location of Proposed Long-term Dredging – Stage 1 and Stage 2
 It should be noted that Stage 1 as shown is indicative of the area within which a dredging plan will be formulated.

PROPONENT COMMITMENTS

OCTOBER 2001

NO	TOPIC	ACTION	OBJECTIVE	TIMING	ADVICE
1	Coastal processes: Wave climate – Owen Anchorage and Cockburn Sound	Prepare a Wave Climate Measurement and Modelling Plan (WCMMP) for Owen Anchorage and Cockburn Sound, which addresses: 1) Measurement of wave climate 2) Validation/modification of model used to forecast changes in wave climate due to dredging	<ul style="list-style-type: none"> Determine changes in wave climate due to previous dredging (validate model) Forecast changes in wave climate due to proposed dredging, using validated model Determine effects of changes in wave climate on shipping, coastal structures, and shoreline stability 	<ul style="list-style-type: none"> Complete six months after the commencement of Long-Term dredging 	FPA DPI
2	Coastal processes: Wave climate – Owen Anchorage and Cockburn Sound	Implement the WCMMP referred to in Commitment 1	<ul style="list-style-type: none"> Achieve the Objectives of Commitment 1 	<ul style="list-style-type: none"> Complete first measurement and modelling programme within 24 months of commencement of Long-Term dredging Repeat each five years, or more frequently if required (see Commitment 1) 	FPA DPI
3	Coastal processes: Sediment transport – Owen Anchorage and Cockburn Sound	Prepare a Shoreline Monitoring Plan (SMP) for Owen Anchorage and Cockburn Sound, that: 1) Monitors shoreline position (aerial photography, shoreline surveys) 2) Calculates changes in shoreline position 3) Determines rates of sediment transport along the shorelines of Owen Anchorage and Cockburn Sound, and 4) Identifies sites of erosion/accretion and rates	<ul style="list-style-type: none"> To ensure that dredging does not adversely modify the natural processes that affect the shoreline 	<ul style="list-style-type: none"> Complete prior to commencement of Long-Term dredging 	DPI
4	Coastal processes: Sediment transport – Owen Anchorage and Cockburn Sound	Implement the SMP referred to in Commitment 3	<ul style="list-style-type: none"> Achieve the Objectives of Commitment 3 	<ul style="list-style-type: none"> Annual summer and winter surveys commencing after start of Long-Term dredging programme Data reports annually Synthesis reports each three years 	DPI
5	Coastal processes: Owen Anchorage and Cockburn Sound	Prepare a Banks and Shoreline Protection Management Programme (BSPMP) that: 1) Maintains shipping and navigation on the Banks, protects coastal structures, and maintains shoreline stability 2) Identifies appropriate management actions and mitigation/protection options and techniques to protect these features	<ul style="list-style-type: none"> Maintain navigational requirements across Success and Parmelia Banks, and adjacent marine areas Protect coastal structures Maintain shoreline stability of Owen Anchorage and Cockburn Sound 	<ul style="list-style-type: none"> Complete BSPMP within 24 months of commencement of Long-Term dredging, to incorporate results from: The WCMMP (see Commitments 1 and 2) The SMP (see Commitments 3 and 4) 	

NO	TOPIC	ACTION	OBJECTIVE	TIMING	ADVICE
				<ul style="list-style-type: none"> Marine habitat monitoring (see Commitment 7) 	
6	Coastal processes: Owen Anchorage and Cockburn Sound	Implement the BSPMP referred to in Commitment 5	<ul style="list-style-type: none"> As for Commitment 5 	<ul style="list-style-type: none"> During dredging programme Review each five years 	FPA DPI
7	Marine habitats: Seagrasses, reef, and sand – Owen Anchorage	<p>Measure distribution of marine habitats in Owen Anchorage, including western side of Success and Parmelia Banks that:</p> <ol style="list-style-type: none"> Identifies nature and distribution of seagrass, reef, and sand habitats Determines the nature, abundance and distribution of flora and fauna associated with these habitats 	<ul style="list-style-type: none"> Determine the distribution of seagrasses, reef, and bare sand in Owen Anchorage Determine changes with time in distribution of marine habitats and associated flora and fauna Enable ecological function, and changes in ecological function over time, to be evaluated 	<ul style="list-style-type: none"> Collect photography annually in summer Detailed groundtruth of entire area each five years Groundtruth selected areas more frequently as required 	Department of Fisheries CALM
8	Marine fisheries: West Success Bank	Undertake survey of commercial and recreational fisheries activity in West Success Bank and adjacent areas	<ul style="list-style-type: none"> Determine commercial and recreational fishing catch and effort on West Success Bank Determine significance of West Success Bank for commercial and recreational fisheries 	<ul style="list-style-type: none"> Commence summer 2002/2003 Complete five years prior to start of Stage Two of Long-Term dredging 	Department of Fisheries CALM
9	Marine habitats: Seagrasses – Seagrass rehabilitation	<p>Conduct a programme of research and development into seagrass revegetation that:</p> <ol style="list-style-type: none"> Develops techniques for the rehabilitation of seagrasses, which are ecologically sound and economically feasible Includes a programme of study of the factors affecting natural recruitment and propagation of seagrass 	<ul style="list-style-type: none"> To maintain the abundance, species diversity and geographic distribution of seagrasses 	<ul style="list-style-type: none"> Programme underway prior to commencement of Long-Term dredging Report annually 	Department of Fisheries CALM
10	<p>Dredging and Environmental Management Programme (DEMP) for dredging: West Success Bank (Stage Two)</p> <p>[Stage Two is estimated to start in 2014/2015]</p>	<p>Prepare a detailed DEMP, which addresses:</p> <ol style="list-style-type: none"> Selection of Stage Two area based on absence of seagrass, as well as wave climate, resources, fisheries, and other relevant information Dredging schedules Dredging management, including turbidity Monitoring of sensitive marine habitats Monitoring of wave climate and shoreline processes Habitat rehabilitation Mine closure plans and schedules 	<ul style="list-style-type: none"> Monitor the implementation of the Proposal described in the ERMP and approved by the Minister Monitor the management of potential environmental impacts associated with the implementation of the Proposal Meet EPA objectives to maintain ecological function of West Success Bank area 	<ul style="list-style-type: none"> Complete 36 months prior to the commencement of Stage Two of the Long-Term dredging 	Department of Fisheries CALM DPI

NO	TOPIC	ACTION	OBJECTIVE	TIMING	ADVICE
		8) Contingency planning for issues such as hydrocarbon spills, and contaminated sediments			
11	Dredging and Environmental Management Programme (DEMP) for dredging: West Success Bank (Stage Two)	Implement the DEMP referred to in Commitment 10	<ul style="list-style-type: none"> Achieve the Objectives of Commitment 10 		CALM Department of Fisheries DPI
12	Seagrasses – West Success Bank	Dredging will only occur in areas where there is no seagrass	<ul style="list-style-type: none"> To avoid the loss of seagrass 		
13	State Agreement Act	No dredging will occur outside the proposed Stage One (Seaway) and Stage Two (West Success Bank) throughout the duration of the proposal	<ul style="list-style-type: none"> To minimise any further loss of seagrass To manage effects of dredging on coastal processes 	<ul style="list-style-type: none"> Prior to the commencement of Stage One of the Long-Term Dredging 	DMPR

Key:

DPI Department of Planning and Infrastructure – Transport Division (formerly the Department of Transport)

FPA Fremantle Port Authority

CALM Department of Conservation and Land Management

DMPR Department of Mineral and Petroleum Resources