ecological AUSTRALIA

ASSESSMENT | PLANNING | MANAGEMENT

Ecological Assessment for Proposed Berth - WB1

(Project No. 48-02)

Report prepared for:
Port Kembla Port Corporation

July 2004

ABN 87 096 512 088 | address Suite 503 3-5 Stapleton Ave Sutherland NSW 2232
postal PO Box 12 Sutherland NSW 1499 | phone 02 8536 8600 | fax 02 9542 5622
web www.ecoaus.com.au

Document Tracking

Item	Detail	Signature
Project Name	Port Kembla Seagrass Mapping - WB1 + EB4 Berths	
Project Number	48-02	
Prepared by	S Ward	
Prepared by	A Morison	
Approved by	A Morison	
Status	Final	
Version Number	1	
File location	G:\Current_Projects\Private Clients\Port Kembla PC\WB1 and EB4 Berths (48-02)\Report\Berth WB1 Final.doc	
Date	23 July 2004	

Acknowledgements
This document has been prepared by Eco Logical Australia Pty Ltd with support from Port Kembla Port Corporation.

The study team would like to thank Chris Doyle, (Port Kembla Port Corporation).

Eco Logical Australia Pty Ltd
Ecological Assessment, GIS, Environmental Management and Planning
Ph - (02) 8536 8600
Fax - (02) 9542 5622

Contents

Eco Logical Australia Pty Ltd
Ecological Assessment, GIS, Environmental Management and Planning
Ph - (02) 8536 8600
Fax - (02) 9542 5622

1. Introduction

1.1 Description of Project

Port Kembla Port Corporation (PKPC) propose capital dredging to create a two new berths in the Inner Harbour of Port Kembla, to be known as Western Basin No.1 (WB1) and Eastern Basin No. 4 (EB4). The location of these two sites is shown in Figure 1. This report applies only to the proposal for WB1, as EB4 is considered in a separate report.

Approximately 450 000 m^3 will be dredged from the Western Basin to create WB1. Approximately 50 000 m^3 of the dredged material will be disposed of in the Inner Harbour, with the remaining material (approximately 400 000 m^3) to be disposed of at an off-shore Spoil Ground.

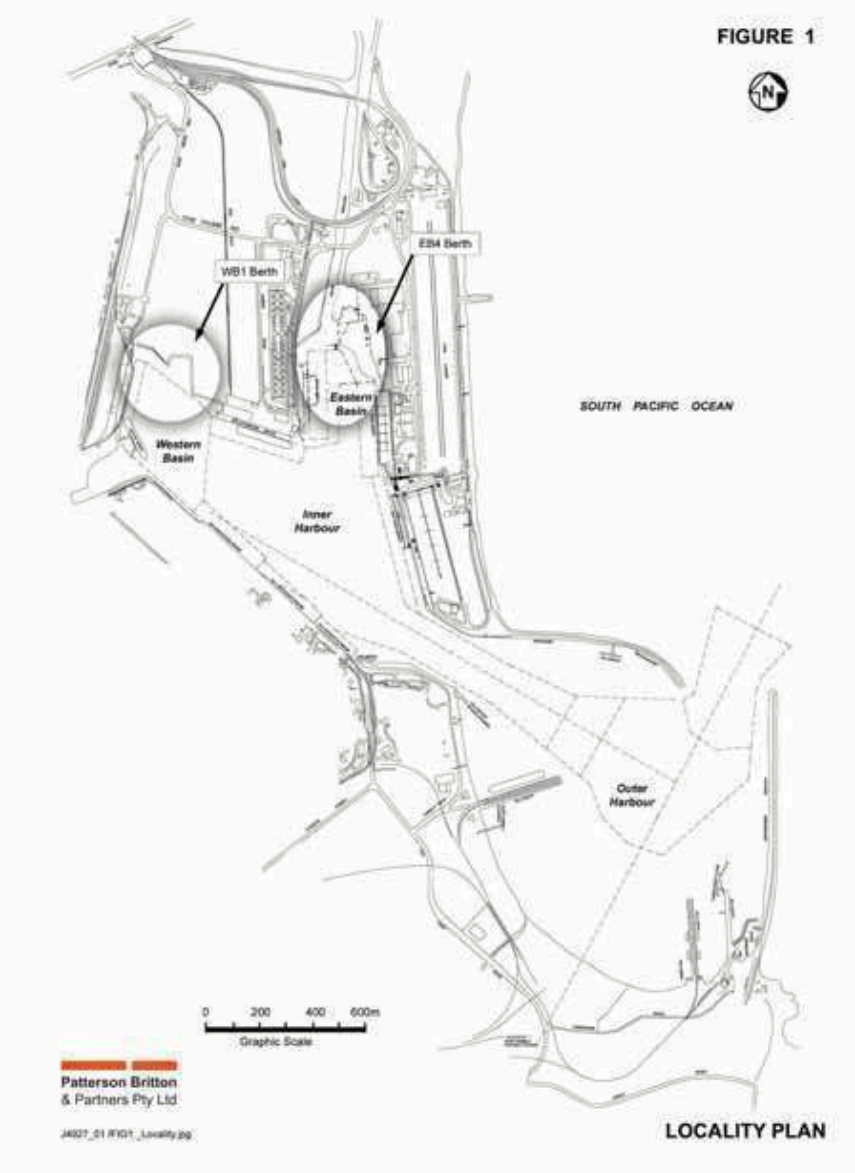

Figure 1. Location of proposed berths (Figure prepared by Patterson Britton & Partners Pty Ltd and used with permission of Port Kembla Port Corporation).

Eco Logical Australia Pty Ltd
Ecological Assessment, GIS, Environmental Management and Planning
Ph - (02) 8536 8600
Fax - (02) 9542 5622

Sinclair Knight Mertz (SKM) consulted government agencies on their requirements for impact assessment. The requirements relevant to this report are listed below:

- NSW Environment Protection Authority (EPA):
  "Any likely impacts on the surrounding aquatic environment, including impacts to flora and fauna associated with the dredging of the site. (Note: Appropriate buffer distances around any sensitive areas must be maintained)."

- Waterways;
  "Locations of marine and terrestrial vegetation, aquatic and animal habitats etc. likely to be affected (directly or indirectly) by the proposed works during construction and operation."

- NSW Fisheries:
  "The nature, quality and value of aquatic habitats within and adjacent to the area to be dredged including information relating to marine vegetation (seagrasses and marine macro-algae) in the area which may be impacted, fish communities and any threatened fish species (as listed by the Fisheries management Act)."

It was further noted by NSW Fisheries that if any marine vegetation occurred within the impacted areas that a Marine Vegetation Permit under S205 of the NSW *Fisheries Management Act 1994* would be required. This report considers these requirements.

Subsequent correspondence from NSW Fisheries (dated 19 April 2004) referred to the need to assess the risk of spreading marine pests resulting from the disposal of soil. Discussions were had with NSW Fisheries (pers. comm., Allan Lugg, 19 July 2004) to seek comment and recommendations on the environmental assessment methods adopted for this study.

1.2 Study Area and Proposal

The study area for this report is the region proposed for dredging within the Western Basin (Figure 2), and the proposed disposal site is adjacent to the multipurpose berth in the Inner Harbour of Port Kembla (Figure 3). Off shore disposal and impacts are not considered in this assessment.

The Port of Port Kembla was created over 100 years ago to support local industry and shipping, and is now ranked as Australia's ninth largest port, with an average of 23 million tonnes moving annually through the port (CRIMP 2001). The Inner Harbour was formed by the dredging of Tom Thumb Lagoon from 1956 – 1960 (PBP 2004a), and is connected to the Outer Harbour by a channel named 'The Cut".

Landuse surrounding the study site is industrial to the north, east and west, with the Inner Harbour of Port Kembla to the south. The Western Basin is south of Tom Thumbs Road, and west of Egret Road and Basin Road. Allans Creek flows into the southwest

Eco Logical Australia Pty Ltd
Ecological Assessment, GIS, Environmental Management and Planning
Ph - (02) 8536 8600
Fax - (02) 9542 5622

region of the dredge area. Allens Creek covers a large catchment area to the west of the study site, including much of the area utilised by BHP, a number of residential suburbs of Port Kembla, and some of the Illawarra Escarpment State Recreation Area.

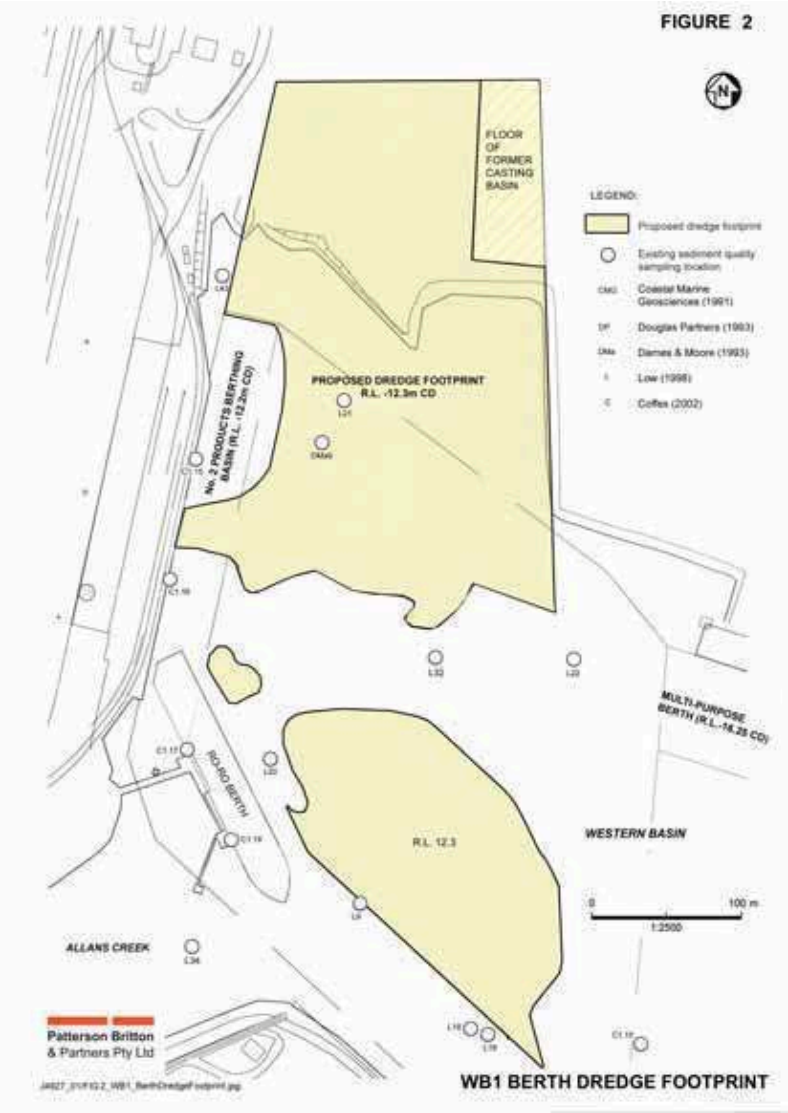

Figure 2. Proposed dredge area for WB1. (Figure prepared by Patterson Britton & Partners Pty Ltd and used with permission of Port Kembla Port Corporation).

Eco Logical Australia Pty Ltd
Ecological Assessment, GIS, Environmental Management and Planning
Ph - (02) 8536 8600
Fax - (02) 9542 5622

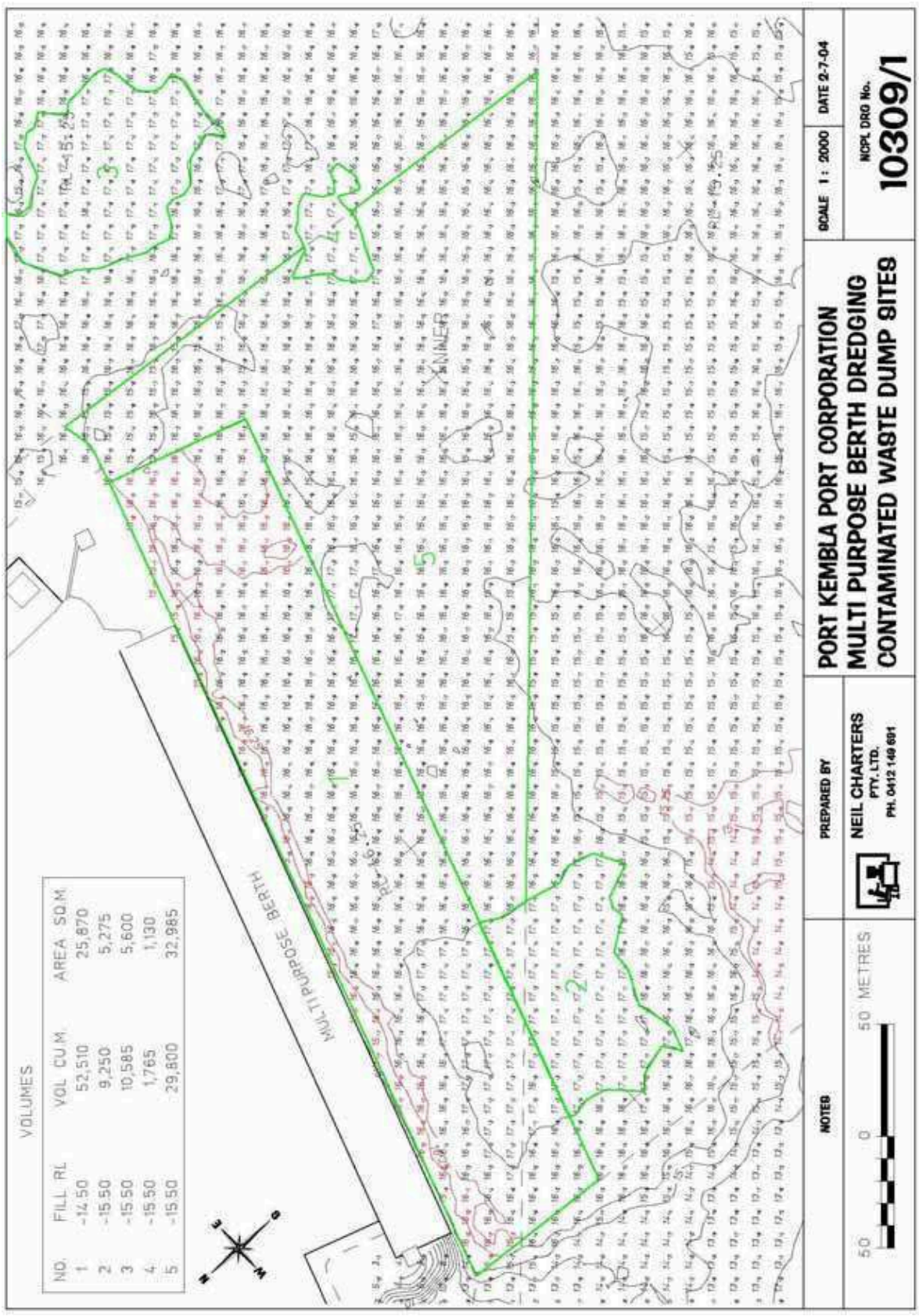

Figure 3. Proposed area for disposal of dredged material within Inner Harbour. (Figure prepared by Neil Charters Pty Ltd and used with permission of Port Kembla Port Corporation).

Eco Logical Australia Pty Ltd
Ecological Assessment, GIS, Environmental Management and Planning
Ph - (02) 8536 8600
Fax - (02) 9542 5622

An unnamed drain, referred to as Tom Thumb Road Drain in this report, flows into the northwest region of the Western Basin. This drain flows in a south-southeast direction to the east of Tom Thumb Road, before it is crossed by Tom Thumb Road and continues into the Western Basin. Tom Thumb Road Drain was artificially constructed to deal with industrial runoff in the immediate area (Chris Doyle pers. comm., 14/5/2004), and is mostly dry with subsurface flow evident at the time of inspection.

Tom Thumb Road Drain forms the western border of the overland dredge area. The dredge proposal will involve the removal of Tom Thumb Road Drain in the dredge area, which will result in the loss of 100m of this watercourse. Tom Thumb Road Drain will then flow into the northwest corner of WB1.

The harbour bed in the area for WB1 is 6.5m below Chart Datum, sloping to the dredge depth of 12.3m along the southern boundary. The area to be dredged for WB1 includes an 'on-land' area, which is 5m above Chart Datum (PBP 2004a).

There has been sediment testing in the overwater portion of WB1. The initial testing found elevated levels of contaminants within the top 1m of sediments (soft clays). An estimate of the volume of contaminants was calculated, assuming all the top 1.5m layer of soft silty clays to be contaminated, at 50 000 m^3. All contaminated material will be disposed of in the area adjacent to the Multi Purpose Berth (Figure 3). Consideration of the impact of these contaminants due to disturbance is outside of the scope of this report, but the presence of the contaminants does reduce the quality of habitat for flora and fauna in the study area.

Points of note for water quality within the Port Kembla Inner Harbour is that turbidity is high, with an average of 2.51 NTU (minimum of 1.31 NTU, maximum of 8.9 NTU from 10 sampling dates), and with secchi depths averaging 2.97m (minimum of 1.2m, maximum of 8.9m from 48 sampling dates), (Port Kembla Harbour Environment Group 2003). Also, some metals occur at high levels compared to the reference site, with mean levels from 5 sampling dates within the Inner Harbour being: Aluminium 7.3 µg/L, Manganese 11.6 µg/L, Copper 2.0 µg/L, Zinc 19.7 µg/L, Cadmium 3.6 µg/L, and Selenium 2.0 µg/L (Port Kembla Harbour Environment Group 2003).

1.3 Legislative Requirements

1.3.1 Environmental Planning and Assessment Act 1979

The NSW *Environmental Planning and Assessment Act 1979* (EP&A Act) is the principal planning legislation for the state, providing a framework for the overall environmental planning and assessment of development proposals. Various legislation and instruments, such as the NSW *Threatened Species Conservation Act 1995* (TSC Act), are integrated with EP&A Act and have been reviewed separately.

1.3.2 Threatened Species Conservation Act 1995

The *Threatened Species Conservation Act 1995* (TSC Act) aims to protect and encourage the recovery of threatened species, populations and communities listed under the Act. The TSC Act is integrated with the EP&A Act and requires

Eco Logical Australia Pty Ltd
Ecological Assessment, GIS, Environmental Management and Planning
Ph - (02) 8536 8600
Fax - (02) 9542 5622

consideration of whether a development (Part 4 of the EP&A Act 1974) or an activity (Part 5 of the EP&A Act) is likely to significantly affect threatened species, populations and ecological communities or their habitat.

1.3.3 Fisheries Management Act 1994

The *Fisheries Management Act 1994* (FM Act) aims to conserve, develop and share the fishery resources of NSW for the benefit of present and future generations. Division 4 of Part 7 covers the protection of marine vegetation (macroalgae, seagrasses or mangroves). Any potential harm to marine vegetation requires a permit from NSW Fisheries.

1.3.4 Rivers and Foreshores Improvement Act 1948

The NSW *Rivers and Foreshores Improvement Act 1948* (RFI Act) aims to provide effective controls on activities that could harm sensitive waterway and foreshore environments. The Act has provisions that require a permit for excavations, fill and other works within 40 m of the top of the bank for rivers, estuaries and lakes as it is recognised that they can have significant detrimental environmental impacts on habitat, water quality, flooding and erosion. This Act exempts 'public authorities' from the need to obtain a permit. It is understood that PKPC is considered a public authority in terms of this Act and therefore do not require a part 3a permit. Furthermore, a "river" as defined under the Act generally applies to those waterways that show up on 1:25,000 topographic mapping, and Tom Thumb Road Drain is not marked on the Wollongong 1:25,000 topographic map.

1.3.5 Noxious Weeds Act 1993

The objectives of the NSW *Noxious Weeds Act 1993* are to identify which noxious weeds require control measures, identify control measures suitable to those species and to specify the responsibilities of both public and private landholders for noxious weed control. Six noxious weed species were observed on the study site.

1.4 Objectives

The objectives of this report are to:

- Review existing literature on aquatic habitats within Port Kembla harbour, particularly in relation to marine vegetation and aquatic habitats
- Survey the region within, and adjacent to, the area proposed for dredging for marine vegetation (seagrasses and marine macro-algae)
- Document the nature, quality and value of aquatic habitats within, and adjacent to, the area proposed for dredging
- Identify likely fish communities and any potential threatened fish species (as listed under the *Fisheries Management Act 1994* and *Environment Protection and Biodiversity Conservation Act 1999*) within, and adjacent to, the area proposed for dredging
- Identify whether a S205 permit would be required through discussions with NSW Fisheries
- Assess impacts on marine vegetation, fish communities and any potential threatened fish species

Eco Logical Australia Pty Ltd
Ecological Assessment, GIS, Environmental Management and Planning
Ph - (02) 8536 8600
Fax - (02) 9542 5622

1.5 Limitations

This report is limited in its nature and scope, and these limitations are identified below:

- Issues relating to release of contaminants are not covered in this report (except how contaminants relate to current on-site habitat)
- Impacts of off-shore disposal of sediments is not considered
- Survey was limited to opportunistic observations during the site inspection (see section 2.2 for further details)
- Information for various issues such as fish and pest species present in Port Kembla and water quality information was obtained from literature reviewed

1.6 Issue Scoping

There are a number of potential issues relating to the objectives of this report, for both aquatic and terrestrial flora and fauna, associated with the proposed capital dredging and disposal within Port Kembla to create WB1. They are discussed in section 4 of this report. These issues are:

- Loss or damage to seagrass beds (if present)
- Loss of macroalgae
- Loss of aquatic substrate for macroalgae
- Disturbance of contaminated sediments, and the transport and disposal of these sediments
- Disturbance of dinoflagellate cysts and a resultant 'toxic bloom'
- Impacts on water quality as a result of the dredging and excavation process
- Impacts on aquatic communities in the sediment disposal areas due to smothering and water quality
- Impacts on aquatic communities from ship wave wash
- Impacts on fish and their habitat
- The spread of marine pest species
- Loss of riparian habitat in Tom Thumb Creek

Eco Logical Australia Pty Ltd
Ecological Assessment, GIS, Environmental Management and Planning
Ph - (02) 8536 8600
Fax - (02) 9542 5622

2. Methods

To complete this report a variety of literature was reviewed in light of the requirements of EPA, NSW Fisheries and Waterways (see section 1.1). The potential likelihood of occurrence of species and communities of interest was assessed based the current industrialised site conditions environment (section 1.2) and observations made during a site visit.

The literature reviewed and field survey methods are provided below (sections 2.1 and 2.2), with results on likelihood of occurrence in section 3.

2.1 Literature Reviewed

The following literature was considered during the preparation of this report:

- CRIMP (2001). *Report on Port Kembla Introduced Marine Pest Species Survey.*
- Eco Logical Australia Pty Ltd (2003). *Examination of Port Kembla Harbour Video for Presence of Seagrasses.*
- MSE & CEC (1991). *Port Kembla Harbour Study 1991.*
- PBP (2004a). *Draft WB1 & EB4 Capital Dredging Sampling & Analysis Plan.*
- PBP (2004b). *Maps of the area proposed for dredging.*
- Phillips (2002). *Monitoring and Assessing the Water and Sediment Quality of Port Kembla harbour According to the ANZECC & ARMCANZ (2000) Guidelines.*
- Port Kembla Harbour Environment Group (2003). *Summary of Port Kembla Harbour Water Quality Results 2003.*
- Port Kembla Harbour Environmental Group (2004). *Draft Port Kembla Harbour Catchment Atlas.*
- Smith & Caccese (2003). *A Biological Study on the Effects of Water Quality on the Development of Sessile Marine Invertebrate Assemblages: Port Kembla Harbour, NSW.*
- Woodroffe (1998). *Environmental Monitoring in a Port.*

2.2 Site Inspection

Mr Andrew Morison and Dr Steven Ward inspected the northern and eastern boundaries of the proposed dredge area on 14 May 2004. The land based inspection occurred during a sunny day at low tide to facilitate the observation of intertidal habitat and possible presence of any seagrass and macroalgae. Water quality and visibility in the water column was poor, due to rain within the catchment of the site on the night of 12 May and ship movements (Chris Doyle pers. comm., 14/5/2004). Whilst poor, this visibility was considered to be within normal conditions experienced at the site, and adequate for the level of survey required.

The aquatic survey conducted consisted of a walked inspection along the rock revetments looking for evidence of seagrasses and macroalgae. This consisted of looking for seagrass beds and macroalgae attached to any visible substrate, and inspecting visible wrack and other debris on the water surface and deposited on the shoreline for seagrass or macroalgae fronds.

Given the highly industrialised nature of the site no terrestrial fauna survey was carried out, and terrestrial flora survey consisted of opportunistic observations.

Eco Logical Australia Pty Ltd
Ecological Assessment, GIS, Environmental Management and Planning
Ph - (02) 8536 8600
Fax - (02) 9542 5622

3. Results

3.1 Terrestrial Flora

The vegetation on the rock revetments and adjacent land was observed to consistent almost exclusively of weeds, but with some opportunistic native knobbly club-rush (*Isolepis nodosa*) also observed. Vegetation was extremely sparse on the rock revetments (Plate 3, Plate 4), and sparse on the adjacent land that was within 25m of the rock revetments (Plate 5).

On-site vegetation in Tom Thumb Road Drain was much thicker, to 3m in height, and was predominantly weed infested with some opportunistic natives, restricted to the drain and its banks (Table 1). The native species observed were knobbly club-rush (*Isolepis nodosa*), Sydney golden wattle (*Acacia longifolia*), 3 samphire (*Sarcocornia quinqueflora*) individuals , and 1 seablite (*Suaeda australis*) individual. (Plate 6, Plate 7). These species are considered to be consistent with an artificially constructed drain.

No vegetation was present in the remainder of the site which was compacted fill (Plate 1, Plate 2).

Given its artificial nature and few native species (Table 1), none of the terrestrial vegetation on site meets the definition of any native vegetation communities. Although both samphire and seablite are indicative of saltmarsh vegetation, the individuals observed are considered to have opportunistically colonised the site (as have many weeds), and are not in sufficient numbers to be considered as a saltmarsh vegetation community.

Table 1. Terrestrial flora species observed at the WB1 site.

Scientific name	Common name	Category *
Acacia longifolia	Sydney golden wattle	
Ageratina adenophora	Crofton Weed	Weed
Bidens pilosa	Cobbler's Pegs	Weed
Cardiospermum grandiflorum	Balloon Vine	Weed
Chrysanthemoides monilifera	Bitou bush	W3
Cortaderia selloana	Pampas Grass	Weed
Cynodon dactylon	Common Couch	Weed
Isolepis nodosa	Knobbly club-rush	
Paspalum dilatatum	Paspalum	Weed
Ricinus communis	Castor oil plant	Weed
Sarcocornia quinqueflora	Samphire	
Setaria sp.		Weed
Suaeda australis	Seablite	
Tetragonia tetragonioides	New Zealand Spinach	Weed
Verbena bonariensis	Purpletop	Weed

* Weed = Environmental weed.

Eco Logical Australia Pty Ltd
Ecological Assessment, GIS, Environmental Management and Planning
Ph - (02) 8536 8600
Fax - (02) 9542 5622

W3 = Listed under the Noxious Weeds Act 1993: The weed must be prevented from spreading and its numbers and distribution reduced

3.2 Terrestrial Fauna

Although no fauna survey was carried out as part of this project, it is considered that suitable habitat for threatened species does not occur on the study site. This assessment is based on the habits of threatened species, the low amount of vegetation, the dominance of weeds, the surrounding industrial landuse and associated current and historical disturbance.

3.2.1 Green and Golden Bell Frog

There are a number of records for the green and golden bell frog (*Litoria aurea*) approximately 2km to the south, and additional records approximately 4km to the north, of the study site (Figure 4). There are no records of green and golden bell frogs within the catchment of Tom Thumb Road Drain, but it is unknown whether or not surveys for this species have been conducted. Potential habitat may be present within the rehabilitated catchment approximately 1.5km to the north. Tom Thumb Road Drain itself has a narrow area of vegetation which is heavily weed dominated and most water flow appearing to be subsurface flow. The drain is thus considered to be unlikely to suitable habitat for the green and golden bell frog. It is unknown whether Tom Thumb Road Drain is utilised for dispersal by this species, although this appears to be unlikely given the low habitat quality of the site, and no known populations to the north.

Figure 4. Map of green and golden bell frog (Litoria aurea) records in the Port Kembla Harbour region. Data and mapping is from the Atlas of NSW Wildlife (NPWS 2004).

3.3 Aquatic Flora

A total of 15 macroalgae species have previously been found in the Inner Harbour (Table 2, CRIMP 2001), although this study focussed on locating introduced, rather

Eco Logical Australia Pty Ltd
Ecological Assessment, GIS, Environmental Management and Planning
Ph - (02) 8536 8600
Fax - (02) 9542 5622

than native, species. For the study site, a total of 4 species came from pile scrapings adjacent to the dredge area for WB1, and one species from the proposed disposal area within the Inner Harbour (Table 2). A species of green filamentous macroalgae were observed on the rock revetments during the field inspection.

Table 2. Macroalgae collected from the Inner Harbour of Port Kembla (data from CRIMP 2001). The relevant site location from CRIMP (2001) for WB1 is N° 2 Products Wharf (PW2), and for the Inner Harbour Disposal Area is Multi-Purpose Berth (MPB).

Species Name	Site		
	All of Inner Harbour	WB1	Inner Harbour Disposal Area
Amphiroa anceps	Y		
Antithamnion amphigeneum	Y	Y	Y
Apoglossum unguiculescens	Y		
Ceramium macilentum	Y		
Ceramium rubrum	Y		
Codium harveyi	Y		
Dictyota alternifida	Y		
Ecklonia radiata	Y		
Haliptilon roseum	Y		
Halopteris paniculata	Y		
Halopteris sp.	Y	Y	
Laurencia obtusa	Y	Y	
Lobophora variegata	Y		
Polysiphonia scopulorum	Y	Y	
Sargassum sp.	Y		

Evidence of the industrial nature of the site was apparent from crystallised gypsum which was observed along the rock revetments (Plate 8).

No seagrass has been observed in the Inner Harbour, either during inspections carried out in this study, or in the CRIMP (2001) study which investigated 13 sites within the Inner Harbour of Port Kembla. Eco Logical Australia Pty Ltd (2003) also reviewed diver video footage for transects carried out for a proposed dredge disposal site in the Outer Harbour, and found that no seagrass or macroalgae were observed, and that the habitat was not suited to seagrass or macroalgae due to the high turbidity (extremely low visibility).

Seagrass was entered in Table 4.2.2 of CRIMP (2001) as being found in a pile scraping sample from the Outer Harbour at N° 6 Jetty (J6O). This result would appear questionable, however, as seagrass is not known to grow on pile substrates.

Habitat at both the proposed dredge site and disposal area were compared seagrass requirements to assess habitat suitability (Table 3). The photic depths are considered to be insufficient to allow light penetration to the current harbour bed, thus habitat in both the WB1 and dredge disposal site are considered to be not suitable for seagrasses.

Eco Logical Australia Pty Ltd
Ecological Assessment, GIS, Environmental Management and Planning
Ph - (02) 8536 8600
Fax - (02) 9542 5622

Table 3. Comparison of seagrass habitat requirements and conditions at WB1 and proposed dredge disposal area.

Variable	Seagrass Requirements	Proposed Dredge Site (WB1)	Proposed Inner Harbour Disposal Area
Substrate	Soft sediments eg. sand or mud	Top sediments are very soft silty clays	Very soft silty clays
Depths	Suitable depths are dependent on light availability	Shallowest depth of -6.5m CD, and a mean secchi depth of 2.97m at WB1 (maximum of 8.9m)	Shallowest depth 15.0m
Water Quality	Generally low nutrient waters with low levels of sediment	Levels of total phosphorus and nitrogen are low in the Inner Harbour (0.29 and 0.02 mg/L respectively), compared to 1km off South Wollongong Beach (1.25 and 0.26 mg/L respectively). Fine sediments are stirred up by ship movements (propeller wash)	Levels of total phosphorus and nitrogen are low in the Inner Harbour (0.29 and 0.02 mg/L respectively), compared to 1km off South Wollongong Beach (1.25 and 0.26 mg/L respectively). Fine sediments are stirred up by ship movements (propeller wash)

No cryptogenic or introduced macroalgae have been found in Port Kembla Harbour. Low levels of *Alexandrium `catenella* type' cysts (a dinoflagellate from the kingdom Protista) have been found in all sediments at low levels (CRIMP 2001). Cysts from the species *A. catenella* can become toxic blooms when disturbed, and blooms are usually less than 4 weeks in length, normally occurring between the months of December and April in southern Australia (CRIMP 2001). These toxic blooms can accumulate in shellfish and cause Paralytic Shellfish Poisoning (PSP) in humans. It was not clear, however, whether or not the cysts observed were from a species that can cause toxic blooms (ie. *A. catenella*) (CRIMP 2001). There is no evidence of a toxic bloom occurring in Port Kembla harbour to date (CRIMP 2001).

Table 4. Cryptogenic and introduced algae species (pests) from CRIMP (2001) at, or near, WB1 site within Port Kembla Harbour.

Group	Cryptogenic and Introduced Species	Notes
Macroalage	None	• No cryptogenic or introduced macroalgae found in Port Kembla
Dinoflagellates	*Alexandrium `catenella* type' cysts	• Cysts found in all sediments at low levels • Can become toxic blooms when sedentary cysts in sediments disturbed

Eco Logical Australia Pty Ltd
Ecological Assessment, GIS, Environmental Management and Planning
Ph - (02) 8536 8600
Fax - (02) 9542 5622

3.4 Aquatic Fauna

There are 87 species of fish known to occur in both the Inner and Outer Harbours of Port Kembla (MSE & CEC 1991). The fish in the Inner Harbour are noted as being basically estuarine in nature, with some species with tropical affinities also occurring (MSE & CEC 1991). The list of fish species from MSE & CEC (1991) was reviewed as part of the preparation of this report, and none of these species are listed under the FM Act.

The black cod (*Epinephelus daemelii*) is known to occur along the coast of New South Wales, and coastal rock pools and rocky shores in estuaries, are important habitat for small and large juveniles respectively (NSW Fisheries 2002). It is considered unlikely that the study site would be important habitat for the black cod because the species has not been observed within Port Kembla Harbour (MSE & CEC 1991), and habitat in the study area is considered unsuitable. Whilst rock revetments do occur on the study site, juveniles of the black cod are not known to utilise this habitat, instead they appear to prefer crevices under a large overhanging rock lip. Juveniles are considered to possibly use the entrance breakwaters. (pers. comm. Allan Lugg, 19/7/04).

There are no known records of species listed under the FM Act within Port Kembla Inner Harbour.

A variety of pest species were documented in CRIMP (2001) (see Table 5 for relevant groups and species). Of these species, the species or groups which occur at, or close to, the WB1 site and have not been recorded at the Inner Harbour disposal site, are 1 Hydrozoan, 1 Polychaete, 6 hull-fouling barnacle (Crustacean), 1 Malacostracan, 3 fish, and up to 16 Bryzoan species (Table 5). The Hydrozoan, barnacle, and Bryzoan species all generally live on hard substrates, and as such are unlikely to survive at the Inner Harbour disposal site or the offshore disposal site where hard surfaces will not occur. The fish pest species are mobile animals, and hence even if they should be transported during dredging works and survive, this is unlikely to spread these animals to regions that they could not reach by normal movements.

The Polychaete worm, *Boccardia chilensis*, can occur in benthos as well as hard surfaces. However, the habitat at the disposal site (soft silty clays) is unlikely to be favourable for this species, and similarly the offshore disposal site would also be unfavourable habitat. The Malacostracan species, *Corophium acutum*, was located on a pile scraping. The Inner Harbour and offshore disposal sites are thus also likely to be unfavourable habitat for this species.

Eco Logical Australia Pty Ltd
Ecological Assessment, GIS, Environmental Management and Planning
Ph - (02) 8536 8600
Fax - (02) 9542 5622

Table 5. Cryptogenic and introduced fauna species (pests) from CRIMP (2001) at, or near, WB1 site within Port Kembla Harbour.

Group	Cryptogenic and Introduced Species	Notes
Poriferans, Anthozoans, and Echinoderms	None	• No cryptogenic or introduced species from these groups found in Port Kembla
Hydrozoans	*Clytia sp. 1*	• Found at WB1 site (PW2) • Unknown source • High abundance in some pile scrapings
	4 other species	• 4 other hydrozoan pest species occur at other sites in Port Kembla, but not found at WB1 site (*Halecium vasiforme, Clytia hemisphaerica, Bougainvillia macloviana, Sarsia eximia*)
Polychaetes	*Boccardia chilensis*	• Found at WB1 site (PW2) • Occurs in various habitats, including on oysters
	2 species	• Found at Inner Harbour disposal site (MPB) (*Boccardia proboscidea, Hydroides ezoensis*)
	Hydroides dirampha	• Found at both Western Basin (WRR, PW2) and Inner Harbour disposal site (MPB) • Most common introduced species sampled
Other worms	*Enatiid sp. 1*	• Not found at Western Basin
Crustaceans	6 known hull-fouling barnacle species	• These species were found at various sites within the Inner Harbour, though not all occurred at the Inner harbour disposal site (*Balanus amphritrite, Balanus trigonus, Balanus variegatus, Megabalanus rosa, Megabalanus tintinnabulum and Megabalanus zebra*) • May occurs on rocks & other hard surfaces (eg. piles)
	4 Malacostracan species	• 4 other malacostracan pest species occur at other sites in Port Kembla, but not found at WB1 site (*Cirolana hardfordii, Paracerceis sculpta, Caprella equilibra, Stenothoe validae*)
	3 Malacostracan species	• Found at WB1 site and at Inner Harbour disposal site (*Sphaeroma walkeri, Liljeborgia c.f. dellavallei, Elasmopus rapax*) • Malacostracan species
	Corophium acutum	• Found close to WB1 site (WRR) • Malacostracan species
Molluscs	*Mytilus galloprovincialis*	• Widespread in harbour including both WB1 site and Inner Harbour disposal site
Bryozoans	16 species	• Occur in various locations including WB1 site • Sessile animals which mostly occur on hard substrates in marine environments
Chordates	2 Ascidian species	• Found at both WB1 site and at Inner Harbour disposal site (*Ciona intestinalis, Styela plicata*)
	Botryllus schlosseri	• Not found at WB1 site • Ascidian species
	3 Fish species	• Likely to occur in all areas of Inner Harbour at some time • 2 pest fish species observed in CRIMP (*Tridentiger trigonocephalus, Acentrogobius pflaumi*) and a further species observed in a previous study (*Acanthogobius flavimanus*)

Eco Logical Australia Pty Ltd
Ecological Assessment, GIS, Environmental Management and Planning
Ph - (02) 8536 8600
Fax - (02) 9542 5622

4. Impact Assessment

Impacts are considered for each of the key issues.

- Loss or damage to seagrass beds (if present)

The habitat at the dredge and disposal site are not considered to be suitable seagrass habitat as they are too deep, light penetration is poor as the water is murky as indicated by low secchi values, the rock revetments do not allow seagrass roots to attach, and soft silty clays are too soft. No seagrass beds or evidence of their leaves were observed during the site inspection. There are no records of seagrass within the Inner Harbour, and only one isolated record from the Outer Harbour. Therefore, no impacts are expected upon seagrass.

- Loss of macroalgae

If macroalage are present on the rock revetments, dredge area, or disposal area, it is expected that these would be lost. Whilst some macroalgae species have been detected (CRIMP 2001), they are not significant species. Therefore, no significant impact upon macroalgae is anticipated.

- Loss of aquatic substrate for macroalgae

Some potential substrate for macroalgae in the rock revetments will be lost. This will be replaced by some new substrate on the berth pylons and new rock revetments. This habitat will however be reduced as the proposed structures will prevent light access. Given that there are currently no known significant macroalgae present, this loss is not considered to be significant.

- Disturbance of contaminated sediments, and the transport and disposal of these sediments

The dredging process will disturb sediments and reduce water quality. These impacts will be minimised through the development of appropriate controls. These techniques will minimise the sediment plume created during dredging, construction, and disposal of sediments. Some fine sediments are likely to not be captured by these techniques, however. There will be a temporary reduction in water quality, particularly light penetration (through increased turbidity). As no seagrasses and no significant macroalgae are known to be present in the dredge site and the disposal area, or the immediate vicinity of both these sites, the impacts upon marine vegetation will not be significant.

The disturbed sediment may also impact upon fish, macroinvertebrates and other fauna (eg. filter feeders).

- Disturbance of dinoflagellate cysts and a resultant 'toxic bloom'

There is a risk that dredging could disturb dinoflagellate cysts and result in a toxic bloom and Paralytic Shellfish Poisoning in humans. It is currently unknown, however, if cysts from port Kembla Harbour include species that can cause toxic blooms (CRIMP 2001). These blooms also usually occur between December and April in southern Australia (CRIMP 2001).

Eco Logical Australia Pty Ltd
Ecological Assessment, GIS, Environmental Management and Planning
Ph - (02) 8536 8600
Fax - (02) 9542 5622

It is not known what mitigation measures could be adopted to reduce the risk of any potential blooms. Two possible options include:

a) Sediment samples from the proposed dredging area be taken and dinoflagellate cysts present be germinated to allow proper identification. Should *A. catenella* or other species that can cause toxic blooms be identified further risk management actions being developed, or
b) Dredging not occur between the months of December and April.

- Impacts on water quality as a result of the dredging and excavation process

Water quality will be reduced during dredging, construction and disposal of sediments through introduction of fine sediments into the water column, and the potential release of contaminants contained within the sediments. The surface sediments are currently disturbed within Port Kembla Harbour by water flows and ship movements. A medium to high impact on water quality is expected in the short term, due to disturbance of fine sediments and contaminants which are not subsequently captured during dredging. Impacts in the long term, however, will be low, as fine sediments in Port Kembla are already disturbed regularly by ship movements and water flow. It is thus not anticipated that this proposal will result in any significant impacts in the long term over current levels of disturbance.

- Impacts on aquatic communities in the sediment disposal areas due to smothering and water quality

It is anticipated that the aquatic communities in both the proposed dredge and disposal areas will be lost, either through removal by dredging or smothered by sediment disposal. No significant marine vegetation or aquatic communities, are known to be present, hence these impacts are not expected to be significant. Recolonisation of species is likely to occur over the long term.

- Impacts on aquatic communities from ship wave wash

Ship wave wash is likely to increase from current levels due to increased ship movements to access WB1. However, as there are no significant seagrass or macroalgae communities these impacts will not be significant.

- Impacts on fish and their habitat

Fish are generally mobile, and thus many individuals are likely to disperse during construction. No threatened fish species are known to occur, and the aquatic habitats which will be affected, sediment substrates with very soft silty clays at depths of >6.5m and rock revetments, are common in Port Kembla. No fish breeding areas or nursery areas are known to be present. Impacts of fish and their habitats is therefore considered to be not significant.

- The spread of marine pest species

It is difficult to ascertain the risk associated with the spread of marine pests as there is a limited understanding of their distribution across the Port and capacity to adapt to various habitats.

The marine pest species found in Port Kembla are generally assumed to have located and established within their preferred habitats already. The risk of additional pest species establishing at either the Inner Harbour or offshore

Eco Logical Australia Pty Ltd
Ecological Assessment, GIS, Environmental Management and Planning
Ph - (02) 8536 8600
Fax - (02) 9542 5622

disposal sites is low. The habitat at these disposal areas is unlikely to be favourable for the pest species detected (see section 3.3).

The rock revetments, piles, and upper sediments are those that are most likely to contain pest species. The top 1.5m of soft silty clays are assumed to be contaminated and will be disposed of at the Inner Harbour disposal site. The rock revetments are likely to be reused in the proposal and piles will be disposed of appropriately.

The deeper sediments to be disposed at the offshore site have a low risk of containing pest species. However, should they contain pest species, the offshore disposal site is unlikely to be of suitable habitat for their establishment (see Section 3.4). The more mobile species that may seek more suitable habitats at coastal sites are likely to have already been able to seek these outside of Port Kembla Harbour. This is considered to be a low risk as any captured organisms are likely to be smothered by the sediments during transport.

- Loss of terrestrial habitat in Tom Thumb Drain

100m of terrestrial habitat in Tom Thumb Road Drain will be lost. This habitat is not considered to meet the definition of any native vegetation communities, including saltmarsh vegetation, although some individual plants found in saltmarsh vegetation were present. The removal of the saltmarsh plants do not require a permit under s205 of the *Fisheries Management Act 1994*.

It is noted that the Fisheries Aquatic Habitat Policy and Guidelines require the provision of compensatory habitat when a proposed development or activity results in the loss of aquatic habitat. No clear guidance is given for the amount or approach to compensation except to say there is a 2:1 ratio for vulnerable habitats and that the creation of new habitats is acceptable for freshwater compensation. The habitat to be affected by this proposal is not considered to be vulnerable and it is therefore recommended that a negotiated approach be adopted with NSW Fisheries where consideration is given to the range of existing projects undertaken by PKPC and possible support provided to other activities such as revegetation works undertaken by community groups on the nearby Tom Thumb Lagoon.

It is possible Tom Thumb Road Drain may be periodically utilised for dispersal by the green and golden bell frog. This proposal would lead to the removal of 100m of Tom Thumb Road Drain, which would become part of the Port Kembla Inner Harbour. Removal of this portion of Tom Thumb Road Drain is considered unlikely to be a significant impact as the drain is highly degraded, poor habitat for this species, does not offer connectivity to many habitat options and thus current usage, if it occurs, would be low. Furthermore, it is considered that should dispersal occur along this drain (an unknown), and the proposal to construct berth WB1 be approved, this would require green and golden bell frogs to utilise an alterative dispersal route for the removed 100m portion of Tom Thumb Drain. Whether this would be possible is unknown, but given the low habitat quality of the site, and no known populations to the north, or use of Tom Thumb Road Drain

Eco Logical Australia Pty Ltd
Ecological Assessment, GIS, Environmental Management and Planning
Ph - (02) 8536 8600
Fax - (02) 9542 5622

for dispersal, the removal of 100m of Tom Thumb Road Drain is considered to be a low risk the green and golden bell frog.

No other threatened terrestrial fauna are known to presently utilise the site, and thus impacts due to the loss of terrestrial vegetation in Town Drain will not be significant.

Eco Logical Australia Pty Ltd
Ecological Assessment, GIS, Environmental Management and Planning
Ph - (02) 8536 8600
Fax - (02) 9542 5622

5. Conclusion and Recommendations

The proposal for the dredging and disposal of sediments associated with construction of the proposed new berth at WB1 is not considered likely to have a significant impact upon aquatic or terrestrial flora or fauna.

The proposal will not result in the loss of any seagrass, or significant macroalgae, but will lead to the loss of 100m of terrestrial habitat along Tom Thumb Drain. This vegetation is dominated by weeds, with some opportunistic natives, including some individual plants found in saltmarsh vegetation.

It is recommended that consideration be given to compensating the loss of this freshwater habitat. The nature and extent of this compensation is to be discussed with NSW Fisheries and may acknowledge many of the existing projects being undertaken by the PKPC as well as possible support to a number of environmental improvement programs being undertaken in the region.

It is further recommended that suitable environmental management measures be developed and adopted to minimise the risk of short term impacts to water quality and sediment dispersal during dredging and disposal.

Eco Logical Australia Pty Ltd
Ecological Assessment, GIS, Environmental Management and Planning
Ph - (02) 8536 8600
Fax - (02) 9542 5622

References

Centre for Research on Introduced Marine Pests (CRIMP) (2001). *Report on Port Kembla Introduced Marine Pest Species Survey*. NSW Fisheries Final Report Series No. 41. Report by Commonwealth Scientific and Industrial Research Organisation(CSIRO) for NSW Fisheries.

Eco Logical Australia Pty Ltd (2003). *Examination of Port Kembla Harbour Video for Presence of Seagrasses.* Unpublished report for Port Kembla Port Corporation.

Marine Science & Ecology and Coastal Environmental Consultants Pty Ltd (MSE & CEC) (1991). *Port Kembla Harbour Study 1991.* Unpublished report prepared for BHP Slab and Plate Products Division.

NSW Fisheries (2002). Black cod - *Epinephelus daemelii*. (online). Available: http://www.fisheries.nsw.gov.au/thr/species/fn-black-cod.htm (6/7/2004).

NSW National Parks and Wildlife Service (NPWS) (2004). *Atlas of NSW Wildlife.* (online). Available:http://wildlifeatlas.nationalparks.nsw.gov.au/wildlifeatlas/watlasSpecies.jsp (28/5/2004).

Patterson Britton & Partners Pty Ltd (PBP) (2004a). *Draft WB1 & EB4 Capital Dredging Sampling & Analysis Plan.* Unpublished report for Port Kembla Port Corporation.

Patterson Britton & Partners Pty Ltd (PBP) (2004b). *Maps of the area proposed for dredging.* Unpublished report for Port Kembla Port Corporation.

Phillips M (2002). *Monitoring and Assessing the Water and Sediment Quality of Port Kembla harbour According to the ANZECC & ARMCANZ (2000) Guidelines.* Honours Thesis, University of Wollongong.

Port Kembla Harbour Environment Group (2003). *Summary of Port Kembla Harbour Water Quality Results 2003.* Unpublished report.

Port Kembla Harbour Environmental Group (2004). *Draft Port Kembla Harbour Catchment Atlas.* Unpublished report.

Smith BA & Caccese M (2003). *A Biological Study on the Effects of Water Quality on the Development of Sessile Marine Invertebrate Assemblages: Port Kembla Harbour, NSW.* Minor Thesis, University of New South Wales.

Woodroffe SL (1998). *Environmental Monitoring in a Port.* Honours Thesis, University of Wollongong.

Eco Logical Australia Pty Ltd
Ecological Assessment, GIS, Environmental Management and Planning
Ph - (02) 8536 8600
Fax - (02) 9542 5622

Appendix 1. Photograph Plates.

Plate 1. Northeastern portion of WB1 overland dredge area.

Plate 2. Northwestern portion of WB1 overland dredge area.

Eco Logical Australia Pty Ltd
Ecological Assessment, GIS, Environmental Management and Planning
Ph - (02) 8536 8600
Fax - (02) 9542 5622

Plate 3. Rock revetment on the eastern boundary of the WB1 dredge area.

Plate 4. Western boundary (on left hand side) and northern rock revetments (on right hand side) for the WB1 dredge area.

Eco Logical Australia Pty Ltd
Ecological Assessment, GIS, Environmental Management and Planning
Ph - (02) 8536 8600
Fax - (02) 9542 5622

Plate 5. Promontory on the northern rock revetment.

Plate 6. Outlet of Tom Thumb Road Drain into Port Kembla Harbour.

Eco Logical Australia Pty Ltd
Ecological Assessment, GIS, Environmental Management and Planning
Ph - (02) 8536 8600
Fax - (02) 9542 5622

Plate 7. Overland portion of Tom Thumb Road Drain (picture taken on WB1 site facing northwest).

Plate 8. Crystallised gypsum (white line from left to right visible on the rocks) along the rock revetments on the eastern boundary of the dredge area. Numerous molluscs are also visible.

Eco Logical Australia Pty Ltd
Ecological Assessment, GIS, Environmental Management and Planning
Ph - (02) 8536 8600
Fax - (02) 9542 5622

ecological AUSTRALIA

ASSESSMENT | PLANNING | MANAGEMENT

Ecological Assessment for Disposal of Dredge Material in Port Kembla Outer Harbour

(Project No. 48-05)

Report prepared for:
Port Kembla Port Corporation

November 2005

ABN 87 096 512 088 | address Suite 503 3-5 Stapleton Ave Sutherland NSW 2232
postal PO Box 12 Sutherland NSW 1499 | phone 02 8536 8600 | fax 02 9542 5622
web www.ecoaus.com.au

Document Tracking

Item	Detail	Signature
Project Name	Port Kembla Dredge Disposal in Outer Harbour	
Project Number	48-05	
Prepared by	S Ward	
Prepared by	A Morison	
Approved by	A Morison	
Status	Final	
Version Number	3	
File location	G:\Current_Projects\Private Clients\Port Kembla PC\Dredge Disposal in Outer Harbour (48-05)\Outer Harbour Dredge Disposal - Final v3.doc	
Date	10 November 2005	

Acknowledgements
This document has been prepared by Eco Logical Australia Pty Ltd with support from Port Kembla Port Corporation and Patterson Britton and Partners.

The study team would like to thank Chris Doyle (Port Kembla Port Corporation), Andrew Dunne (Port Kembla Port Corporation), Ali Stone (Patterson Britton and Partners), Christopher Carter (Department of Primary Industries), Allan Lugg (Department of Primary Industries), and Damien Ogburn (Department of Primary Industries).

Eco Logical Australia Pty Ltd
Ecological Assessment, GIS, Environmental Management and Planning
Ph - (02) 8536 8600
Fax - (02) 9542 5622

Contents

Eco Logical Australia Pty Ltd
Ecological Assessment, GIS, Environmental Management and Planning
Ph - (02) 8536 8600
Fax - (02) 9542 5622

1. Introduction

1.1 Description of Project

Port Kembla Port Corporation (PKPC) propose to dispose of up to 300,000 m^3 of material in a disposal area in the Outer Harbour of Port Kembla (Figure 1). The material will come from a capital dredging program to create two new berths in the Inner Harbour of Port Kembla, to be known as Multi-Purpose Berth No.3 (MPB3) and Eastern Basin No. 4 (EB4).

The material to be dredged from EB4 is very soft dark grey to black estuarine clay. To create MPB3 there will be both harbour dredging (also of very soft dark grey to black estuarine clay), and onland dredging. The following layers are present in the onland material to be dredged (from surface to bottom of dredge area):

- slag fill
- slag fill with associated sandwiched clay layers
- sandy material (previous dredge material)
- soft to firm silty estuarine clays
- very stiff alluvium/residual clay
- rock (soft to hard sandstone)

Laboratory results and comparison to guideline levels for sediments to be dredged and placed in the disposal area were provided by Patterson Britton & Partners Pty Ltd (unpub. data). The guideline levels used were low and high interim sediment quality guidelines (ISQG) contamination thresholds for sediments.

The top sediments (very soft dark grey to black estuarine clays) in the harbour for dredging for both proposed berths had contaminants above high ISQG levels for lead, zinc, naphthalene, acenaphthylene, fluorene, phenanthrene, and anthracene (data supplied by Patterson Britton & Partners). The onland materials were below all high ISQG threshold levels for the top three layers, though a number of contaminants were above the low ISGQ levels. The onland soft to firm silty estuarine clays, however, had levels above the high ISQG thresholds for lead, zinc, naphthalene, acenaphthylene, fluorene, phenanthrene, pyrene, benz(a)anthracene, benzo(a)pyrene and dibenz(ah)anthracene.

The top 3 layers and part of the 4th layer are to be disposed of in the Outer Harbour, with the remaining material to be disposed of offshore. It is understood that a Dredged Material Placement Management Plan would be prepared which would set out the proposed disposal operation in a systematic manner. A hydrodynamics report found for storm wave activity that apart from the sandy sediment and the soft clay, the sediments are stable in 1-year ARI wave conditions, and the coarse slag would be stable up to at least ARI 25 years (Cardno Lawson Treloar Pty Ltd 2005).

It is understood that this proposal will form the first stage of a subsequent reclamation program. No assessment of later reclamation proposals is made in this report.

Eco Logical Australia Pty Ltd
Ecological Assessment, GIS, Environmental Management and Planning
Ph - (02) 8536 8600
Fax - (02) 9542 5622

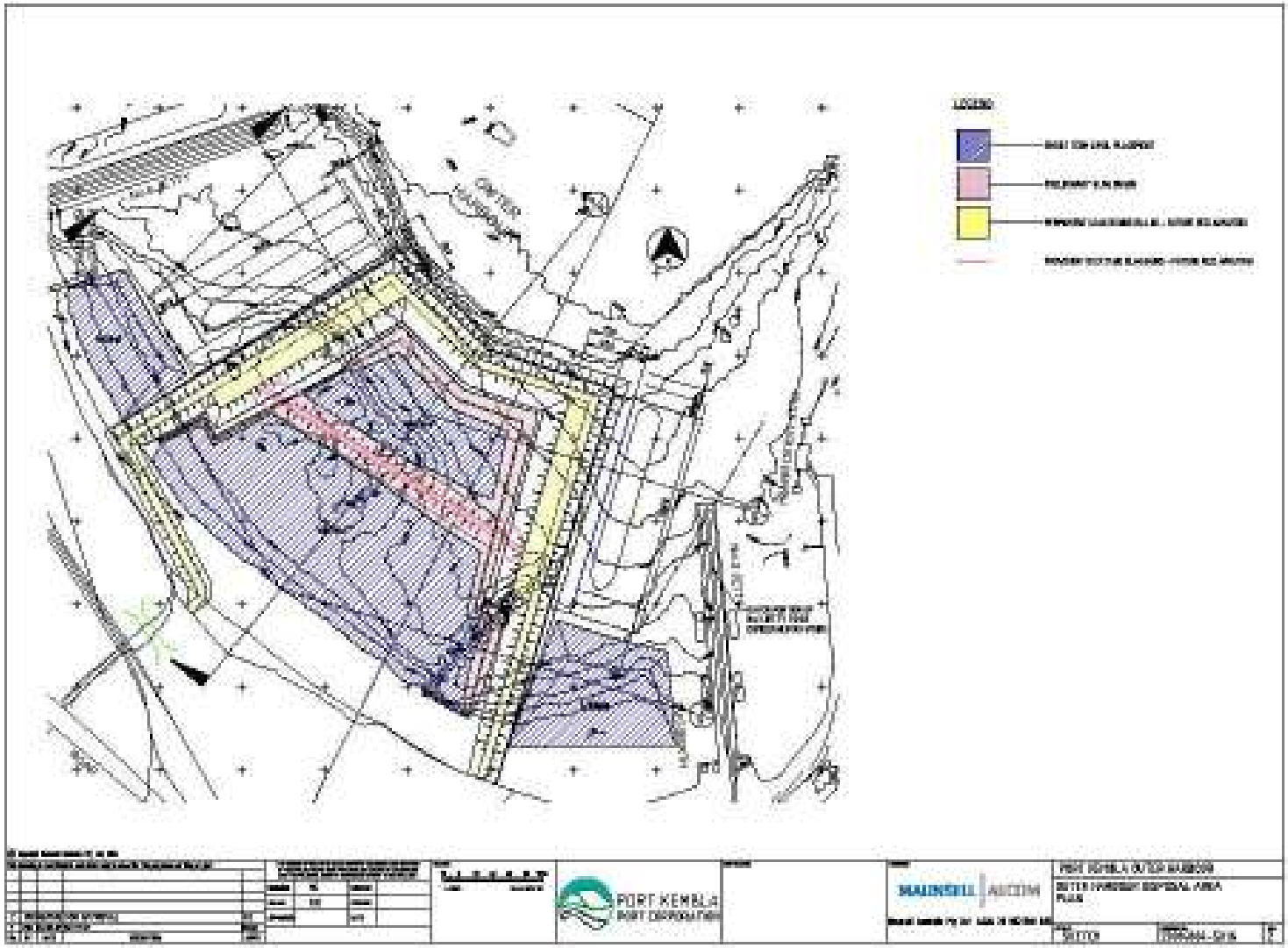

Figure 1. Location of proposed disposal area (Figure prepared by Patterson Britton & Partners Pty Ltd, drawing 20014804-SK16, and used with permission of Port Kembla Port Corporation).

Eco Logical Australia Pty Ltd
Ecological Assessment, GIS, Environmental Management and Planning
Ph - (02) 8536 8600
Fax - (02) 9542 5622

A previous report investigated the flora and fauna impacts of the proposed capital dredging. At that time all materials were to be disposed of offshore, but this aspect of the proposal has now changed. This report solely investigates the potential flora and fauna impacts associated with the proposed disposal of sediments in the Outer Harbour.

1.2 Study Area

The port of Port Kembla was created over 100 years ago to support local industry and shipping. The port hence has a long history of use as an industrial port.

Landuse surrounding the proposed disposal site is industrial to the east and south, with the Tasman Sea to the north and east beyond the breakwaters.

Salty Creek currently flows directly into the proposed disposal site, with the catchment being primarily the Bluescope Steel industrial area. Darcy Rd Drain flows out towards the southern portion of the disposal area. This creekline is the eastern outlet for the Port Kembla Copper Plant.

The shoreline consists of a beachfront of 150-200m long, with the remainder consisting of rock revetments.

There has been a history of dredging in Port Kembla Harbour, with disposal of 50,000 m^3 of material to create MPB130 disposed over part of the study site in 2005, and a number of dredging operations within Port Kembla Harbour prior. The current study area is larger than the previous disposal sites.

Port Kembla Harbour has sediments with contaminates above high threshold levels. Consideration of the impact of contaminants is outside of the scope of this report. It is noted, however, that estuarine clay's with high levels of contaminants are currently present at the proposed disposal site (Patterson Britton & Partners Pty Ltd unpub. data). The presence of the contaminants does reduce the quality of habitat for aquatic flora and fauna in the study area.

Points of note for water quality within the Port Kembla Outer Harbour is that turbidity is moderate, with an average of 1.63 NTU (minimum of 0.72 NTU, maximum of 2.50 NTU from 10 sampling dates), and with secchi depths averaging 4.37m (minimum of 2.0m, maximum of 9.0m from 48 sampling dates), (Port Kembla Harbour Environment Group 2003). Also, water quality testing has found aluminium to consistently be above the ANZECC 95% trigger value, with peaks appearing to correlate with high rainfall events, and with manganese, cadmium, tin, lead and arsenic 'mostly below' the ANZECC 95% trigger value (Anon. 2005).

Eco Logical Australia Pty Ltd
Ecological Assessment, GIS, Environmental Management and Planning
Ph - (02) 8536 8600
Fax - (02) 9542 5622

1.3 Legislative Requirements

1.3.1 Environmental Planning and Assessment Act 1979

The NSW *Environmental Planning and Assessment Act 1979* (EP&A Act) is the principal planning legislation for the state, providing a framework for the overall environmental planning and assessment of development proposals. It is understood that this proposal will be considered under Part 3A of the EP&A Act (Major Projects). As such, the approvals under eight NSW acts are incorporated into the approval process.

The requirements of the *Fisheries Management Act 1994* (FM Act) is reviewed separately below, but it is noted that there are special provisions for projects under Part 3A.

1.3.2 Fisheries Management Act 1994

The *Fisheries Management Act 1994* (FM Act) aims to conserve, develop and share the fishery resources of NSW for the benefit of present and future generations. Division 4 of Part 7 covers the protection of marine vegetation (macroalgae, seagrasses or mangroves).

Eco Logical Australia (ELA) contacted Department of Primary Industries (NSW Fisheries) for comment on information relevant to their assessment of the proposal (Allan Lugg, pers. comm., 17 October 2005), and from this discussion, the information relevant to NSW Fisheries is:

1. Details of the proposal, including:
    - The source and nature of the dredge material for disposal
    - Where dredge material will be placed
    - How the stability of the dredge disposal area will be assured
    - How water quality will be monitored (eg. turbidity monitoring)

2. Details on the nature, quality and value of within the disposal site and surrounds for aquatic habitat, and comments on the likely impact of the proposed disposal of dredge material. This Includes marine vegetation (seagrasses and marine macro-algae), fish communities and any threatened fish species (as listed by the Fisheries Management Act).

Any potential harm to marine vegetation usually requires a permit from NSW Fisheries. However, as the proposal comes under Part 3A no permit is required, and the assessment process will occur under the provisions of Part 3A of the EP&A Act.

The details of the proposal will be provided in the full Environmental Assessment. This report considers and provides comment on the aquatic habitat and likely impacts (item 2).

Eco Logical Australia Pty Ltd
Ecological Assessment, GIS, Environmental Management and Planning
Ph - (02) 8536 8600
Fax - (02) 9542 5622

1.4 Objectives

The objectives of this report are to:

- Liaise with Allan Lugg of Department of Primary Industries (NSW Fisheries) to confirm the requirements for the aquatic ecology assessment
- Undertake a literature review of the available data including but not limited to:
    - the assessment of the aquatic ecology at the MPB3 and EB4 berth dredge sites undertaken by Eco Logical Australia in 2004
    - the biological monitoring program using settlement plates for the recent MBP130 dredging and disposal to the Outer Harbour by Dr Emma Johnston from the UNSW Centre of Marine and Coastal Studies
    - Eco Logical Australia's 2003 review of the video undertaken by Southern Commercial Divers
    - AWT 1999 aquatic studies for the Port Kembla Outer Harbour Disposal Site
- Provide text for inclusion in the Environmental Assessment describing the existing aquatic ecology at the disposal site and the impact on aquatic ecology from the disposal of in the order of 300,000 m^3 of material.

1.5 Limitations

This report is limited in its nature and scope, and these limitations are identified below:

- Issues relating to release of contaminants are not covered in this report (except how contaminants relate to current on-site habitat)
- Impacts of off-shore disposal of sediments is not considered
- Information for various issues such as fish and pest species present in Port Kembla and water quality information was obtained from literature reviewed

1.6 Issue Scoping

There are a number of potential issues relating to the objectives of this report, for both aquatic and terrestrial flora and fauna, associated with the proposed disposal of dredged material within the Outer Harbour site at Port Kembla site. They are discussed in section 3 of this report. These issues are:

- Loss or damage to seagrass beds (if present)
- Loss of macroalgae
- Release or resuspension of contaminated material with the disposal of sediments
- Disturbance of disposed sediments
- Disturbance of dinoflagellate cysts and a resultant 'toxic bloom'
- Impacts on aquatic communities in the sediment disposal areas due to smothering and water quality
- Impacts on aquatic communities from ship wave wash
- Impacts on fish and their habitat
- The spread of marine pest species
- Impacts on shoreline aquatic habitat
- Future impacts due to sediment resuspending

Eco Logical Australia Pty Ltd
Ecological Assessment, GIS, Environmental Management and Planning
Ph - (02) 8536 8600
Fax - (02) 9542 5622

1.7 Literature Reviewed

The following literature was considered during the preparation of this report:

- CRIMP (2001). *Report on Port Kembla Introduced Marine Pest Species Survey.*
- Eco Logical Australia Pty Ltd (2003). *Examination of Port Kembla Harbour Video for Presence of Seagrasses.*
- MSE & CEC (1991). *Port Kembla Harbour Study 1991.*
- Phillips (2002). *Monitoring and Assessing the Water and Sediment Quality of Port Kembla harbour According to the ANZECC & ARMCANZ (2000) Guidelines.*
- Port Kembla Harbour Environment Group (2003). *Summary of Port Kembla Harbour Water Quality Results 2003.*
- Port Kembla Harbour Environmental Group (2004). *Draft Port Kembla Harbour Catchment Atlas.*
- Smith & Caccese (2003). *A Biological Study on the Effects of Water Quality on the Development of Sessile Marine Invertebrate Assemblages: Port Kembla Harbour, NSW.*
- University of New South Wales (2004). "Port Kembla Harbour Water Quality Presentation". Unpublished document.
- Woodroffe (1998). *Environmental Monitoring in a Port.*
- Maps and background material supplied by Patterson Britton.

Eco Logical Australia Pty Ltd
Ecological Assessment, GIS, Environmental Management and Planning
Ph - (02) 8536 8600
Fax - (02) 9542 5622

2. Results

2.1 Aquatic Flora

A total of 27 macroalgae species have previously been found in the Outer Harbour (Table 1, CRIMP 2001), although this study focussed on locating introduced, rather than native, species.

Table 1. Macroalgae collected from the Outer Harbour of Port Kembla (data from CRIMP 2001). The relevant site locations from CRIMP (2001) for the proposed Outer Harbour Disposal Area are sites Western Revetment Wall (WRW) and Spoil Ground (SGO). The nearest sampling sites outside of the proposed disposal area are jetty 3 (J3O) and jetty 6 (J6O).

Species Name	Site			
	All of Outer Harbour	Proposed Outer Harbour Disposal Area	J3O	J6O
Acrosorium venulosum	Y	Y		
Antithamnion amphigeneum	Y		Y	
Callithamnion korfense	Y			
Callithamnion pacifica	Y			
Champia parvula	Y			
Crustose corraline	Y			
Derbesia sp.	Y			
Dictyota alternifida	Y		Y	
Dictyota dichotoma	Y			
Dilophus marginatus	Y			Y
Dicyopteris acrostichoides	Y			
Ecklonia radiata	Y			
Gelidium sp.	Y			
Halopteris ovalis	Y			Y
Heterosiphonia auStralis	Y		Y	
Phycodrys australasica	Y			
Phyllospora comosa	Y			
Polysiphonia constricta	Y			
Polysiphonia scopulorum	Y			
Polysiphonia sp.	Y			
Polysiphonia sp. x	Y		Y	
Rhipidothamnion secundum	Y		Y	
Rhodymenia australis	Y		Y	
Sargassum sp.	Y			
Spatoglossum sp.	Y		Y	
Sphacelaria sp.	Y			
Zonaria diesingiana	Y	Y		

Eco Logical Australia Pty Ltd
Ecological Assessment, GIS, Environmental Management and Planning
Ph - (02) 8536 8600
Fax - (02) 9542 5622

For the proposed disposal site, a total of 2 macroalgae species were identified: *Acrosorium venulosum*, from the family Rhodophyta, a "red" macroalgae, and *Zonaria diesingiana,* from the family Phaeophyta, a "brown" macroalgae, with the specimens from a benthic core and a qualitative sample respectively. A further 9 species were found from pile scraping samples taken at either jetty 3 or jetty 6 in Port Kembla (Table 1).

Seagrass was entered in Table 4.2.2 of CRIMP (2001) as being found in a pile scraping sample from the Outer Harbour at N° 6 Jetty (J6O). This result would appear questionable, however, as seagrass is not known to grow on pile substrates.

Eco Logical Australia Pty Ltd (2003) reviewed diver video footage for transects carried out within a proposed dredge disposal site in the Outer Harbour (ie. the same site as this study). This study found that seagrass was unlikely to be found at the disposal area because of low photic depths, depth (RL -4 to -11m) as well as extremely fine sediment substrate with high turbidity. We note that the area covered by this proposal is larger than the 2003 study site, but the habitats are similar, with fine sediment substrates. Further, no seagrass fronds were found by Eco Logical Australia in a wrack survey of the dredge sites in the northern shore of the Inner Harbour in 2004.

No cryptogenic or introduced macroalgae have been found in Port Kembla Harbour. Low levels of *Alexandrium* `*catenella* type' cysts (a dinoflagellate from the kingdom Protista) have been found in all sediments at low levels (CRIMP 2001). Cysts from the species *A. catenella* can become toxic blooms when disturbed, and blooms are usually less than 4 weeks in length, normally occurring between the months of December and April in southern Australia (CRIMP 2001). These toxic blooms can accumulate in shellfish and cause Paralytic Shellfish Poisoning (PSP) in humans. It was not clear, however, whether or not the cysts observed were from a species that can cause toxic blooms (ie. *A. catenella*) (CRIMP 2001). There is no evidence of a toxic bloom occurring in Port Kembla harbour to date (CRIMP 2001).

Table 2. Cryptogenic and introduced algae species (pests) from CRIMP (2001) at, or near, the proposed disposal site.

Group	Cryptogenic and Introduced Species	Notes
Macroalage	None	• No cryptogenic or introduced macroalgae found in Port Kembla
Dinoflagellates	*Alexandrium* `*catenella* type' cysts	• Cysts found in all sediments at low levels • Can become toxic blooms when sedentary cysts in sediments disturbed

2.2 Aquatic Fauna

There are 87 species of fish known to occur in both the Inner and Outer Harbours of Port Kembla (MSE & CEC 1991). The list of fish species from MSE & CEC (1991) was reviewed as part of the preparation of this report, and none of these species are listed under the FM Act.

Eco Logical Australia Pty Ltd
Ecological Assessment, GIS, Environmental Management and Planning
Ph - (02) 8536 8600
Fax - (02) 9542 5622

The black cod (*Epinephelus daemelii*) is known to occur along the coast of New South Wales, and coastal rock pools and rocky shores in estuaries, are important habitat for small and large juveniles respectively (NSW Fisheries 2002). It is considered unlikely that the study site would be important habitat for the black cod because the species has not been observed within Port Kembla Harbour (MSE & CEC 1991), and habitat in the study area is considered unsuitable. Whilst rock revetments do occur on the study site, juveniles of the black cod are not known to utilise this habitat, instead they appear to prefer crevices under a large overhanging rock lip. Juveniles are considered to possibly use the entrance breakwaters. (pers. comm. Allan Lugg, 19/7/04).

There are no known records of fauna species listed under the FM Act within Port Kembla Inner Harbour (fish or other aquatic fauna).

No benthos fauna listed as threatened species under the FM Act are known to exist within Port Kembla. The benthos habitat in the disposal area consists of fine silty materials (Eco Logical Australia 2003), which are common in Port Kembla.

Eco Logical Australia Pty Ltd
Ecological Assessment, GIS, Environmental Management and Planning
Ph - (02) 8536 8600
Fax - (02) 9542 5622

3. Impact Assessment

Impacts are considered for each of the key issues.

- Loss or damage to seagrass beds (if present)

The habitat at the dredge and disposal site are unlikely to be seagrass habitat. There are no records of seagrass within the Inner Harbour, and only one isolated record from the Outer Harbour, which appears to be dubious as it was noted as coming from a pile scraping. Therefore, no impacts are expected upon seagrass.

- Loss of macroalgae

The number and diversity of macroalgae in the proposed disposal area is low, and the fine silt substrates are not ideal habitat. It is anticipated macroalage present would be lost. There may also be impacts on macroalgae present on rock revetments, and jetty pylons, in the vicinity of the disposal site. Whilst some macroalgae species have been detected (CRIMP 2001), they are not significant species. Therefore, no significant impact upon macroalgae is anticipated.

- Disturbance of disposed sediments

The disposal process will disturb sediments and reduce water quality. These impacts will be minimised through the use of a silt curtain within the bunds for the disposal area. Some fine sediments are likely to not be captured by these techniques. There will be a temporary reduction in water quality, particularly light penetration (through increased turbidity). As no seagrasses and no significant macroalgae are known to be present in the dredge site and the disposal area, or the immediate vicinity of both these sites, the impacts upon marine vegetation will not be significant.

The disturbed sediment may also impact upon fish, macroinvertebrates and other fauna (eg. filter feeders). A study in Port Kembla Harbour found no significant impact on hard-substrate invertebrates associated with a dredging activity (Johnston & Clark 2004). It is anticipated that impacts would be high over the short term, but low in the long term because of the industrialised nature of the harbour.

It is also recommended that the silt curtain be opened for as short a time as possible to permit ship movements.

Monitoring of turbidity in the vicinity of the works should be considered as part of the proposed Dredged material Placement Management Plan.

- Release or resuspension of contaminated material with the disposal of sediments

There is the potential for contaminants to become mobilised with the dredging / disposal activity. Water quality in the harbour is currently reduced due to the industrial nature of the site, but aluminium, the only compound found to be consistently above the 95% ANZECC trigger value was also high at reference sites in the region (Prattis 2005), indicating that this is not a localised problem. If the sediments, particularly the fine surface sediments can be trapped within the

Eco Logical Australia Pty Ltd
Ecological Assessment, GIS, Environmental Management and Planning
Ph - (02) 8536 8600
Fax - (02) 9542 5622

disposal site this may allow some increase in water quality in the long term. In the short term, however, it is likely that there will be impacts from reduced water quality, but the water quality of the site is already degraded due to sediments currently present.

- Disturbance of dinoflagellate cysts and a resultant 'toxic bloom'

There is a risk that dredging could disturb dinoflagellate cysts and result in a toxic bloom. Toxic blooms from this species have been known to result in Paralytic Shellfish Poisoning in humans. It is currently unknown, however, if cysts from Port Kembla Harbour include species that can cause toxic blooms (CRIMP 2001). In addition, dredging and disposal of material to the Outer Harbour has been undertaken previously, and there is no evidence of a toxic bloom occurring in Port Kembla Harbour. These blooms also usually occur between December and April in southern Australia (CRIMP 2001).

There are treatments to kill cysts, such as heating to 40-50 °C, or using hydrogen peroxide, but these are unlikely to be viable for such a large volume. The CRIMP study did note that densities of the cysts were low, and the fine harbour sediments will be placed in the disposal area first, and will be covered by other material. Hence the overall risk appears to be low.

Possible options to address the risk include:

a) Sediment samples be taken and dinoflagellate cysts present be germinated to allow proper identification. Should *A. catenella* (or other toxic bloom species) be present, further risk management actions to be developed as appropriate.
b) Dredging not occur between the months of December and April.
c) Heat (or other) treatment of materials to kill cysts (given the volume it is unlikely this will be practicable)
d) Develop procedures to monitor for toxic blooms and to inform the community if a toxic bloom is observed. This could occur together with other water quality monitoring.

Given the potential for a high level of detrimental harm to both humans and the environment, monitoring for dinoflagellates as part of any overall water quality monitoring program is recommended (option d outlined above).

- Impacts on aquatic communities in the sediment disposal areas due to smothering and water quality

It is anticipated that the aquatic communities in disposal area will be lost, due to smothering by sediment disposal. No significant marine vegetation or aquatic communities, are known to be present, hence these impacts are not expected to be significant. Recolonisation of species is likely to occur over the long term.

- Impacts on aquatic communities from ship wave wash

Ship wave wash is likely to increase from current levels at the disposal site. However, as there are no significant seagrass or macroalgae communities these impacts will not be significant.

Eco Logical Australia Pty Ltd
Ecological Assessment, GIS, Environmental Management and Planning
Ph - (02) 8536 8600
Fax - (02) 9542 5622

- Impacts on fish and their habitat

Fish are generally mobile, and thus individuals are likely to disperse during construction, except for those captured within the silt net for the disposal area. No threatened fish species are known to occur, and the aquatic habitats which will be affected, soft sediment substrates, are common in Port Kembla. No fish breeding areas or nursery areas are known to be present. Impacts on fish and their habitats are therefore considered to be not significant.

- The spread of marine pest species

A variety of pest species have been documented in both the Inner and Outer Harbours (CRIMP 2001). The risk of transferring pest species is considered to be low as it is likely most organisms in the sediments being transferred will be smothered, particularly if the harbour sediments are dredged and placed in the disposal area first, and because the dredging and disposal sites are in close proximity.

- Impacts on shoreline aquatic habitat

There may be some impacts on aquatic habitats in proximity to the proposed site, particularly the deposition of fine sediments on the shoreline or rock revetments. There has been previous disposal of dredged material in these areas and a history of industrial use, hence it is not anticipated that these impacts will be significant.

- Future impacts due to sediment resuspending

There is the potential that the sediment in the disposal area could become resuspended. Those sediments at the top of the disposal area will have the greatest potential to be resuspended. Placing the fine sediments first is desirable as there will be less risk of exposing the contaminants once these are covered.

If possible, it is recommended that the soft to firm silty estuarine clays from the MPB3 dredging area not be last in the disposal area, as these materials have levels above ISQG high levels for lead, zinc, naphthalene, acenaphthylene, fluorene, phenanthrene, pyrene, benz(a)anthracene, benzo(a)pyrene and dibenz(ah)anthracene (from sediment test data supplied by PKPC).

Using slag fill from the MPB3 onland dredging area is likely to provide the greatest stability, and these materials appear to have lower levels of contaminants than other layers.

It is also recommended that the bund walls to contain the sediments have a high probably of being stable over the longer term.

Eco Logical Australia Pty Ltd
Ecological Assessment, GIS, Environmental Management and Planning
Ph - (02) 8536 8600
Fax - (02) 9542 5622

4. Conclusion and Recommendations

The proposal for the disposal of sediments at the proposed site in the Outer Harbour is not considered likely to have a significant impact upon aquatic flora or fauna.

The proposal is not likely to result in the loss of any seagrass. However, some macroalgae habitat may be impacted over the short term. Few macroalgae will be directly lost (only two species recorded).

In summary, it is recommended that:

- The very soft dark grey to black estuarine clays (from harbour bottom) are placed in the disposal area first
- Slag fill from the MPB3 onland dredging area is used as a cap to the disposal area
- If possible, the soft to firm silty estuarine clays from the MPB3 onland dredging area be placed in the disposal area as early as possible,
- The bund walls to contain the sediments have a high probably of being stable over the longer term
- To further minimise the release or disturbance of sediments it is recommended that the silt curtain in the disposal area be opened for as short a time as possible for ship movements
- That water quality be monitored in proximity to the disposal site (eg. jetties 3 and 6), and possibly at other locations in the outer harbour. This may include turbidity monitoring, taking photographic images, testing for contaminants, and levels of toxic dinoflagellates.
- Testing for dinoflagellates should consist of plankton trawls at a minimum of 3 locations on a monthly basis between October and May, with screening of the samples for toxic species. Testing prior to commencement of works to provide baseline data is strongly recommended
- Should a positive result for a toxic species be returned, the Regional Algal Co-ordinating Committee must be contacted as a matter of urgency. Damien Ogburn, Department of Primary Industries, is the relevant first point of contact (02) 4916 3920

Eco Logical Australia Pty Ltd
Ecological Assessment, GIS, Environmental Management and Planning
Ph - (02) 8536 8600
Fax - (02) 9542 5622

References

Anonymous (2005). *Port Kembla Water Quality Presentation*. Unpublished notes on the results of water quality monitoring since Phillips (2000), as supplied by Port Kembla Port Corporation.

Cardno Lawson Treloar Pty Ltd (2005). *Port Kembla Outer Harbour stability of dredged spoil & blast furnace slag.* Letter to Maunsell Australia Pty Ltd dated 26 October 2005.

Centre for Research on Introduced Marine Pests (CRIMP) (2001). *Report on Port Kembla Introduced Marine Pest Species Survey*. NSW Fisheries Final Report Series No. 41. Report by Commonwealth Scientific and Industrial Research Organisation(CSIRO) for NSW Fisheries.

Eco Logical Australia Pty Ltd (2003). *Examination of Port Kembla Harbour Video for Presence of Seagrasses.* Unpublished report for Port Kembla Port Corporation.

Johnston EL and Clark GF (2004). *No effect of dredging on hard-substrate invertebrates in Port Kembla Harbour.* Unpublished report for Port Kembla Port Corporation.

Marine Science & Ecology and Coastal Environmental Consultants Pty Ltd (MSE & CEC) (1991). *Port Kembla Harbour Study 1991.* Unpublished report prepared for BHP Slab and Plate Products Division.

NSW Fisheries (2002). Black cod - *Epinephelus daemelii*. (online). Available: http://www.fisheries.nsw.gov.au/thr/species/fn-black-cod.htm (6/7/2004).

Patterson Britton & Partners Pty Ltd (2005).

Phillips M (2002). *Monitoring and Assessing the Water and Sediment Quality of Port Kembla harbour According to the ANZECC & ARMCANZ (2000) Guidelines.* Honours Thesis, University of Wollongong.

Port Kembla Harbour Environment Group (2003). *Summary of Port Kembla Harbour Water Quality Results 2003.* Unpublished report.

Port Kembla Harbour Environmental Group (2004). *Draft Port Kembla Harbour Catchment Atlas.* Unpublished report.

Prattis PK (2005). *Port Kembla Water Quality Presentation.* Notes from a presentation to BlueScope Steel.

Smith BA & Caccese M (2003). *A Biological Study on the Effects of Water Quality on the Development of Sessile Marine Invertebrate Assemblages: Port Kembla Harbour, NSW.* Minor Thesis, University of New South Wales.

Woodroffe SL (1998). *Environmental Monitoring in a Port.* Honours Thesis, University of Wollongong.

Eco Logical Australia Pty Ltd
Ecological Assessment, GIS, Environmental Management and Planning
Ph - (02) 8536 8600
Fax - (02) 9542 5622