14. Traffic and Transport

The DGRs list the assessment of traffic impacts as a section of the Spoil Handling and Disposal assessment requirements. Chapter 13 (Spoil Handling and Disposal) provides details on the spoil handling options for the Project, and context for the assessment of traffic and transportation impacts. This chapter identifies and assesses the potential traffic and transport impacts of the Project and provides mitigation measures to eliminate or reduce those impacts.

The DGRs for the Transport and Traffic component of the EIS are provided in Table 14-1.

Table 14-1 Traffic and Transport DGRs

Environmental Impact Statement Requirements	Where Addressed
Traffic impacts associated with the hauling of dredged material to disposal locations, taking into account the *Guide to Traffic Generating Developments* (RTA, 2002), including:	Section 14.2.2 (Legislation and Guidelines)
◗ Identification of haulage routes, and a traffic analysis on the local and regional road network, including intersection analysis, having regard to the number, frequency and size of construction related vehicles and the nature of existing traffic on construction routes.	Section 14.3 Potential Impacts from Traffic)
◗ Identification of any necessary road upgrades.	Section 14.3 (Potential Impacts from Traffic)
◗ Management of impacts to minimise the potential for cumulative traffic impacts with other major construction activities in the region.	Section 14.4 (Recommended Mitigation Measures)
◗ Consultation with the RTA (now RMS)	Chapter 4 (Consultation)

14.1 Introduction

Traffic impacts as a result of the Project would be minor in scale. Impacts on traffic as a result of the Project would be produced by the movement of spoil by the landside transport network. The preferred method for the disposal of the dredged material is by sea dumping. A barge would carry out sea dumping directly, and would not require landside transportation.

The dredging proponent would assess potential alternative uses for the spoil. Chapter 13 (Spoil Handling and Disposal) provides details on the spoil disposal and management options. Where alternatives to sea dumping are identified, the proponent would assess potential traffic or transportation impacts at the time. Alternative uses would include reclamation works, use as clean fill for industrial developments or beach renourishment. These works would also likely be done directly by barge and not require landside transportation.

A proportion of the dredged material may not be suitable for sea dumping or alternative uses due to potential contamination levels. Chapter 9 (Contamination) provides details on the location and levels of contaminated material present in the river sediment.

Previous studies have identified a potential contamination hotspot in the area of the proposed Walsh Point Berth Pocket. Geochemical testing undertaken for the EIS however did not detect this hotspot. This EIS and this traffic assessment have made allowance for the disposal of this potentially contaminated material to landfill. This material would be disposed after suitable treatment by transporting it to an appropriate receiving location. This was determined to be in Kemps Creek in Western Sydney.

14.2 Existing Environment

14.2.1 Literature Review

A number of previous studies have been reviewed for this EIS. The review of previous studies was undertaken to gather information on the existing road and traffic conditions in the area surrounding the Port of Newcastle, in particular the road linkages with the regional arterial road network, including Industrial Drive, Maitland Road/Pacific Highway, and the Sydney-Newcastle Freeway.

Project-specific transport and traffic studies for a number of development proposals in the Port of Newcastle area were reviewed. These reports include:

- Stapes Pty Ltd, (2005).*Expansion of the Cargill Oilseed Processing Facility – Environmental Assessment*. Appendix 4 – Traffic Study.
- Connell Hatch, (2007), *Newcastle Coal Export Terminal – Road Transport Assessment Newcastle Coal Export Terminal* – Construction Traffic Management Protocol.
- Christopher Stapleton Consulting Pty Ltd, (2007).*Kooragang Island Fuel and Bio-Diesel Facility* – Traffic Impact Assessment.
- Mark Waugh Pty Ltd, (2009), *Proposed Extension to Orica Works, Greenleaf Road, Kooragang Island, Newcastle, NSW* – Traffic Impact Statement.
- *AECOM (2009),Orica – Proposed Ammonium Nitrate Facility Expansion* – Environmental Assessment.
- URS Australia Pty Ltd, (2009).*Steel River Glass Wool Manufacturing Plant* – Transport and Accessibility Assessment.
- EMGA | Mitchell McLennan, (2010*), The Terminal 4 Project* – Preliminary Environmental Assessment Report.

- GHD, (2010).*Orica Australia Ammonium Nitrate Facility Upgrade* – Construction Traffic Management Plan.
- Worley Parsons, (2010).*Capital Strategic Dredging Project (MP10_0203)* – South Arm, Hunter River, Preliminary Environmental Assessment.
- In addition, reports containing traffic volume information published by the Roads and Traffic Authority, including the 2004 AADT Report for the Northern Region and the 2005 AADT Report for the Sydney Region were used as reference materials.

The PEA for the Project assessed that traffic impacts from the Project would have a negligible impact on the local or regional road network. It noted that a dredging strategy would be developed upon completion of further geotechnical and geochemical testing. The PEA identified that the dredged material would be disposed via three basic options:

- Offshore disposal.
- Beneficial reuse.
- Treatment of contaminated sediments for subsequent reuse or disposal.

The PEA anticipated that approximately 62 percent of spoil would be suitable for beneficial reuse such as in reclamation works, as fill material or as beach nourishment. The remaining 38 percent would not be suitable for reuse because of geotechnical properties, and part of this could be disposed offshore. It did not identify what proportion of this 38 percent would be suitable for sea dumping, and what proportion would require treatment and disposal to landfill.

14.2.2 Legislation and Guidelines

The assessment of traffic impacts have been based following the *Guide to Traffic Generating Developments* (RTA, 2002).

14.2.3 Methodology

The assessment of traffic impacts has been undertaken in accordance with the guidelines provided in the *Guide to Traffic Generating Developments* (RTA, 2002). The assessment of traffic impacts of the proposed activities relate to the following:

- Disposal of spoil material via truck transport from the Port of Newcastle to Kemps Creek in Western Sydney.
- Traffic generated by staff working on the dredging project as they travel to and from work at the Port of Newcastle.

The methodology for assessing traffic impacts of the dredging proposal involved the following tasks:

- Establishing existing traffic conditions.
- Estimating the volume of spoil requiring transportation by road.
- Calculating required truck movements to haul the material out.
- Assessing the likely distribution routes for the transportation of the material.
- Estimating the number of staff and likely travel modes.

- Estimating the number of staff trips onto the surrounding road network.
- Assessing the performance of affected road sections and intersections with additional truck and staff movements.
- Providing mitigation measure to reduce or eliminate traffic impacts.

Key Road Corridors

The key roads that comprise the route for spoil disposal in the vicinity of the Port of Newcastle are:

Cormorant Road (MR 108) – comprises the key road link within Kooragang Island and links with the regional road network. It is part of Main Road (MR) 108, and is classified as a state road under the jurisdiction of the RTA (now RMS). To its west, it connects with the Tourle Street Bridge of the South Arm of the Hunter River and to Industrial Drive (MR 316) in the south. To the east it links with Teal Street and the eastern portion of South Arm Road to the Stockton Bridge over the North Arm of the Hunter River, and eventually to Nelson Bay Road. It caters to through traffic movements and provides access to the industrial locators on Kooragang Island. Cormorant Road is a two lane undivided road with a posted speed limit of 80 km/h in its central section.

Tourle Street – links Cormorant Road on the north side of the South Arm of the Hunter River, with Industrial Drive in the south. The Tourle Street Bridge, which carries an average daily traffic volume of about 24,000 vehicles, was recently upgraded with the new bridge structure accommodating one lane in each direction. The old Tourle Street Bridge was closed to traffic when the new bridge opened.

Industrial Drive (MR 316) **–** is a major road under the jurisdiction of the RTA (now RMS) linking the Honeysuckle area of the Newcastle CBD with the Pacific Highway in Maitland, and serves as the main access route to the Port of Newcastle. Industrial Drive is generally a four-lane divided road with a speed limit of 80 km/h.

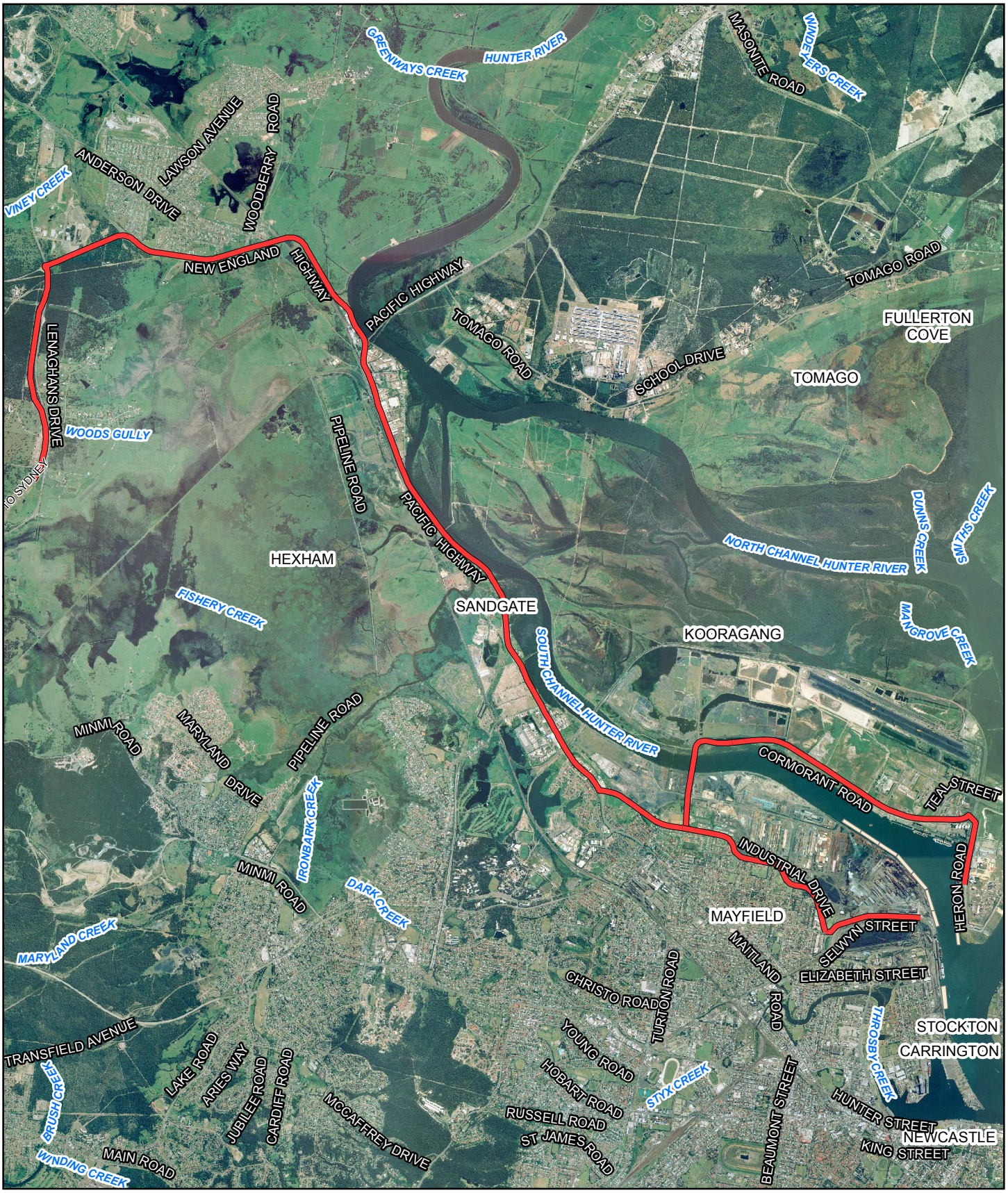
Pacific Highway (Maitland Road) – is a regional arterial road linking New South Wales and Queensland. The section of the Pacific Highway between Industrial Drive and the New England Highway is a divided carriageway with generally two through traffic lanes in each direction. There is provision for turn lanes at approaches to key intersections, as well as marked on-road cycle lanes. It links with the Sydney-Newcastle Freeway via John Renshaw Drive in Beresfield.

The other road corridors proposed to be used for hauling spoil material include:

- John Renshaw Drive.
- Sydney-Newcastle Freeway (F3).
- Pennant Hills Road.
- M2 Motorway.
- M7 Motorway.
- Elizabeth Drive to Kemps Creek, Sydney.

These roads are all designated heavy vehicle routes.

Figure 14.1 shows the proposed haul route to the Sydney-Newcastle Freeway (F3) for the spoil material to be transported out of the Port of Newcastle. Figure 14.2 shows that the proposed haul routes are designated B-Double routes.



LEGEND

Proposed Spoil Haul Route

1:75,000 (at A4)

0 275 550 1,100 1,650 2,200

Metres

Map Projection: Transverse Mercator
Horizontal Datum: Geocentric Datum of Australia (GDA)
Grid: Map Grid of Australia 1994, Zone 56

N

GHD CLIENTS | PEOPLE | PERFORMANCE

NEWCASTLE PORT CORPORATION

Newcastle Port Corporation
Capital Strategic Dredging EA

Job Number 22-15683
Revision 0
Date 10 SEP 2012

Proposed Spoil Haul Route

Figure 14.1

Level 3, GHD Tower, 24 Honeysuckle Drive, Newcastle NSW 2300 T 61 2 4979 9999 F 61 2 4979 9988 E ntlmail@ghd.com.au W www.ghd.com.au

G:\22\15683\GIS\Maps\Deliverables\Environmental Assessment\Traffic & Transport\2215683_T001_Traffic_HaulRd_Locality_20110818_A.mxd

Data Source: LPMA: Imagery - 2007; LPMA: DTDB - 2007. Created by: gmcdiarmid, fmackay, tmorton

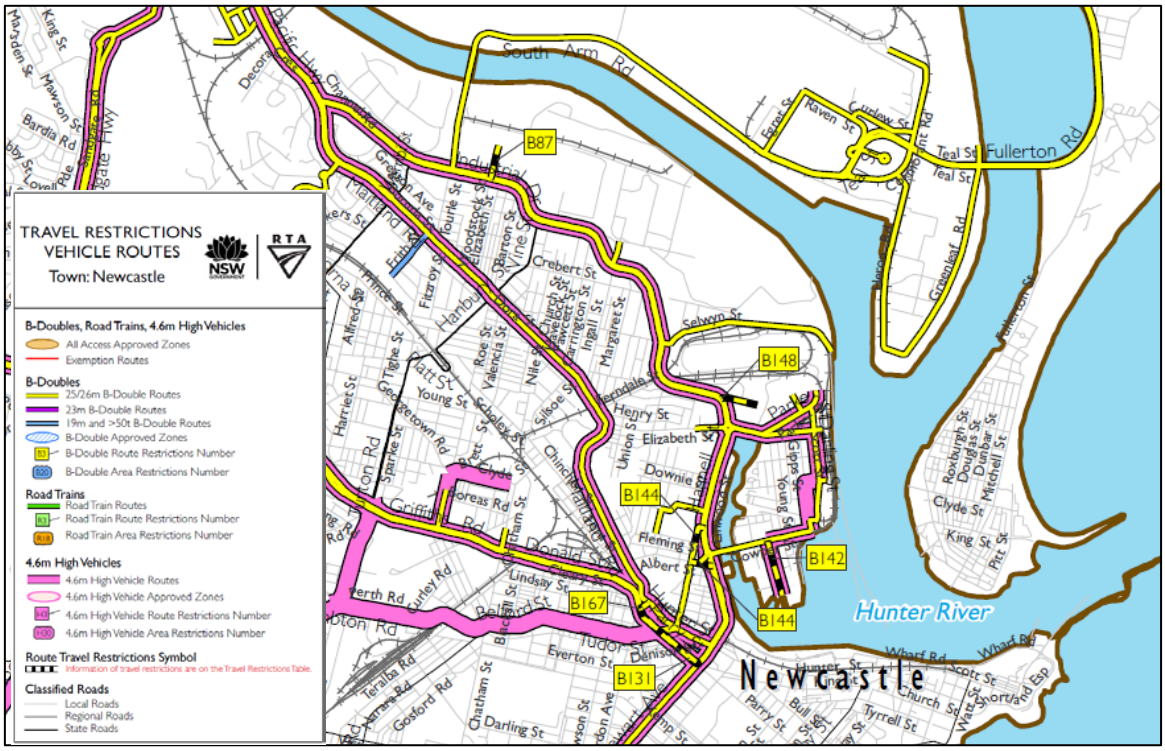


Figure 14.2 Approved B-Double Routes – Road Network Surrounding Port of Newcastle

Source: http://www.rta.nsw.gov.au/heavyvehicles/downloads/rav_maps/rav_nswtowns/rav_nsw_towns_newcastle.pdf

Traffic Volumes

Traffic volumes on the likely haul route between Newcastle and Sydney are given in Table 14-2. These are based on available traffic information.

Table 14-2 Daily Traffic Levels

Road	Location	AADT	Year of Count
Cormorant Road / Tourle Street	North of Industrial Drive	24,052	2004
Industrial Drive	East of Tourle St	30,717	2004
Maitland Road / Pacific Hwy	Sandgate, south of Wallsend Road	40,947	2004
New England Highway	Near Hexham Bridge	64,300	2004
John Renshaw Drive	Between F3 and Pacific Highway	19,600	2004
Sydney- Newcastle Fwy	Beresfield, south of John Renshaw Drive	32,997	2004
Pennant Hills Road	Carlingford, west of Marsden Rd	35,018	2008
M2 Motorway	West of Pennant Hills Road	81,550	2009
M7 Motorway	Western Sydney	136,076	2010
Elizabeth Drive	Kemps Creek, at South Creek Bridge	9,757	2005

Source: Roads and Traffic Authority, Transurban.

14.3 Potential Impacts

The Project has the potential to impose impacts on traffic conditions surrounding the site, and along the proposed route to be used for the disposal of spoil material that is not suitable for sea dumping disposal. Transport of the spoil material to the receiving site will be via road haulage, which will impact on existing road network operations, albeit very marginally. The impacts assessed in this section are based on the scenario that all berths are dredged during a single campaign. As described in Section 2.4, it is unlikely that dredging would be undertaken at all twelve berths simultaneously, but rather in a series of smaller work packages. However, to assess the highest possible level of impact, this assessment has considered twelve berths being dredged during a single campaign.

In addition to the direct traffic impacts generated by the hauling of spoil material unsuitable for reuse or sea dumping, traffic generated by staff involved in the dredging operations travelling to and from the worksite on a day-to-day basis will also bring impacts to surrounding traffic operations.

It has been estimated that a total of 10 full time staff will be required for the dredging operations. This estimate has been derived based on similar dredging operations in Newcastle undertaken recently.

The traffic volumes generated by staff journeys-to-work are likely to coincide with peak traffic periods. However, given the low traffic volumes generated by staff movements, their impacts are not likely to adversely affect peak period traffic operations to a significant level. Nevertheless, they have been included in this assessment for completeness.

14.3.1 Generated Traffic

Current assumptions used in calculating traffic generation:

- Volume for haul = 1.6 percent of total sediment. This figure of 32,500 cubic metres is comprised of up to 30,000 cubic metres of river sediment from Walsh Point, and 2,500 cubic metres from Mayfield 1 and 2.
- Road hauling to use truck and dog combination at 14 cubic metres per truck.
- Total hauling duration = 60 days.
- Staff numbers = 10.
- Car mode share for staff journeys-to-work = 95 percent.

Total truck volumes generated = 74 two-way truck trips per day.

Total staff traffic generated = 19 two-way car trips per day.

14.3.2 Haul Equipment

In order to minimise heavy vehicle movements, the spoil disposal will be undertaken using truck and dog trailers, with an estimated capacity of 14 cubic metres.

14.3.3 Road Traffic Impacts of Project

The share of Project generated road traffic compared with daily traffic volumes for the affected road corridors is given in Table 14-3. The resultant shares of generated traffic compared with overall daily traffic on the affected roads can be considered minor. The levels of project generated traffic are well within the daily fluctuation of traffic volumes on these roads, thus can be absorbed by the traffic network without significant change in existing levels of service of traffic performance.

Table 14-3 Impacts of Generated Traffic

Road Section	Daily Traffic Volumes	Share of Haul Trips	Share of Staff Trips	Share of Total Generated Traffic
Cormorant Road / Tourle Street	24,052	0.31%	0.08%	0.39%
Industrial Drive	30,717	0.24%	0.06%	0.30%
Maitland Road / Pacific Highway	40,947	0.18%	-	0.18%
New England Highway	64,300	0.11%	-	0.11%
John Renshaw Drive	19,600	0.38%	-	0.38%
Sydney- Newcastle Freeway	32,997	0.22%	-	0.22%
Pennant Hills Road	35,018	0.21%	-	0.21%
M2 Motorway	81,550	0.09%	-	0.09%
M7 Motorway	136,076	0.05%	-	0.05%
Elizabeth Drive	9,757	0.76%	-	0.76%

14.3.4 Impacts on Intersection Operations

Based on the project-generated traffic volumes being very minor, the impacts on intersection operations would be minimal. To further mitigate potential impacts on the operation of the Industrial Drive – Tourle Street intersection due to the transport of spoil material by road, truck movements may be scheduled to avoid peak traffic periods. This would aid in maintain the levels of service of intersections at current levels.

14.4 Recommended Mitigation Measures

The following strategies are recommended to mitigate the impacts of the traffic generated by the Project:

- Designation of temporary stockpile location for spoil material unsuitable for reuse within Port of Newcastle, in order to manage the volume of spoil material required to be transported by road.
- The spoil disposal route from Newcastle to Sydney should be limited to designated heavy vehicle routes, as follows:
  - Cormorant Road-Tourle Street-Industrial Drive or Selwyn Street-Industrial Drive.
  - Pacific Highway/Maitland Road-New England Highway-John Renshaw Drive-Sydney-Newcastle Freeway.
  - Pennant Hills Road-M2 Motorway-Westlink M7 Motorway-Elizabeth Drive to Kemps Creek, Sydney.
- Hauling of spoil should use truck and dog combination with capacity of 14 cubic metres each, to minimise required number of heavy vehicle movements.
- The dispatch of trucks from the Port of Newcastle need to be managed so as not to occur during peak travel periods.

15. Flora and Fauna

Flora and fauna were listed as key issues in the DGRs. This chapter addresses the DGRs for the assessment of flora and fauna and considers the requirements of relevant Government agencies that were attached to the DGRs. Agency requirements considered in this assessment include those of NSW Office of Environment and Heritage (OEH), Industry & Investment (Fisheries) and NSW Office of Water (NOW). This chapter closely relates to Chapter 8 (Sediment and Water Quality) and Chapter 10 (Hydrology). Appendix G provides a copy of the Flora and Fauna Database Search Results.

The DGRs for the Flora and Fauna component of the EIS are provided in Table 15-1.

Table 15-1 Ecology DGRs

Environmental Impact Statement Requirements	Where Addressed
Assess potential impacts on threatened populations and ecological communities, and critical habitat.	Section 15.3 (Potential Impacts on Flora and Fauna)
Consider the impacts on estuarine ecosystems, wetlands and mangroves up-river of the dredging operation, and the potential mobilisation of sediment on aquatic fauna.	Section 15.3 (Potential Impacts on Flora and Fauna) and Chapter 10 (Hydrology)
Take into account the *Draft Guidelines for Threatened Species Assessment* (DEC).	Section 15.2.1 and 15.2.2 (Relevant Legislation and Relevant Guidelines)

15.1 Introduction

The Project would disturb river sediment through dredging activities. Foreshore treatment works have the potential to affect water quality through erosion. Therefore, the Project has the potential to affect aquatic flora and fauna species and aquatic habitat quality.

Species that utilise the river in the area of the berths may be directly affected by dredging. Through impacts to water quality, the Project also has the potential to affect flora and fauna species not in the immediate vicinity of the sites.

The flora and fauna assessment was conducted using a range of methods. These methods are described in detail in Section 15.2.15. Relevant legislation and guidelines were referenced in preparing the methodology for the assessment. The assessment included a review of existing studies undertaken in the area of the Project. Relevant databases were searched to determine threatened species and ecological communities that have been previously recorded in the area. A site visit was conducted to assess the potential for the area to support habitat suitable for threatened species.

The assessment of the Project's potential impacts on flora and fauna species has considered potential impacts at the site of the works, together with areas up and down stream of the site that may be indirectly affected. The assessment considers relevant legislation and guidelines in assessing the potential impacts, and in preparing the mitigation measures to reduce or eliminate potential impacts.

15.2 Existing Environment

The description of the existing environment provided in this section is based on a review of relevant legislation and guidelines (Section 15.2.1 and 15.2.2), the methodology listed in Section 15.2.15 and the site inspection of Walsh Point.

15.2.1 Relevant Legislation

Legislation considered in the assessment of flora and fauna included, but was not limited to:

- *Commonwealth Environmental Protection and Biodiversity Conservation Act 1999* (EBPC Act).
- *NSW Threatened Species Conservation Act 1995* (TSC Act).
- *NSW Fisheries Management Act 1994* (FM Act).

Environment Protection and Biodiversity Conservation Act 1999

The Commonwealth EPBC Act prescribes the Commonwealth's role in environmental assessment, biodiversity conservation and the management of protected areas and species, populations and communities and heritage items. The approval of the Commonwealth Minister for Sustainability, Environment, Water, Population and Communities is required for:

- An action which has, would have or is likely to have a significant impact on 'matters of national environmental significance' (NES matters).
- An action likely to have a significant impact on the environment in general (for actions by Commonwealth agencies or actions on Commonwealth land) or the environment on Commonwealth land (for actions outside Commonwealth land).

An action is considered to include a project, development, undertaking, activity or series of activities. Matters of NES include World Heritage properties, Ramsar wetlands, nationally threatened species and ecological communities, migratory species, Commonwealth marine areas, nuclear actions and national heritage places.

An EPBC Act protected matters search was undertaken on 25 May 2012 covering the study area plus a 10 kilometre search radius. The protected matters search identifies NES matters that have either been recorded or are predicted to occur within the search area. The matters of NES of relevance to the Project and to the study area (such as the South Arm of the Hunter River) are:

- Ramsar wetlands (Hunter Estuary Wetlands).
- Threatened species.
- Migratory species.

There are no World Heritage properties, Commonwealth marine areas, nuclear actions, threatened ecological communities or National Heritage places within the study area.

The assessment of flora and fauna impacts (Section 15.3) includes an assessment of the Project's potential to have a 'significant impact' on any relevant NES matters.

Threatened Species Conservation Act 1995

The TSC Act provides for listing of threatened species, populations and ecological communities (and their habitats) as well as critical habitat and key threatening processes.

The site was assessed for the potential presence of threatened species, populations and ecological communities listed under the TSC Act. The site of the Project is not located on land that is listed as 'critical habitat' under the TSC Act and no endangered populations or endangered ecological communities are present within the study area.

Potential impacts on threatened species, populations or ecological communities (or their habitats) listed under the TSC Act must be undertaken in the form of an Assessment of Significance, according to the criteria outlined in Appendix 3 of the *Draft Guidelines for Threatened Species Assessment* (DEC and DPI 2005). This assessment of significance is used to determine if the Project is likely to have a significant impact on threatened species (or their habitat) at the site or that have the potential to occur within the study area.

Fisheries Management Act 1994

The FM Act includes provisions to list threatened species of aquatic and marine fauna and marine vegetation, as well as endangered populations, ecological communities and key threatening processes. Marine vegetation, includes mangroves, sea grasses and saltmarsh. Marine vegetation is defined under the FM Act as 'any species of plant that at any time in its life must inhabit water (other than fresh water)'.

Examination of the distributional ranges and habitat requirements of threatened species, populations and endangered ecological communities listed under the FM Act indicates that none are likely to be affected by the Project. Additionally, no key threatening processes listed under the FM Act apply to the Project.

An Assessment of Significance has been undertaken according to the DEC and DPI (2005) guidelines for potential impacts on any threatened aquatic fauna listed under the FM Act.

15.2.2 Relevant Guidelines

This assessment has been prepared with reference to the *Draft Guidelines for Threatened Species Assessment* (DEC & DPI 2005). It includes Assessments of Significance for potential impacts on threatened biota, as well as a justification of the Project against the key thresholds contained within these guidelines.

The DEC (2004) *Threatened Species Survey and Assessment (Working Draft)* guidelines were also considered for this Project, in relation to recommended survey techniques for terrestrial flora and fauna. However, given the highly modified nature of the terrestrial components of the study area and the lack of suitable habitat, surveys for threatened species in accordance with these guidelines were not undertaken.

With regard to consideration of the significance of impacts on matters of NES listed under the EPBC Act, the *Significant Impact Guidelines 1.1* (DEWHA 2009) were addressed (Section 15.2.2).

15.2.3 Terrestrial Habitats

Walsh Point Berth Pocket and Kooragang (K1, W1, W2, and W3)

Walsh Point is located at the eastern end of Kooragang Island. The Walsh Point berth pocket and the Kooragang 1 berth are located on the western side of Walsh Point.

Kooragang Island is approximately 2,600 hectares in size and comprises predominately reclaimed land. The southeastern portion of the island is dominated by light and heavy industrial development, and port related activities (EMGA Mitchell McLennan 2010).

The area of the island immediately adjacent to the Walsh Point berths is owned by Orica Australia Pty Ltd, and contains an ammonium nitrate production facility. The land surrounding the Orica site is used for industrial and port related activities, including a fertiliser storage and despatch facility, bulk goods/exporting operations and storage facilities (ENSR Australia Pty Ltd 2008).

The Orica site and surrounds are highly modified with little value for native flora and fauna. Vegetation at the site primarily comprises grasses and weeds such as Common Couch (*Cynodon dactylon*) and Paspalum (*Paspalum dilatatum*), as well as some landscaped areas containing planted native species. In low-lying areas, *Juncus* spp. and Common Reed (*Phragmites australis*) are common (ENSR Australia Pty Ltd 2008). The areas immediately adjacent to the proposed berths contain hardstand areas and areas of exotic grasses and weeds, with no native vegetation, wetlands or other habitat features.

The northern and western portions of Kooragang Island, approximately 1.5 kilometres from the Walsh Point berth pocket and Kooragang 1, contain estuarine wetlands, mangroves, saltmarsh and forested lands. This area was reserved for conservation as the Kooragang Nature Reserve in 1983. This reserve was subsequently incorporated into the Hunter estuary National Park, and forms part of the broader Hunter estuary Wetlands Ramsar site. This area is known to support a range of threatened and migratory species and threatened ecological communities (ENSR Australia Pty Ltd 2008, EMGA Mitchell McLennan 2010, and NCIG 2006).

Mayfield Berths (M1 to M7)

This area is adjacent to existing industrial land, containing the former BHPB site. The industrial area has been subject to extensive disturbance, through industrial development, past land use practices and recent landside remediation activities (AECOM 2010).

The land directly adjacent to these berths does not contain any trees or remnant native vegetation, and is dominated by hardstand areas and exotic weeds and shrubs. There is no habitat for threatened ecological communities, flora or fauna within this area, nor any habitat for migratory species which may utilise Kooragang Island.

Dyke 3 (D3)

The landside environment of D3 is comprised entirely of concrete hardstand, with port related infrastructure, including rail lines, buildings, transmission lines and other ancillary structures. Similar to Mayfield, there is no habitat for threatened ecological communities, flora or fauna within this area, nor any habitat for migratory species which may utilise Kooragang Island.

15.2.4 Terrestrial Flora and Fauna

Flora

Mostly introduced flora species were recorded at the Walsh Point berth during the site visit. These species are all common and widespread within south-eastern Australia and are typical of disturbed estuarine environments within or adjoining industrial areas. Table 15-2 lists the terrestrial flora species recorded during the site visit at Walsh Point. A total of 18 plant species were recorded, of which only two are native species.

Table 15-2 Flora Species Recorded at Walsh Point

Common Name	Scientific Name
African Love Grass	*Eragrostis curvula**
Bitou Bush	*Chrysanthemoides monilifera* subsp. *rotundata***
Buffalo Grass	*Stenotaphrum secundatum**
Clover	*Trifolium subterraneum**
Couch	*Cynodon dactylon*
Cudweed	*Gamochaeta* sp.*
Fennel	*Foeniculum vulgare**
Grey Mangrove	*Avicennia marina* subsp. *australasica*
Kikuyu	*Pennisetum clandestinum**
Marine Couch	*Sporobolus virginicus*
Parramatta Grass	*Sporobolus africanus**
Paspalum	*Paspalum dilatatum**
Perennial Ryegrass	*Lolium perenne**
Plantain	*Plantago lanceolata**
Scarlet Pimpernel	*Anagallis arvensis**
White Evening Primrose	*Oenothera speciosa**
Wild Oats	*Avena fatua**
Winter Grass	*Poa annua**

** introduced species*

*** introduced species that are declared noxious weeds in the Newcastle Local Government Area*

Fauna

Table 15-3 lists the terrestrial fauna species recorded during the Walsh Point site visit. Six bird species were recorded at the site. Five were native species and one was an introduced species. The individuals recorded were either in flight above the site, foraging in the Hunter River or foraging over the exotic grassland of Walsh Point.

Less open grassed habitat is available at the Mayfield and Dyke Point sites. Although a similar suite of species has the potential to occur at these other Sites, the concrete hardstand environments and lack of open grassed areas reduces their likely use of these areas.

A range of other fauna species have the potential to occur on the disturbed landside environments of Walsh Point, Mayfield and Dyke Point. Fauna groups with the greatest likelihood of occurring at these sites include:

- Introduced ground mammals – the European Rabbit and Red Fox. Walsh Point's substrate is sandy and therefore burrowing ground mammals could build warrens or burrows within the grassy areas and foreshore banks of Walsh Point Reserve. Rabbits were observed in the area during the site visit and foxes have been recorded in the Newcastle locality. Native ground mammals are not likely to be present at Walsh Point owing to the built up nature of the site, its isolation from natural bushland habitats and the likely presence of feral predators. The concrete hardstand environments at Mayfield and Dyke Point do not provide suitable habitat for native ground mammals.
- Bats – individuals of some native microchiropteran bat species, as well as the Grey-headed Flying Fox, could occur in flight above the site during nocturnal foraging activities. However, there is no roosting or breeding habitat for bats within the sites.
- Reptiles – a small selection of common native reptiles, such as the Garden Skink (*Lampropholis guichenoti*) and the Eastern Water Skink (*Eulamprus quoyii*) are likely to utilise the grassland and rocky intertidal zone.
- Amphibians – there are no freshwater wetland habitats present (whether artificial or naturally occurring) that would provide suitable habitat for amphibians at Walsh Point, Mayfield or Dyke Point.

Table 15-3 Fauna Species Recorded at Walsh Point

Common Name	Scientific Name
Australian Raven	*Corvus coronoides*
Common (Indian) Myna	*Acridotheres tristis**
Little Black Cormorant	*Phalacrocorax carbo*
Magpie Lark	*Grallina cyanoleuca*
Pelican	*Pelecanus conspicillatus*
Richard's Pipit	*Anthus novaeseelandiae*

**note: species marked with an asterisk are introduced species*

Umwelt (2009) conducted a flora and fauna investigation of the Kooragang Island Terminal 4 site, located approximately two kilometres north-west of the study area. A similar suite of fauna, to that recorded at Walsh Point, was recorded in that study.

A similar suite of fauna species have the potential to occur at the Mayfield and Carrington sites, although no grassy areas are present at these sites. Therefore the range of fauna species potentially occurring at these sites is expected to be less than that at Walsh Point.

Noxious Weeds

The only noxious weed recorded at Walsh Point during the site visit was Bitou Bush (*Chrysanthemoides monilifera*). This is listed as a Class 4 noxious weed under the *Noxious Weeds Act 1993* in the Newcastle Local Government Area. This Act requires that the growth and spread of the plant must be controlled according to the measures specified in a management plan published by the local control authority.

Hardstand areas at Mayfield and Dyke Point show evidence of weed infestation in concrete cracks and remaining cleared areas. No noxious weeds were identified immediately adjacent to the proposed berths.

15.2.5 Estuarine Habitats

The environment of the Hunter River estuary is highly modified due to past dredging activities, land reclamation, port infrastructure and industrial land uses. Maintenance dredging activities have been undertaken in the Port for over 100 years, with an average of approximately 400,000 cubic metres of material dredged from the Port every year (Worley Parsons 2009).

The berths have been subject to previous dredging and are subject to ongoing port related activities, including ship movements and periodic maintenance dredging. The intertidal zone of the berths is largely artificial, comprising rock revetment walls. The estuarine sands, silts and muds on the river floor would provide habitat for organisms commonly found on rocky shores and within the benthos, such as macroinvertebrates, mollusc and crustaceans.

No seagrass habitat has been mapped in the Hunter River estuary. No mangroves or saltmarsh habitats have been mapped within the study area, or within the lower South Arm of the Hunter River (I&I NSW 2009). However, it was noted during the site inspection that three isolated individuals of Grey Mangrove (*Avicennia marina*) have established in the rocky intertidal area (on reclaimed land) at Walsh Point.

Walsh Point Pocket and Kooragang (K1, W1, W2, and W3)

Walsh Point contains a rocky intertidal area at the base of the severely eroded artificial bank. The area is reclaimed land and provides limited aquatic habitat. The rocky shoreline is exposed only during the outgoing tide and is dominated by rubble, small areas of exposed sand/mudflat, debris and rubbish.

There are very limited areas of exposed sand at low tide that would provide marginal foraging habitat for shorebirds (including migratory birds). Hence, the Walsh Point berth does not contain any substantial or important habitats of relevance for shorebirds or other terrestrial fauna.

Mayfield Berths (M1 to M7)

Estuarine habitats in the vicinity of the Mayfield berths are described in AECOM (2010). AECOM report that there was a small (approximately 5 x 15 metre) stand of Grey Mangrove (*Avicennia marina*) in the northern edge of the BHPB site, in the vicinity of the proposed M7 berth. Approval and appropriate permits from the NSW Department of Primary Industries were granted to clear this stand of vegetation as part of BHP's Hunter River Remediation Project (AECOM 2010). This stand of mangroves has been removed.

Mangroves were also recorded growing along the benches of the 'Eastern Drain', which runs parallel to Selwyn Street at the south of the site and discharges to the Hunter River in the vicinity of proposed berth M1. These mangroves established at the site after the construction of the drain, but would not be affected by the Project.

Dyke 3 (D3)

The aquatic environment of D3 is similar to the other sites, in that there is no marine vegetation, including mangroves, salt marsh or sea grass present. A combination of estuarine silts, sands and muds would comprise the sea bed of D3, as with the other berths.

15.2.6 Aquatic Flora (Marine Vegetation)

Mapping of the estuarine habitats of the lower Hunter River by I&I NSW (2009) indicates that there are no stands of estuarine vegetation within the study area. A review of available literature and reports, combined with observations during site inspections, indicates that there is no sea grass, saltmarsh, mangroves or other marine vegetation occurring within the berths. An exception is the presence of isolated individuals of Grey Mangrove (*Avicennia marina*) in the rocky intertidal area at Walsh Point. Therefore, no surveys for aquatic flora were conducted as part of the current investigation.

15.2.7 Aquatic Fauna

A range of aquatic fauna occur throughout the Hunter estuary. Major faunal groups include fish, crustaceans and benthic invertebrates. Over 100 species of fresh and saltwater fish have been recorded in the Hunter estuary since 1975, of which 32 species are economically important (Patterson Briton, 2003). Aquatic faunal habitats closely follow the aquatic floral habitat types of the wider estuary, namely tidal saltmarsh flats and mangrove stands. Other aquatic faunal habitats comprise saline open water bodies, fresh open water bodies and wetlands, artificial structures and bare sandy sites.

Fish and crustaceans in the Hunter estuary are primarily affected by the availability of nursery habitats (saltmarsh flats and mangrove stands) during their juvenile stages. Mature individuals (in later life stages) are more widespread throughout the estuary and into the open fresh and saline water bodies. Mature species aggregate around structures and forage over bare sandy substrates.

Benthic invertebrates are generally less mobile, with successional changes in community composition a common occurrence. Benthic invertebrates are influenced by a wide variety of physical and chemical parameters such as substrate composition, water temperature, depth, dissolved oxygen concentrations, pH, salinity, sediment carbon: nitrogen (C/N) ratios and hydrography.

15.2.8 Threatened Biota

A summary of threatened species known or predicted to occur in the locality, along with their habitat requirements and likelihood of occurrence within the study area, is provided in Appendix G (Flora and Fauna Database Search Results).

Records of threatened flora and fauna listed under the TSC Act from within a 10 kilometre radius of the locality obtained from the Office of Environment and Heritage (OEH) Atlas of NSW Wildlife database are presented in Appendix G (Flora and Fauna Database Search Results).

Threatened Terrestrial Species (TSC Act)

A search of the OEH Atlas of NSW Wildlife database records in 25 May 2012 indicates that 73 threatened species, as listed under the TSC Act, have been previously recorded within 10 kilometres of the study area. The database search results are provided in Appendix G. Additionally, the location, distribution and habitat requirements for these species are detailed in Appendix G, along with an assessment of the likelihood of occurrence of each species within the study area. The Wildlife Atlas records for the locality include:

- 14 threatened flora, all of which are terrestrial. Based on species distribution ranges, their habitat requirements and the nature and condition of habitats within the study area, none are considered likely to occur within the study area.
- 59 threatened fauna, comprising 45 bird, 12 mammal, and 2 frog species. Based on the ecological habitats, distribution ranges, and habitat requirements of these species and on the nature of the habitats present within the study area, there is very limited potential for threatened species to occur on the sites.

The search results are provided in Appendix G (Flora and Fauna Database Search Results).

Endangered Populations (TSC Act)

A search of the on-line OEH threatened species database for threatened biota with the Hunter CMA subregion (dated 4 June 2012) indicates that six endangered populations, as listed under Schedule 1 (Part 2) of the TSC Act, occur within the subregion:

- Weeping Myall (*Acacia pendula*) population in the Hunter catchment.
- Emu population in the New South Wales North Coast Bioregion and Port Stephens local government area..
- River Red Gum (*Eucalyptus camaldulensis*) population in the Hunter Catchment
- *Leionema lamprophyllum* subsp. *obovatum* – endangered population in the Hunter catchment
- *Cymbidium canaliculatum* population in the Hunter Catchment
- Pine Donkey Orchid (*Diuris tricolor)* population in the Muswellbrook local government area

The location, distribution and habitat requirements for these populations are detailed in Appendix G. The assessment of likelihood of occurrence for these six populations (Appendix G) concludes that none would occur within the study area. In the case of the Weeping Myall, River Red Gum, *Leionema lamprophyllum* and *Cymbidium canaliculatum* populations, these populations are located in the middle to upper Hunter Valley and are not recorded from the locality of the study area.

The *Diuris tricolor* population is restricted to the Muswellbrook local government area and would therefore not occur within the locality.

The *Cymbidium canaliculatum* population may occur north of the Hunter River within the locality; however there is no suitable habitat for this species within the study area.

The endangered population of the Emu is known to occur within Port Stephens LGA. The southern extent of Port Stephens LGA is located within two kilometres to the north and northeast of the study area at its closest point. However, this part of Port Stephens is separated from the study area by the open water of the Hunter River (North Arm). Based on the lack of suitable habitat within the study area and its isolation from nearby areas of habitat within Port Stephens LGA, there is no likelihood that Emus would occur within the study area.

Threatened Ecological Communities (TSC Act)

A search of the OEH on-line database of threatened biota indicates that 18 threatened ecological communities (TECs), comprising 16 endangered ecological communities and two vulnerable ecological communities, are known or predicted to occur within the Hunter CMA subregion. The habitat requirements and geographical distributions of these communities are listed in Appendix G, along with the likelihood of occurrence of each community. The assessment indicates that, based on either their known distributions or on a lack of suitable habitat at the site, that none of the TECs recorded within the CMA subregion are likely to occur within the study area.

Mapping prepared for Lower Hunter Central Coast Regional Environmental Management Strategy (LHCCREMS) indicates that there are several TECs mapped in the locality of the study area, but none are mapped as occurring within (or adjacent to) the proposed sites. Figure 15.1 shows the distribution of native vegetation types within the locality. Two TECs are mapped within the locality: *Swamp Sclerophyll Forest on Coastal Floodplains of the New South Wales North Coast, Sydney Basin* and *South East Corner Bioregions* and *Swamp Oak Floodplain Forest of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions* (Appendix G). However, there is no evidence of these two TECs within the study area.

Threatened Fish and Aquatic Species (FM Act)

The I&I NSW Threatened and Protected Species Record Viewer (accessed 25 May 2012) does not reveal any records of threatened fish, as listed under the *Fisheries Management Act 1994* (FM Act), within a 10 kilometre radius of the study area.

The Black Cod (*Epinephelus daemelli*), which is listed as 'vulnerable' under the FM Act and EPBC Act, inhabits inshore marine caves and rocky reefs with larger juveniles found around rocky shores in estuaries. The local occurrence of Black Cod is known to be restricted to the northern section of the break wall at the entrance to Newcastle Harbour (i.e. the mouth of the Hunter River) and is not likely to occur within or near to the study area (Worley Parsons 2009). On this basis, the Black Cod is not likely to occur within the South Arm of the Hunter River or within the study area.

15.2.9 SEPP 14 Wetlands

There are no *State Environmental Planning Policy No 14 – Coastal Wetlands* (SEPP 14) wetlands located within the study area. SEPP 14 wetlands associated with the Hunter estuary wetlands complex are located several kilometres upstream of the study area.

The closest SEPP 14 wetland is No. 849, which lies on the eastern foreshore of the North Arm, approximately 2.6 kilometres upstream of the Dyke 3 berth. Upstream of the study area on the South Arm, the closest SEPP 14 wetland is No. 844a, which lies 3.5 kilometres upstream of the Mayfield berths (M7 is the closest berth to the SEPP 14 wetland). Figure 15.2 shows the location of this wetland in relation to the Project area.

LEGEND

Vegetation Type

- Beach Spinifex
- Coastal Foothills Spotted Gum - Ironbark Forest
- Coastal Plains Smooth-barked Apple Woodland
- Coastal Sand Apple - Blackbutt orest
- Coastal Sand Scrub
- Coastal Wet Sand Cyperoid Heath
- Mangrove-Estuarine Complex
- Swamp Mahogany - Paperbark Forest
- Swamp Oak Rushland Forest
- Endangered Ecological Communities *
- Study Area Locality
- Berth Locations

*** Source:** Inferred from LHCCREMS (2005)

1:50,000 (at A4)

0 250 500 1,000 1,500 2,000

Metres

Map Projection: Transverse Mercator
Horizontal Datum: Geocentric Datum of Australia (GDA)
Grid: Map Grid of Australia 1994, Zone 56

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Job Number 22-15683
Revision 0
Date 10 Sep 2012

Threatened Ecological Communities within the Locality of the Study Area

Figure 15.1

Level 3, GHD Tower, 24 Honeysuckle Drive, Newcastle NSW 2300 **T** 61 2 4979 9999 **F** 61 2 4979 9988 **E** ntlmail@ghd.com.au **W** www.ghd.com.au

G:\22\15683\GIS\Maps\Deliverables\Environmental Assessment\Flora & Fauna\2215683_E003_EcoCommunities_20120910_0.mxd

Data Source: LPMA: DTDB - 2007, Imagery - 2007; LHCCREMS: Vegetation - 2005. Created by: gmcdiarmid, fmackay, mbarnier

LEGEND

Study Area Locality

Berth Locations

849 SEPP14 Wetlands (& No.)

1:50,000 (at A4)

0 180 360 720 1,080 1,440

Metres

Map Projection: Transverse Mercator

Horizontal Datum: Geocentric Datum of Australia (GDA)

Grid: Map Grid of Australia 1994, Zone 56

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SEPP14 Wetlands within the Locality of the Study Area

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Figure 15.2

Level 3, GHD Tower, 24 Honeysuckle Drive, Newcastle NSW 2300 T 61 2 4979 9999 F 61 2 4979 9988 E ntlmail@ghd.com.au W www.ghd.com.au

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Data Source: LPMA: DTDB - 2007, Imagery - 2007; DEWHA: SEPP14 Wetlands - 2008. Created by: gmcdiarmid, fmackay

15.2.10 Threatening Processes

The following key threatening processes (KTPs) listed under the TSC, FM and EPBC Acts are currently operating or would have operated within the study area in the past:

EPBC Act

- Injury and fatality to vertebrate marine life caused by ingestion of, or entanglement in, harmful marine debris.
- Land clearance.
- Loss and degradation of native plant and animal habitat by invasion of escaped garden plants, including aquatic plants.

TSC Act

- Clearing of native vegetation.
- Invasion of native plant communities by Bitou Bush and Boneseed.
- Invasion of native plant communities by exotic perennial grasses.
- Invasion, establishment and spread of Lantana.
- Entanglement in, or ingestion of anthropogenic debris in marine/estuarine environments.

Alteration to the natural flow regimes of rivers, streams, floodplains and wetlands.

FM Act

- Introduction of non-indigenous fish and marine vegetation to coastal waters of NSW.
- Installation and operation of instream structures and other mechanisms that alter natural flow regimes of rivers and streams.
- Degradation of native riparian vegetation along NSW waterways.

The only KTP applicable to the Project is the alteration of the natural flow regime of the Hunter River. As discussed in Chapter 10 (Hydrology), the proposed dredging works are not likely to cause a significant change to the hydrology of the lower Hunter River. Hence the Project is not likely to significantly increase the operation of this KTP in the locality.

15.2.11 Critical Habitat

There is no critical habitat listed on the OEH, DSEWPaC or DPI registers of critical habitat for threatened biota in the locality (OEH 2011a, DSEWPaC 2009, DPI 2011).

15.2.12 Groundwater Dependent Ecosystems

There are no stands of terrestrial or wetland vegetation, and hence no groundwater dependent ecosystems, within the study area. The Hunter estuary wetlands are likely to receive groundwater inflow and therefore could be considered to be groundwater dependent. However, the Project is not likely to have any substantial effect on groundwater inflow to the Hunter wetlands system and therefore is not likely to have an adverse effect on groundwater dependent ecosystems in the locality.

15.2.13 EPBC Act Protected Matters Search

A search of the DSEWPaC Protected Matters Database for matters of NES was undertaken on 25 May 2012. The Protected Matters search results are provided in Appendix G (Flora and Fauna Database Search Results). The search results indicate the following matters of NES (or their habitats) could occur within the locality:

- One Ramsar wetland.
- Two threatened ecological communities.
- 56 threatened species.
- 68 migratory species.

A discussion of the potential occurrence of these matters within the study area is provided below.

Threatened Ecological Communities

Two threatened ecological communities listed under the EPBC Act are predicted to occur within the locality including White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland (critically endangered) and Lowland Rainforest of Subtropical Australia (critically endangered). However, there is no evidence of these communities within the study area. Additionally, the study area is outside of the known distributional range of White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland community (DEC 2005). Hence, there is no likelihood that these ecological communities occur within the study area.

Threatened Species

A total of 56 threatened species listed under the EPBC Act (and/or their habitats) are predicted to occur within 10 kilometres of the study area. The species list comprises 22 bird, one fish, two frogs, 10 mammals, 11 plants, six reptiles and four sharks. Based on species distribution ranges, habitat requirements and the nature and condition of the habitats within the study area, no such threatened species are considered likely to utilise the study area, on other than a transient basis (such as aerial species occurring above the study area).

Listed Migratory Species

A total of 68 migratory species (or their habitats) listed under the EPBC Act are predicted to occur within 10 kilometres of the study area, comprising 20 migratory marine bird species, 16 migratory marine species, seven migratory terrestrial species and 25 migratory wetland (bird) species. Based on the distribution ranges and habitat requirements of these species and the nature of the site, there is a low likelihood of migratory species occurring within the site. Given the location of the site near the Hunter Estuary and associated wetlands at the nearby Kooragang Island, individuals of some of these species can be expected to occur in flight above the site on a seasonal basis. However, as the site does not provide roosting, nesting or foraging habitat for the listed migratory birds, their occurrence within the site would be on a transient basis only.

Wetland of International Significance (Ramsar Wetland)

The Hunter estuary Wetlands Ramsar site lies within the locality, approximately 5 kilometres upstream of the study area on the South Arm (although the boundary of the wetlands does not intersect the channel of the South Arm), and approximately 3 kilometres upstream of D3 on the North Arm, as shown on Figure 15.3.

The Hunter estuary Wetlands Ramsar site comprises two components, the Hunter Wetlands National Park[1] and Shortland Wetlands (the Hunter Wetlands Centre). Hunter Wetlands National Park is located in the estuary of the Hunter River, approximately 7 kilometres north of Newcastle. The Hunter Wetlands Centre lies 2.5 kilometres south-west of Hunter Wetlands National Park at Hexham (Figure 15.3). Although the sites are not contiguous they have significant linkages, both hydrologically and by a wildlife corridor consisting of Ironbark Creek, the Hunter River and Ash Island (DSEWPaC 2011).

Hunter Wetlands National Park includes Kooragang Island and Fullerton Cove, two areas that lie in the estuarine section of the Hunter River. Habitat types within the National Park include mangrove forests dominated by Grey Mangrove, Samphire saltmarsh, Paperbark and Swamp She-oak swamp forests, brackish swamps, mudflats, and sandy beaches (DSEWPaC 2011).

Hunter Wetlands Centre is a small but unique complex of wetland types surrounded by urban development along three boundaries. Habitat types at the Hunter Wetlands Centre include restored semi-permanent/seasonal freshwater ponds and marshes, natural semi-permanent/seasonal brackish ponds and marshes, freshwater swamp forests and a coastal estuarine creek (DSEWPaC 2011).

The Hunter estuary Wetlands Ramsar site is important as both a feeding and roosting site for a large seasonal population of shorebirds and as a stopover site for transient migratory birds. Over 250 species of birds have been recorded within the Ramsar site, including 45 species listed under international migratory conservation agreements. In addition, the Ramsar site provides habitat for the nationally threatened Green and Golden Bell Frog and Red Goshawk, and the state-listed threatened Australasian Bittern.

Nationally Important Wetlands

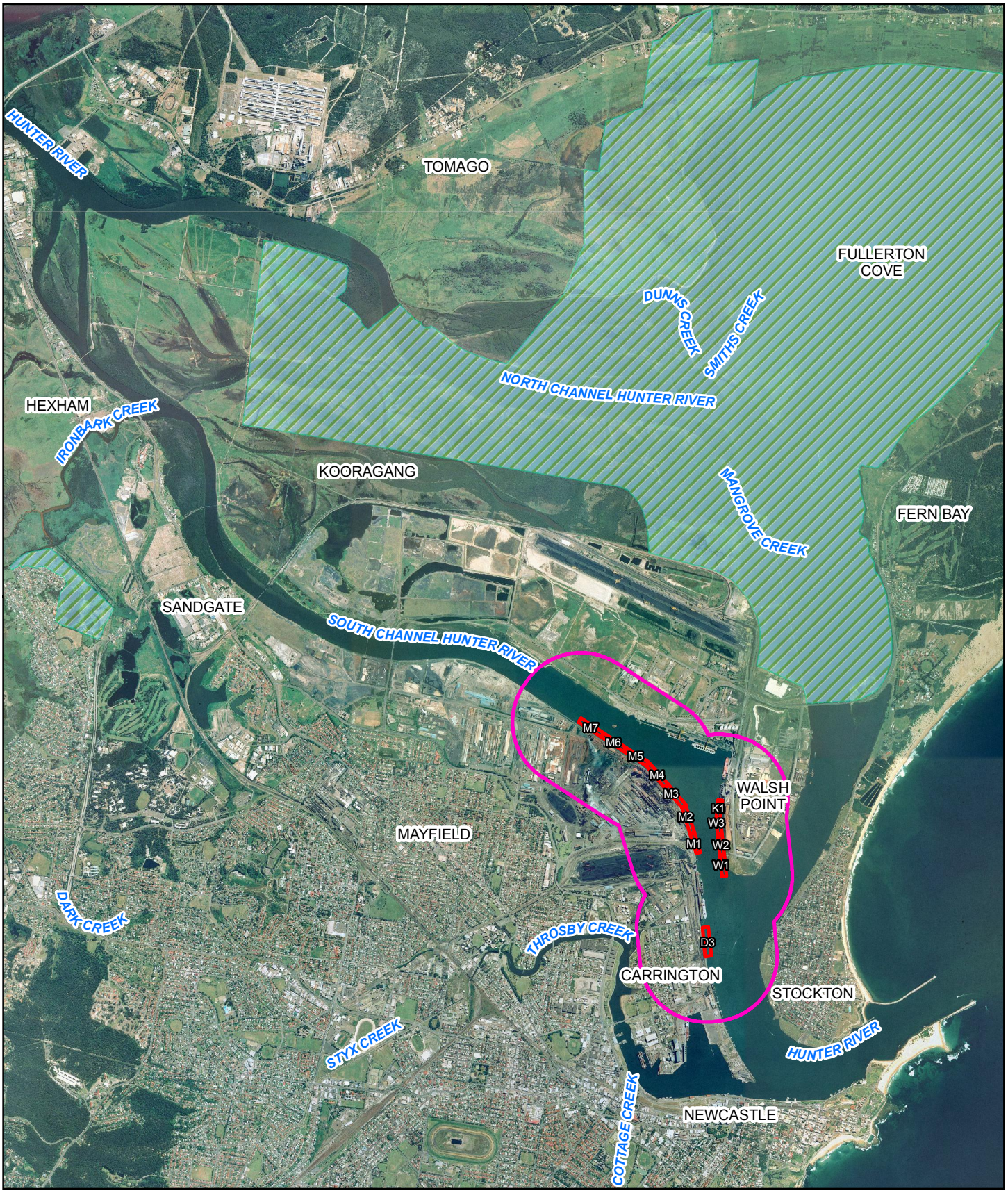
The Protected Matters Search interactive map indicates that the study area lies within Kooragang Nature Reserve, which is listed as a Nationally Important Wetland. This area of the Kooragang Nature Reserve is located in the South Arm where dredging works will be undertaken as part of the Project.

15.2.14 Commercial Fisheries and Aquaculture

The Hunter River prawn fishery was declared closed, effective from the 4 June 2010, for a period of five years unless sooner amended or revoked. The taking of prawns by commercial fishers by any method is prohibited.

[1] Hunter Wetlands National Park is a new national park that includes the previous Kooragang and Hexham Swamp Nature Reserves, and incorporates Stockton Sandspit and part of Ash Island (OEH 2011b).

A small number of operational oyster leases are located in the North Arm of the Hunter River adjacent to the Stockton Bridge, approximately three to four kilometres upstream of the Dyke 3 berth. The majority of these leases are within the Hunter Wetlands National Park.



LEGEND

- Study Area Locality
- Berth Locations
- Ramsar Wetlands

1:60,000 (at A4)

0 220 440 880 1,320 1,760

Metres

Map Projection: Transverse Mercator
Horizontal Datum: Geocentric Datum of Australia (GDA)
Grid: Map Grid of Australia 1994, Zone 56

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Hunter Estuary
Ramsar Wetlands

Job Number 22-15683
Revision 0
Date 10 Sep 2012

Figure 15.3

Level 3, GHD Tower, 24 Honeysuckle Drive, Newcastle NSW 2300 **T** 61 2 4979 9999 **F** 61 2 4979 9988 **E** ntlmail@ghd.com.au **W** www.ghd.com.au

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Data Source: LPMA: DTDB - 2007, Imagery - 2007; DEWHA: Ramsar Wetlands - 2008. Created by: gmcdiarmid, fmackay

15.2.15 Methods

The methods employed for the flora and fauna assessment include:

- Desktop review of relevant literature and databases, including the Atlas of NSW Wildlife for threatened species listed under the TSC Act, DPI Records Viewer for threatened aquatic species listed under the FM Act and Protected Matters search tool for matters of NES listed under the EPBC Act. The literature reviewed for the current investigation is listed below.
- Site inspection of the study area to identify terrestrial and aquatic habitats and native vegetation (where present) and identify potential habitat for threatened species.
- Assessments of Significance according to Draft Guidelines for Threatened Species Assessment (DEC & DPI 2005) to determine if the Project is likely to have a significant effect on threatened biota listed under the TSC Act and the FM Act.
- Significance assessments to determine if the Project is likely to have a significant impact on matters of NES listed under the EPBC Act.

Database Searches

Searches of the following data sources were undertaken to determine the threatened biota that have the potential to occur within the study area:

- OEH Atlas of NSW Wildlife database records for threatened terrestrial flora and fauna species listed under the TSC Act within a 10 kilometres radius of the site. The search was completed on 25 May 2012.
- Records of endangered populations and threatened ecological communities listed under the TSC Act from the Hunter CMA subregion (Hunter/Central Rivers catchment management area) were obtained from the on-line OEH threatened species database (accessed 4 June 2012).
- Department of Sustainability, Environment, Water, Populations and Communities (DSEWPaC) Protected Matters Search Tool for NES listed under the EPBC Act, which may occur within a 10 kilometres radius of the study area. The search was completed on 25 May 2012.

Industry and Investment (I&I) NSW Threatened and Protected Species Records Viewer database for records of threatened fish species and locations listed under the FM Act. The search was completed on 25 May 2012.

Literature Review

A review of the following relevant environmental reports was undertaken:

- AECOM (2010). Mayfield Site Port-related Activities Concept Plan: Environmental Assessment.
- EMGA Mitchell McLennan (2010). The Terminal 4 Project: Preliminary Environmental Assessment Report.
- ENSR Australia Pty Ltd (2008). Environmental Assessment Scoping Report: Planning Approval for Uprating of Ammonium Nitrate Facility, Kooragang Island.

- GHD (2011) Vibrocore Sediment Sampling South Arm Hunter River, Review of Environmental Factors.
- NCIG (2006). Newcastle Coal Infrastructure Group Export Coal Terminal: Environmental Assessment.
- NPC (2011) Dredging. NPC web site: http://www.newportcorp.com.au/site/index.cfm?display=111689 (accessed 9 September 2011).
- Worley Parsons (2010) Capital Dredging Project (MP10_0203) South Arm, Hunter River Preliminary Environmental Assessment Report.
- Worley Parsons Resources and Energy, (2009), Area E Maintenance Dredging and Placement of Dredged Material Off Stockton, Review of Environmental Factors.
- Umwelt Pty Ltd (2009) Environmental Assessment. Kooragang Coal Terminal Stage 4 Project.
- Industry and Investment NSW (2009) Mapping the habitats of NSW Estuaries, Fisheries Final Report Series No. 113 ISSN 1837-2112.

Site Inspection

A site inspection was conducted at Walsh Point on 4 August 2011 by two ecologists. The landside area and the intertidal zone of the proposed Walsh Point berth pocket and the Kooragang 1 berth were inspected on foot. The site inspection involved the following techniques:

- Compilation of an inventory of flora and fauna species.
- Identification and assessment of terrestrial and aquatic habitats.
- Identification of vegetation types (where present), including Threatened Ecological Communities (listed under the TSC ACT and EPBC Act) mapped as occurring within the locality and marine vegetation listed under the FM Act.
- Searches for threatened species (and their habitats) previously recorded within the locality.

Access to the other berths was not possible at the time of the inspection. However, information on the landside environments of the Mayfield and Carrington berths was obtained through literature review, visual inspections conducted during a boat survey of the berths and through aerial photo interpretation.

15.3 Potential Impacts

15.3.1 Terrestrial Flora and Fauna

The potential impacts of the Project on flora and fauna primarily relate to impacts on aquatic environments through dredging. Dredging would be undertaken to create new berths and associated channels. There will be minimal impacts on terrestrial environments.

Excavated sediment that is not suitable for sea disposal due to contamination would be stockpiled and dewatered before it is transported offsite to landfill. It is expected that contaminated sediment will be stockpiled on the southwest corner of Walsh Point. The environment of this area at Walsh Point is highly disturbed, containing only exotic grass and herb species and is of very low ecological value.

This area would provide marginal foraging habitat for a small selection of common and widespread bird species that are typical of urban environments, including those that were recorded during the site visit. Stockpiling sediment could affect nesting individuals of the Masked Lapwing, a species known to occupy playing fields and other modified grasslands of urban areas during their breeding season, although no individuals were recorded during the site visit.

The landside environments adjacent to all of the proposed berths are highly modified, comprise predominately hardstand areas or cleared land, and are cleared of native vegetation. They therefore have negligible value for native terrestrial flora and fauna.

The proposed dredging works would not affect the landside environments of the berths, with the exception of Walsh Point where potential stockpiling is proposed. Therefore, there are not likely to be any adverse effects on terrestrial flora and fauna associated with the Project.

Potential indirect impacts such as sedimentation or altered hydrology in these areas would therefore have minimal consequences for native biota, particularly in the context of ongoing regular maintenance dredging and industrial and port activities that occur in the area. Chapter 10 (Hydrology) and Chapter 8 (Sediment and Water Quality) demonstrate that any changes to hydrology or water quality conditions would be minor and localised. No impacts would be imposed on upstream wetlands, and therefore the Project would not produce indirect impacts on threatened terrestrial flora and fauna that inhabit wetland areas upstream. No habitat areas that support threatened species would be impacted.

15.3.2 Terrestrial Threatened Biota

Several species of threatened fauna are known to occur on Kooragang Island. However, suitable habitat is largely restricted to the western and northern sections of the island. The berths and adjacent areas of land do not contain any suitable habitat for threatened terrestrial biota and threatened terrestrial fauna species are unlikely to utilise the study area. The Project would not produce any direct impacts for threatened terrestrial fauna species or their habitats.

There are no endangered populations or TECs present within the study area. The Project would not impose any adverse effects on endangered populations or TECs listed under the TSC Act.

With regard to the more mobile threatened fauna species previously recorded in the locality that could occur over the study area (such as airborne individuals of bat or bird species), an assessment of significance according to the DEC and DPI (2005) guidelines has been prepared, as follows:

How is the project likely to affect the lifecycle of a threatened species and/or population?

There is no likelihood that the Project would disrupt the lifecycle of any threatened species or populations listed under the TSC Act, as there is no habitat present for such species within the study area, and no breeding, nesting or roosting activities occurring within the study area or adjoining areas.

The Project would not displace or disturb threatened terrestrial fauna species or populations, and would not disrupt their breeding cycle. Dormancy is not relevant to threatened terrestrial fauna species or populations.

The Project would not affect either roosting or foraging behaviour as no habitat for threatened terrestrial fauna species would be impacted by the Project. The Project will not affect the migratory or dispersal ability of any terrestrial or aerial threatened species.

Pollination, seedbanks and recruitment (germination and establishment of plants) are not relevant to threatened terrestrial fauna species or populations. Regardless, the Project would not affect pollination, seedbanks or recruitment.

The Project would be highly unlikely to affect the interaction between threatened species and other species in the community, as there is no habitat present for such species within the study area. Threatened fauna may occur at or near the site on an occasional basis but would be unlikely to be affected by the Project.

How is the project likely to affect the habitat of a threatened species, population or ecological community?

There are no habitats for threatened terrestrial species, populations or ecological communities within the study area.

Does the project affect any threatened species or populations that are at the limit of its known distribution?

The Project will not affect any areas of suitable habitat for threatened species or populations, and will not affect any threatened species at the limits of their known distribution.

How is the project likely to affect current disturbance regimes?

The Project would not alter existing fire regimes.

The hydrology of the Hunter River would not be affected by the Project. Chapter 10 (Hydrology) details the hydrological assessment for the Project.

How is the project likely to affect habitat connectivity?

The Project will not fragment or isolate any areas of fauna habitat or otherwise create a barrier to fauna movement. There is no remnant vegetation or identified wildlife corridors within the study area that would be affected by the Project.

How is the project likely to affect critical habitat?

There is no critical habitat within the study area or surrounds that would be affected by the Project.

Conclusion

Given the above considerations, the Project would not have a significant impact on any threatened species, populations or ecological communities listed under either the TSC or FM Acts.

15.3.3 Aquatic Ecology

The Project would have minor direct impacts on the surrounding aquatic ecological receiving environment, which includes the water column of the Hunter River at this location, and the benthic environment (ie the bed of the river). Furthermore, indirect impacts on downstream and upstream aquatic ecosystems, including mangrove and saltmarsh communities associated with the Hunter estuary Wetlands (of which various components are mapped as SEPP 14 and/or Ramsar wetlands), and associated fauna species (fish, crustaceans) are likely to be negligible.

By contrast, benthic invertebrates inhabiting the sediments of the proposed dredge area will be directly impacted by the operation.

Marine Vegetation

Changes in channel profile caused by dredging can increase tidal area, wave height and water velocity, resulting in bank erosion. Eroding banks threaten mangroves and other mud bank communities and can lead to increased turbidity. Suspended sediment in the water column blocks light, reducing benthic primary productivity and inhibits the ability of benthic plants to recover from impacts of dredging (Pringle, 1989).

Marine vegetation (mangroves, saltmarsh and seagrass) does not occur at the site or on downstream shores and subtidal zones. A number of individual mangroves are present within the rocky intertidal zone at Walsh Point however, these appear to have established opportunistically in the limited interstitial spaces between rock substrate. These isolated individuals do not constitute a significant stand of mangrove.

The Hunter estuary SEPP 14 and Ramsar wetlands are located upstream of the Project site, on the northern margin of Kooragang Island, the northern shores of the north arm of the Hunter River and adjacent Fullerton Cove. Sedimentation from dredging conducted during the incoming tide has limited potential to migrate upstream and enter these wetlands. However, wetlands are generally accumulators of finer grained sediments and recyclers of associated nutrients (Ozcoasts, 2011). As such, the potential impacts from sediment migration and deposition in these wetlands are likely to be short term and minimal, if occurring at all.

The extent of potential sediment transport and deposition is detailed in Chapter 8 (Sediment and Water Quality).

Water Quality (turbidity)

Turbidity impacts from the proposed dredging are likely to be localised and short term. Regular maintenance dredging and the passage of vessels produce turbidity regularly. The Hunter River is known to have elevated turbidity levels (MHL, 2002) and as such, the aquatic ecosystem has adapted to high sediment loading.

Dredging mitigation measures such as silt fencing generally alleviate any long term increased turbidity impacts. Chapter 8 (Sediment and Water Quality) details the Project's potential impacts on river turbidity.

Fish and Crustaceans

The berths contain only an open saline waterbody flanked by constructed rockwall features. As such, fish and crustacean species would likely utilise the site in a transitory and/or foraging capacity only. Additionally, in response to large scale water based activities such as the presence of dredges and the disturbance caused by dredging, fish and most crustaceans generally display avoidance behaviour.

Benthic Communities

Benthic communities would be directly impacted by dredging. Dredging would dislodge benthic fauna and result in the collection and mortality of invertebrate by-catch.

The magnitude and persistence of dredging impacts varies between species. The loss of sensitive species can cause a change in community structure, although such changes are often hard to detect at first and can be small in comparison to natural variability measured over seasons and years (Ozcoasts, 2011).

The Project would dredge sediments from a localised area. When compared to regular maintenance dredging undertaken by NPC in the South Arm channel (NPC, 2011), the area to be dredged for the Project is comparatively small in scale and potential for impacts are limited to the localities of the berths. The composition of the benthic communities to be affected by the Project would be common to the broader lower estuary areas. The overall proportion of these communities impacted by dredging would be minor in relation to the broader lower estuary and impacts would be limited to discrete areas. As such benthic communities impacted by the dredge are expected to recover over time.

No habitat for threatened aquatic species has been identified in the area of the Project. Threatened aquatic species that have the potential to utilise the Project area would do so in a transitory and opportunistic manner. Therefore, the impacts to the benthic communities would not have flow-on effects to threatened aquatic fauna that would utilise the Project area.

15.3.4 Aquatic Threatened Species

There no records of threatened aquatic species or habitats for threatened aquatic species listed under the FM Act within the study area. Therefore, the Project would have no adverse effects on threatened aquatic biota associated within the Project area.

The six heads of consideration listed under Appendix 3 of the Draft Guidelines for Threatened Species Assessment (DEC & DPI 2005) for assessing the potential effects on threatened aquatic biota have been considered in the assessment of potential impacts.

How is the project likely to affect the lifecycle of a threatened species and/or population?

The Project is not likely to disrupt the lifecycle of any threatened aquatic species or populations listed under the FM Act, as there is no evidence for the presence of individuals or habitats for such species or populations within the study area.

How is the project likely to affect the habitat of a threatened species, population or ecological community?

The Project would not affect the habitat of a threatened aquatic species, population or ecological community.

Does the project affect any threatened species or populations that are at the limit of its known distribution?

There are no threatened aquatic species at the limits of their known distributions within the locality of the study area.

How is the project likely to affect current disturbance regimes?

The Project would affect current disturbance regimes, mainly through changes to the hydrology of the lower South Arm. However, any changes to disturbance regimes are not likely to affect any threatened aquatic biota.

How is the project likely to affect habitat connectivity?

The Project is not likely to affect habitat connectivity, as it will not create a barrier to fauna movement and will not fragment or isolate any areas of aquatic habitat.

How is the project likely to affect critical habitat?

There is no critical habitat present within the study area or within the locality. Hence, critical habitat is not relevant to the current proposal.

Based on the assessment of significance, the Project would not have a significant effect on any threatened species, populations or ecological communities listed under the FM Act.

15.3.5 EPBC Act matters

The NES listed under the EPBC Act located near the Project site that could be potentially be affected by the Project are:

- Wetlands of international importance (Hunter Estuary Ramsar Wetlands).
- Listed migratory species.

In order to assess the potential impacts of the proposal on these matters of NES, the DEWHA (2009) *Significant Impact Guidelines 1.1* have been addressed below.

Hunter Estuary Wetlands (Ramsar)

According to the *Significant Impact Guidelines 1.1* (DEWHA 2009), an action '*is likely to have a significant impact on the ecological character of a declared Ramsar wetland if there is a real chance or possibility that it will result in:*

- *Areas of the wetland being destroyed or substantially modified:*

  The Project will not have any direct effects on the Hunter Estuary Wetlands, which lie, at their closest point, approximately 3 kilometres upstream of Dyke 3 on the North Arm. The Project will not destroy or modify any areas of this Ramsar wetland.

- *A substantial and measurable change in the hydrological regime of the wetland, for example, a substantial change to the volume, timing, duration and frequency of ground and surface water flows to and within the wetland:*

  The dredging works will cause minor and localised changes in the hydrology of the South Arm of the Hunter River in the vicinity of the berths. There is no direct hydrological connection between the study area and the Ramsar site along the North Arm. Tidal flows do not move sediment from the study area into the North Arm of the River.

  Figure 15.3 shows that there is no direct connection between the South Arm and the Ramsar site, as the Ramsar boundary does not extend to the banks of the South Arm. Changes to the hydrology of the South Arm would be very localised, and would not have a substantial effect on the hydrological regime of the Ramsar wetlands.

  Maintenance dredging is undertaken in the South Arm regularly. No discernible effects on the Ramsar site have been produced from regular maintenance dredging. The Project would not be of a large enough scale to alter the hydrological regime to affect the Ramsar site.

- *The habitat or lifecycle of native species, including invertebrate fauna and fish species, dependent upon the wetland being seriously affected*

  The Hunter Estuary Ramsar wetland would not be 'seriously affected' by the Project. The potential effect of the dredging works on the wetland is the limited deposition of mobilised sediment, via tidal movements. Chapter 10 (Hydrology) details the potential deposition in this area, and demonstrates that any deposition would be negligible.

  The estuarine wetlands exist within a highly depositional environment. Any deposition of sediment in the wetlands from the dredging process would be very minor and short-term in duration. Any potential deposition of sediment in the Ramsar wetlands as a result of the action of incoming tides would be negligible. Any sedimentation will have a negligible effect on invertebrate fauna and fish species within the Ramsar wetlands.

- *A substantial and measurable change in the water quality of the wetland – for example, a substantial change in the level of salinity, pollutants, or nutrients in the wetland, or water temperature which may adversely impact on biodiversity, ecological integrity, social amenity or human health, or*

  The Project would not have any substantial or measurable change in the water quality of the Hunter estuary, and no consequent negative effects on wetlands. Chapter 8 (Sediment and Water Quality) assesses the Project's potential to alter water quality within the estuary.

  The assessment of the Project's potential impacts on water quality determined that only minor and short-term effects would result from the dredging works. Minor and short-term increases in salinity would occur in the immediate vicinity of the dredging areas. Salinity levels would not increase in the area of the wetland as a result of the Project.

Pollutants contained within the river sediment would be disturbed by dredging works. However, appropriate management measures, such as those used for regular maintenance dredging, would limit the potential for transfer of these sediments upstream on in-coming tides. Furthermore, Chapter 10 (Hydrology) determines that the Project's potential effects on the hydrology of the estuary would be minor, and not affect the area of the Ramsar wetlands. Therefore, the Project would not result in pollutants being transferred to the site of the Ramsar wetland. No nutrients would be mobilised by dredging works, and therefore would not impact the Ramsar site. Water temperature would not be altered by the Project.

The Project would not affect the biodiversity or compromise the ecological integrity, social amenity or health risk of the wetlands.

- *An invasive species that is harmful to the ecological character of the wetland being established (or an existing invasive species being spread) in the wetland.*

  The Project would not introduce any invasive species that could be harmful to the wetland ecosystem.

Migratory Birds

According to the *Significant Impact Guidelines 1.1*, an action *'is likely to have a significant impact on a migratory species if there is a real chance or possibility that it will:*

- *Substantially modify (including by fragmenting, altering fire regimes, altering nutrient cycles or altering hydrological cycles), destroy or isolate an area of important habitat for a migratory species*

  Areas of aquatic habitat within the study area do not qualify as 'important habitat' for migratory species under the DEWHA (2009) definition. Hence, the Project would not 'substantially modify' an area of important habitat for migratory species.

  The Hunter Estuary Wetlands would constitute an area of important habitat for listed migratory species. The Project would not adversely affect (through fragmentation of habitat, alteration of fire regimes, changes to nutrient cycles or by altering hydrological cycles) the Hunter Estuary Wetlands.

- *Result in an invasive species that is harmful to the migratory species becoming established in an area of important habitat for the migratory species, or*

  The Project would not introduce invasive species into the Hunter Estuary Wetlands, or any other areas of important habitat for migratory species.

- *Seriously disrupt the lifecycle (breeding, feeding, migration or resting behaviour) of an ecologically significant proportion of the population of a migratory species.*

  The Project would not disrupt the life cycle of any listed migratory species known to occur within the locality, nor an ecologically significant proportion of any such population.

Conclusion

The consideration of potential impacts of the Project on relevant matters of NES listed under the EPBC Act indicates that the Project would not impose 'a significant impact' on the Hunter Estuary Ramsar Wetlands or on listed migratory species.

15.3.6 Commercial Fisheries and Aquaculture

No impacts would be imposed on commercial fisheries in the lower Hunter, as the prawn fishery is currently closed until 4 June 2015.

The potential for transportation of sediments to oyster leases upstream on the North Arm of the Hunter River is considered unlikely as tidal ingress from the proposed dredge locations travels directly upstream along the Hunter River South Arm channel. The Project would not impose any adverse effects on aquaculture within the lower Hunter estuary.

15.4 Recommended Mitigation Measures

15.4.1 Terrestrial Flora and Fauna

The Project would not produce adverse effects on terrestrial flora and fauna. As such, no mitigation measures for terrestrial flora and fauna are considered necessary.

15.4.2 Estuarine Flora and Fauna

The following measures would limit the potential impacts on aquatic (estuarine) habitats and biota:

- Measures to control surface water runoff and sedimentation, as outlined in Chapter 10 (Hydrology) and Chapter 8 (Sediment and Water Quality) of the EIS during the dredging works.
- Installation of silt curtains (with floating booms) around the dredge area.

If a dewatering basin is required at Walsh Point (or other suitable location) for treating and stockpiling contaminated sediment, specific management measures would be developed in an Environmental Management Plan, and supporting sub-plans. The EMP and sub-plans would cover:

- Erosion and sedimentation.
- Water management.
- Dust and air quality.
- Contamination.

16. General Environmental Impact Statement Requirements (Non-key Issues)

16.1 Social and Economic

16.1.1 Introduction

The DGRs did not identify social and economic issues as key issues for the EIS. This section describes the existing socio-economic environment of the Project area and the Project's potential impacts on these characteristics. Mitigation measures are provided to address the potential impacts.

The Port of Newcastle is a key part of the Hunter and NSW economies. The growth and diversification of trade through the Port will both continue to boost the regional economy and provide long term port based revenue.

The Port lies on the north and south banks of the south arm of the Hunter River, and extends to the entrance to Newcastle Harbour. It provides income for the region through trade, a recreational outlet, a fishing industry, and boosts tourism for the city. Many residents living around the port enjoy a scenic vista and increased property values, and take an active interest in port development. This Project has the potential to affect a range of stakeholders.

16.1.2 Existing Environment

Literature Review

The following information describes the characteristics of the communities that may be impacted by the Project. The information is drawn from past Australian Bureau of Statistics (ABS) Census data. There are three communities adjacent to the Project: Mayfield, Newcastle, and Stockton.

Mayfield Community

Population

The Mayfield Planning District (incorporating Mayfield, Mayfield East, Mayfield West and Warabrook) has undergone sustained population loss over the past 30 years. The population peak was in 1971 with 16,579 residents (this is with the exception of the 1996 to 2001 period when the suburb of Warabrook was developed). According to the 2006 ABS census the Mayfield Planning District had a population of 14,303 residents which represents 86 percent of the 1971 total.

According to Newcastle City Council, these population changes have contributed to overall negative impacts on local shops and services over the past decades, and the physical appearance of some commercial areas. Household structures in Mayfield are changing, with increases in couples without children (from 18.7 percent in 2001 to 23.1 percent in 2006) and lone person households (from 32.9 percent to 37.1 percent). The statistical suburb of Mayfield East has a significantly higher percentage of single parent families (29.5 percent) when compared to the Newcastle average of 13.0 percent.

Housing

Mayfield has a higher proportion of rental households (38.7 percent) and lower proportion of outright home ownership (31.2 percent), when compared with Newcastle LGA (34.4 percent and 34.8 percent respectively). The high rental figures are most likely a consequence of a student population (due to its close proximity to TAFE and university), and lower socio-economic status, as indicated by the weekly income figures.

The Mayfield population has become more stable, with the number of households at the same address five years ago increasing from 51.1 percent in 2001 to 56.4 percent in 2006. This is very similar to that for the whole Newcastle LGA which in 2006 was 57.9 percent.

Stockton Community

Population

The suburb of Stockton is located within the Inner North Planning District, an area that also encompasses the suburbs of Carrington, Wickham, Maryville, Islington and Tighes Hill. As with the Mayfield Planning District, the Inner North has also undergone sustained population loss over the past 30 years when it had a population peak of 15,930 residents in 1981. In 2001 the ABS Census recorded a residential population of 10,527, which represents 66 percent of the 1971 total. The suburb of Stockton, as defined by the ABS, had a population of 4,208 residents in 2001.

In 2006, the population of Stockton was significantly older than that of the Newcastle Local Government Area, with nearly 33 percent of the population over the age of 55, while for Newcastle this was 26 percent. Just over 13 percent of the population of Stockton was under the age of 15 (17 percent for Newcastle). The majority of households in Stockton are families (63 percent), and of these, 37 percent are couple families with children. Although the percentage of single parent families was less than that documented for Mayfield East, Stockton still had a significantly high percentage (21 percent) when compared to the Newcastle average of 13 percent.

Housing

Stockton has a higher proportion of outright home ownership (37.3 percent) and lower proportion of rental households (30.8 percent) when compared with Newcastle LGA (both at 32.1 percent). The high proportion of home ownership could be due to the significant percentage of family households. For the 23.8 percent of households with a home loan, the median monthly housing loan repayment of $1,300 was consistent both with the median for Newcastle LGA and Australia.

Newcastle Community

Population

The Inner City Planning Precinct (incorporating the Newcastle Central Business District, The Hill, Cooks Hill, Newcastle East and Newcastle West) is considered the regional hub of the Hunter providing administrative and commercial services, employment and entertainment. The area experienced a significant decline for the two decades following the 1970s as industry closed and retail and major employers moved to suburban locations. Efforts have been made to revitalise the Inner City.

According to the 2006 census the Newcastle Inner City Statistical Area has a population of 48,063 residents. Being a predominantly business area the Newcastle Inner City has significantly fewer couples with children when compared to the broader Newcastle Local Government Area (36 percent for Inner City and 40.1 percent for Newcastle LGA). This is also reflected in the age distribution of residents with the Inner City Area having 13.5 percent of residents younger than 15 years old, in comparison to Newcastle LGA that has 17.1 percent.

Residents of the Inner City Area tend to be professionals (28.2 percent) aged 25-54 (43.8 percent). This is in contrast to the Newcastle LGA where professionals account for 24.1 percent and those aged 25-54 account for 41.4 percent. This is due to the area containing the main Central Business District for the Hunter Region.

Housing

The Inner City has a higher proportion of rental households (38.8 percent) and lower proportion of outright home ownership (27.8 percent), when compared with Newcastle LGA (32.1 percent and 32.1 percent respectively). Density in the Inner City area is slightly higher than for that experienced in the Newcastle LGA. This is evident by the higher percentages of residents residing in apartments or units (24.7 percent) or semi-detached dwellings (14 percent). For the Newcastle LGA these are respectively (14.9 percent and 10.9 percent). Despite being a CBD, median rental prices are fairly consistent with that of the Newcastle LGA.

Value of Port Operations

Newcastle Port throughput increases every year with 3,700 ship movements recorded annually. The numbers of ships visiting the Port is forecast to increase due to steadily rising demand for Australian energy resources. Trade opportunities are also developing on the Mayfield Portside lands site (Newcastle Ports Corporation Newsletter, June-July, 2011). Newcastle Port Corporation records the quantities of materials imported and exported through the Port, and these are shown in Table 16-1.

Table 16-1 Import and Export Quantities through Newcastle Port

Commodity	2010-2011 Total	2009 -2010 Total	2008 - 2009 Total
Aluminium	120,755	123,650	105,101
Steel Import/Export	291,035	269,727	289,832
Grinding Media	79,130	86,191	65,155
Logs	125,231	0	0
Other general cargo	245,646	202,957	260,881
Alumina	1,353,487	1,390,907	1,347,459
Petroleum Coke	280,632	256,725	245,202
Mineral Concentrates	376,176	406,436	411,486
Grains	1,329,803	1,210,295	882,090
Fertilizer products	316,901	327,963	277,277
Woodchips	349,441	330,721	264,530

Commodity	2010-2011 Total	2009 -2010 Total	2008 - 2009 Total
Fuels	373,149	376,175	42,094
Coal	108,256,626	97,077,637	90,492,998
Other Bulk	1,077,732	967,188	1,155,752
TOTALS	***114,575,744***	***103,026,572***	***95,839,857***

The proposed dredging for additional berths will assist in increasing the Port's capacity and consequently trade volumes. Furthermore, the new berths will also allow for greater diversification of trade in commodities other than coal.

Methodology

The socio-economic profile of the surrounding area was quantitatively assessed to determine potential impacts on the broader community. The assessment involved:

- Identifying key stakeholders using the Australian Bureau of Statistics (ABS) data.
- Assessing potential Project risks.
- Assessing the potential social and economic impacts identified for the construction and operation phases of the Project.
- Describing the mitigation measures to be implemented to avoid, minimise, mitigate, offset, manage and/or monitor potential impacts.

16.1.3 Potential Impacts

Positive socio-economic outcomes

The Project would assist NPC in increasing port capacity in the non-coal sector, and diversify trade through the port. The development of non-coal trading enterprises would generate additional direct and indirect economic and employment benefits for the broader community. The Project would also help to reduce the dominance of coal trade, positioning the port for any potential future decline in coal trade.

The Project would utilise existing vacant industrial port side land. The Project would make use of an existing resource that is currently under-utilised. It would reduce the need to develop non-industrial areas for port side land.

Flow on economic benefits from non-coal related berths are likely to be greater than for the development of additional coal berths. Non-coal related port side enterprises tend to employ more people than coal loaders. Supporting enterprises would be encouraged to develop facilities to service non-coal trade, thereby providing further economic flow on benefits.

At this stage the details of dredging contractors and whether they would be local firms employing local people is unknown. Therefore it cannot be determined if the Project would provide direct local employment. The numbers of people directly employed for construction works would be small. Dredging and construction activities are unlikely to have a direct economic impact on the locality.

Dredging and Construction

Potentially negative social impacts from the Project would be related to issues such as noise and vibration caused by the operation of plant and equipment. Air quality is not likely to be impacted by the Project. Water quality adjacent to the dredging may be affected. The presence of dredging equipment may alter the visual amenity of the surrounding area but this would be a temporary effect.

Operation

The dredging of the additional berths would enable expansion and diversification of the Port's facilities and allow trade volumes to increase. In the long term, this would benefit the national, state, and regional economy through the provision of jobs at the Port and associated goods and services. Further, the development of berths dedicated to commodities other than coal would assist the future viability of the Port should coal export volumes decrease.

16.1.4 Recommended Mitigation Measures

Mitigation measures addressing amenity impacts associated with the dredging of the berths are provided in relevant chapters in the EIS. A Stakeholder Engagement Strategy has been developed for the Project that outlines the means of consultation with the community. This would involve informing the various stakeholders about the Project, and providing them with contact information so that they can communicate with the project team with any questions and concerns. Chapter 4 (Community Consultation) details the Stakeholder Engagement Strategy.

16.2 Air Quality and Climate

16.2.1 Introduction

The DGRs did not identify air quality as a key issue for the EIS. This section describes the existing air quality environment surrounding the site, and identified potential impacts as a result of the Project. Mitigation measures are provided to address the potential impacts.

The proposed berths in the South Arm would be dredged and excavated to the required depth. Banks would be battered and protected with a rock revetment to prevent scour and erosion.

It is likely that the majority of excavation would be done by trailer suction dredges located on the river. A small proportion of sediment would be excavated by a backhoe excavator on floating barge (for contaminated sediment) or land-based excavation using large civil engineering earth moving equipment and trucks.

Sediments suitable for ocean disposal would be stored on the dredge and transported to offshore locations for disposal. Of the total excavated sediment, approximately 30,000 cubic metres (1.6 percent) has been identified as being potentially contaminated and may not be suitable for ocean disposal. This sediment may require some form of treatment before disposal or reuse.

Excavated sediment that is contaminated will be stockpiled and dewatered before it is transported offsite to landfill. In the event that contaminated sediment is identified, this material would potentially be stockpiled on the southwest corner of Walsh Point. The proposed stockpile area is shown in Figure 16.1.

In the order of 1,250 square metres will be excavated for the construction of Mayfield berths 1 and 2. This equates to approximately 20,600 cubic metres of landside material that would be excavated. Approximately 2,500 cubic metres of this material would be classified as contaminated material, and would require disposal to landfill. The material would be stockpiled on site, tested and treated if required before being disposed to landfill at Kemps Creek, Sydney. The duration of stockpiling would be short term.

LEGEND

- Berth Locations
- Proposed Stockpile Area

1:15,000 (at A4)

0 50 100 200 300 400

Metres

Map Projection: Transverse Mercator
Horizontal Datum: Geocentric Datum of Australia (GDA)
Grid: Map Grid of Australia 1994, Zone 56

N

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NEWCASTLE PORT CORPORATION

Newcastle Port Corporation
Capital Strategic Dredging Project

Job Number 22-15683
Revision 0
Date 10 SEP 2012

Proposed Berths, Stockpile Location and Surrounding Area

Figure 16.1

Level 3, GHD Tower, 24 Honeysuckle Drive, Newcastle NSW 2300 **T** 61 2 4979 9999 **F** 61 2 4979 9988 **E** ntlmail@ghd.com.au **W** www.ghd.com.au

G:\22\15683\GIS\Maps\Deliverables\Environmental Assessment\Non Key Issues\Air Quality\2215683_AQ001_PropBerthsStockpileLocationSurroundingArea_0.mxd

Data Source: LPMA: DTDB - 2007, Imagery - 2007. Created by: gmcdiarmid, fmackay, mbarnier

16.2.2 Existing Environment

Local Meteorology

Local wind and meteorological conditions have a significant influence on the transportation of emissions to air from a source. GHD has previously produced a weather dataset for Tomago, NSW, is considered to represent the meteorological conditions in the study area.

Figure 16.2 shows the annual and seasonal wind roses for Tomago which indicates that the prevailing wind is from the north-west quadrant. The incidence of light winds, which are related to poor emission dispersion at ground level, is highest from the northwest quadrant. Winds from the northwest comprise approximately 20 percent of total winds in the 0.1 – 2.0 m/s range.

There is a clear distinction in wind direction between the winter and summer seasons at the site. This is reflective of increased temperatures during summer inducing a sea breeze from the south-eastern quadrant and easterly component synoptic flows as the sub-tropical ridge migrates south of the Australian continent during the peak of summer.

During the spring and autumn months the sea breeze is present, but is less frequent. The prevailing wind remains from the northwest with an increase in winds from the south-eastern quadrant compared to winter.

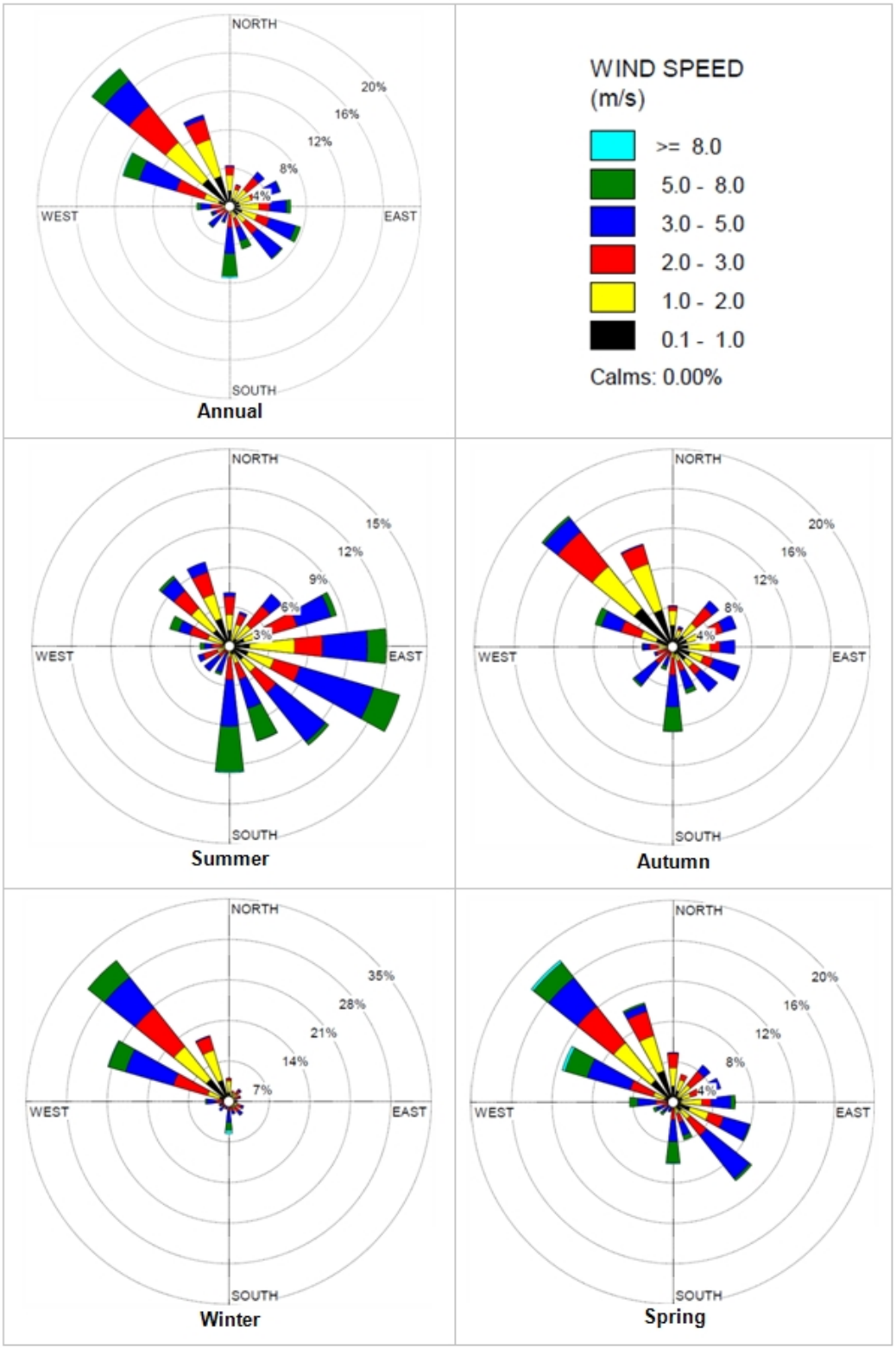

Figure 16.2 Annual and Seasonal Wind Roses

Ambient Air Environment

The *Newcastle State of the Environment Report* (Newcastle City Council, 2009) states that air quality in the Newcastle local government area meets the goals set in the National Environment Protection Measure (NEPM) for ambient air quality. The report also identifies that industrial, domestic and transportation sources are all significant contributors to adverse air quality in Newcastle.

The National Pollutant Inventory (NPI) holds a database of facilities and emissions to air in the Newcastle region. A search of the NPI for a 5 kilometre radius around the site indicated that there are 21 nearby industrial facilities resulting in the emissions of 44 reportable substances. A number of these sources are located in Mayfield (including Mayfield East and West) or on Kooragang Island. The two largest single sources of pollutants within 5 kilometres of the site are OneSteel in Mayfield and Orica on Kooragang Island. Nearby coal and grain terminals also impact on local air quality through the generation of dust.

Other sources of emissions around the site include motor vehicles on the surrounding road network, diesel trains and ships in the Port of Newcastle.

Literature Review

In order to get a better understanding of the existing air quality in the area surrounding the site, a variety of ambient air monitoring data has been referenced. Ambient air monitoring data has been sourced from the following:

- NSW Office of Environment and Heritage (2006-2007), Quarterly; *Air Quality Monitoring Reports* for Newcastle and Wallsend.
- AECOM (2010), *Air Quality Impact Assessment for Newcastle Port Corporation for Mayfield, Steel River and Stockton air quality monitoring stations*.

Data for the following air pollutants was sourced:

- O_3.
- NO, NO_2 and NO_x.
- CO.
- SO_2.
- Fine particulates (PM_{10}) and total suspended particulates (TSP).
- BTEX (benzene, toluene, ethylbenzene, and xylenes).

A review of the ambient air quality data from previous reports in the Mayfield area and OEH monitoring stations has led to the following findings:

- The NSW OEH *Approved Methods* air quality criteria are met for all pollutants, except for the occasional exceedance of the PM_{10} 24-hour average concentration level.
- The PM_{10} 24 hour average concentration level of 50 $\mu g/m^3$ was exceeded for one day during 2006 (Nov) and 2 days during 2007 (May) at the Newcastle OEH monitoring station, and for one day each in 2006 (Nov) and 2007 (May) at the OEH Wallsend monitoring station. The Mayfield PM_{10} monitoring also notes exceedances of this criterion during October 2007 and July 2008. However, NEPM also states that the 24-hour concentration goal for PM_{10} can be exceeded for up to five days per year to allow for increases in particulate matter due to bush fire or other natural sources. It is noted that this national goal is met at all monitoring sites.
- The measured levels of BTEX at the Mayfield site indicate that the OEH criteria are readily met for all pollutants.

Methodology

The following sub-sections identify the expected air emission from the proposed dredging operations and provide a screening assessment to gauge the potential for air quality impacts at nearby sensitive receptors. This assessment has been undertaken with consideration to the DEC 2005 *Approved Methods for the Modelling and Assessment of Air Pollutants in New South Wales*.

Sensitive Receptors

Contaminated sediment is expected to be stockpiled on Walsh Point. This area is primarily surrounded by industrial developments on Kooragang Island. The nearest residential receivers are identified in Table 16-2 below. Stockton has the closest receptors and these are in the downwind direction of the prevailing wind. The other areas are further away but occasionally downwind during the on-shore prevailing wind-flows of the non-winter months.

Table 16-2 Identified Residential Receivers

Suburb	Distance from Stockpile (m)	Direction from Stockpile
Stockton	900	East, Southeast
Carrington	950	Southwest
Tighes Hill, Mayfield East	1500	West

Contaminated landside material from the construction of the Mayfield 1 and 2 berths would be temporarily stockpiled at the Mayfield site. This area is surrounded by industrial land. The nearest residential receivers would be located in Mayfield East, approximately 1,200 metres to the west. This area would be downwind in the prevailing north easterly air flows of summer.

Emissions Inventory

The types of emissions to air during the dredging operations would primarily consist of:

- Odorous emissions from the exposure of contaminated sediment and river mud.
- BTEX emissions if any of the contaminates are petroleum product based.
- Dust emissions from both the mechanical disturbance and wind erosion of unconsolidated surfaces.
- Exhaust emissions from the range of mobile plant and fixed equipment.

It is noted that excavated sediment will be wet when removed from the river, thus dust generation will be negligible. Therefore, activities that have been identified as possible sources of dust emissions are:

- Sediment handling and excavation of dried stockpiled sediment.
- Vehicle induced dust emissions on unconsolidated surfaces around areas of on-land excavation or the stockpile area.
- Loading of dried stockpiled sediment into haul trucks for transport to landfill.
- Wind erosion of uncovered stockpiles and other unconsolidated surfaces.

Exhaust emissions from mobile plant and equipment on site has the potential to impact on air quality, however the impact is likely to be negligible given the separation distance to sensitive receptors and limited number of sources.

16.2.3 Potential Impacts

The Project has the potential to impact local air quality during construction and operation of the berths.

Construction

Typically, the potential for air quality impact is greatest at receptors located nearest to the ground-based source, with the level of impact decreasing with distance. As a dust (or odour) plume is transported downwind from a source, the coarser particulates progressively drop-out of the air column to deposit on surfaces downwind of the source, while the finer particulate fractions will be retained in the air column longer by turbulent mixing.

The nearest receptor to the proposed stockpile site is located approximately 850 metres away. Therefore a significant buffer zone exists between the site and sensitive receptors which will help to minimise potential for dust and odour impacts. It is also noted that stockpiled sediment and much of the material around the site will be wet or moist, which should be sufficient to minimise the potential for dust impacts. Furthermore, sediment is not expected to be stockpiled for extended periods of time and should be transported off-site prior to it drying out.

Stockpiled sediments have the potential to create odour impacts in the locality, particularly material containing odorous compounds such as polycyclic aromatic hydrocarbons (PAHs). Analysis of local meteorological data shows that the prevailing winds are from the north-west and southeast. North-west winds would transport air pollutants towards sensitive receptors in Stockton. However a buffer of approximately 850 metres exists, thus significantly reducing the potential for impacts.

In addition, the proposed dredging works will be short-term in nature and therefore, any adverse air quality impacts will also be during the construction period and therefore short-term.

Although it is unlikely that adverse air quality impacts will be generated from the proposed dredging operations, recommendations for dust and odour mitigation measures have been outlined below. This assessment has been based on the information available at the time and should be verified once specific details such as stockpile locations, timing and site operations are known.

Operation

The berths are located in industrial areas, and not adjacent to residential areas. The Project would utilise currently redundant berths that have been in use since the early twentieth century. The potential impacts on local air quality as a result of the operation of the berths would depend on the nature of the land side developments.

The Project would contribute to an increase in vessel movements within the port. The main potential impact on local air quality from the increase in vessel movements would be from vessel emissions. The Project would not result in new berths being located closer to residential areas. Vessel emissions would not significantly affect residential areas due to the significant distance separation.

16.2.4 Recommended Mitigation Measures

Managing air pollution at the source through management practices is a key element and in-principal recommendations are outlined below:

- Limit the time that stockpiled material is exposed and aim to transport material off-site before it becomes too dry (and a potential dust source).
- Aim to minimise the size of storage stockpiles where possible.
- Where feasible, cover stockpiles during the night or when not in use to limit the exposure of odorous compounds to the atmosphere.
- All trucks hauling sediment must be covered before exiting the site and should maintain a reasonable amount of vertical space between the top of the load and top of the trailer.
- Where feasible, have vehicles utilise hard areas to minimise dust from traffic movements.
- Material spillage on roads and pathways should be cleaned up immediately.

16.3 Energy and Greenhouse

16.3.1 Introduction

The DGRs did not identify energy and greenhouse as a key issue for the EIS. This section describes the potential energy and greenhouse impacts as a result of the Project, and provides mitigation measures to address these impacts.

16.3.2 Methodology and Scope

A desktop assessment of the potential greenhouse gases produced by the Project was undertaken in accordance with the Department of Planning's Draft Guidelines *Energy and Greenhouse EIA* (August 2002). A Level 1 Assessment of the construction phase of the Project considered energy consumption and methane generation potential.

The Level 1 assessment considered:

- Energy use on site.
- Electricity generated off site.
- Energy used for transport.
- Methane generated either on-site or off-site.

The greenhouse gases considered by the assessment are:

- Carbon dioxide (CO^2).
- Nitrous oxide (NO).
- Methane (CH^4).

Three emission scopes are considered when assessing greenhouse gases. Scope 1 emissions are greenhouse gas emissions created directly by a person or business from sources owned or controlled by that person or business.

Scope 2 are indirect emissions created by sources related to but not owned or controlled by the electricity consumers. Scope 3 are wider community issues generated as a consequence of the person's business.

16.3.3 Potential Impacts

Emissions from construction activities were categorised in line with the requirements of a Level 1 assessment as:

- Energy used on site.
- Transportation of raw materials to site.
- Transportation of waste transported from site.
- Methane generating activities.

Fuel consumption is necessary for the operation of the dredge, construction plant and equipment at site, and for haulage trucks removing spoil to landfill. The dredging activities at site would be comparatively short term and two vessels would be the maximum likely to be used at once. Dredging plant and equipment used to undertake the works would depend on market forces at the time of tender, though the most likely types of dredge vessel would be a trailer suction hopper barge (TSHB) and a backhoe dredge (BHD). The type of dredge to be used for the Project would be confirmed at the time of dredging. Foreshore treatment works at each berth would be short-term, taking on average 12 weeks per berth. It is unlikely that all 12 sites would be developed at the same time, and therefore construction plant and equipment would not significantly add to fuel usage and consequently greenhouse emissions.

A very small proportion (approximately 2 per cent) of material dredged from the sites would be disposed to landfill. Trucks hauling this material to landfill would not add significantly to existing truck movements and therefore not significantly contribute to fuel usage.

The construction works have very little potential to produce methane gas. Methane is unlikely to be generated by the dredging of river sediments.

Table 16-3 shows the estimated the fuel consumption from construction activities. Chapter 13 (Spoil Handling and Disposal) lists a number of assumptions and exclusions associated with these estimations, including the amount of dredged material that would require disposal to landfill.

Table 16-3 Emissions from Construction Activities

Source	Quantity
Fuel consumption from dredging (dredge types combined) and site construction	1,544,000 litres of marine diesel oil
Fuel consumption from transportation (sea dumping)	1,203,000 litres of marine diesel oil
Fuel consumption from transportation (by haulage trucks to landfill)	460,000 litres of diesel
Total Fuel Consumption	**3,207,000 litres of diesel**

16.3.4 Mitigation Measures

Mitigation of greenhouse gas emissions would follow a hierarchical approach:

- Avoid emissions source.
- Reduce consumption.
- Improve energy efficiency.
- Replace with low emissions alternative.
- Offset.

Table 16-3 shows that the Project would not consume a significant quantity of fuel for construction or transportation.

The consumption of fuel is a necessary requirement of the Project, however, a reduction in the quantity of fuel consumed may be achievable through optimisation of construction activities and logistics. Optimisation of these activities could reduce the number of vehicles and barge trips required. The detailed project design and planning stage would develop options for optimising transportation activities and minimising fuel usage.

A small reduction in fuel consumption may be achieved through the use of more efficient plant and vehicles. Newer ship, vehicle and plant models are typically more fuel efficient than the older models. The use of more recent ship, vehicles and plant models would need to be part of a wider fuel management strategy that incorporates project planning, logistics, operator education and maintenance as any fuel reduction due to more efficient models may be outweighed by poor management in other areas.

16.4 Risks and Hazards

Risks and hazards were not listed as a key issue in the DGRs. The ERA identified risks associated with the construction of the Project. Section 4.2.1 (Environmental Risk Analysis) details the findings of the ERA process.

16.4.1 Potential Hazards

There is the potential for human health risks and other hazards associated with the construction and operation of the Project. Some of these may include:

- Possible injury to construction or maintenance staff.
- Possible collision with construction or maintenance vehicles and equipment.
- Possible contact with hazardous materials.

Environmental hazards and risks related with the Project would include:

- Potential spillage from vehicles transporting material to and from the construction site.
- Potential water quality impacts due to any accidental leaks or spills during construction.
- Erosion and sedimentation hazards.
- Consider any hazardous waste generated by the Project, and determine waste management options.
- Risk of pollution from construction vehicle fuel spillages and dredging activities.
- Risk of pollution from contaminants, such as heavy metals and petroleum based products, being discharged to receiving waterways.

Navigational Hazards

The ERA workshops identified navigational hazards as a potential risk during construction. The workshops identified possible impacts to navigation from the presence of the dredging barge within the Port. Risks associated with this hazard include potential collisions and damage to harbour vessels or structures, as well as environmental impacts associated with such incidents.

Navigational hazards have the potential to cause severe consequences, however implementation of standard mitigation measures would substantially reduce this residual risk rating.

The current timber wharve structure at Mayfield 3 and 4 is considered to be in poor condition with sections of the wharf fully collapsed. Newcastle Port Corporation has since received consent by Newcastle City Council to remove the timber wharves at Mayfield 3 and 4. These timber wharves have been removed as the structure was degraded and had the become a navigation hazard.

16.4.2 Hazard Management and Safeguards

Mitigation measures for key and non-key issues are provided throughout this report. Several specific hazard and risk management measures would include, but not be limited to:

- Avoidance and control of pollution associated with the construction and operation phases.
- In the event of a spillage of materials from construction vehicles, spilled material would be removed as soon as practicable.
- An appropriate spill kit would be kept on site at all times and any spillage would be immediately and appropriately cleaned up. In the event of a large or hazardous spill, the Fire Brigade, Police, Ambulance and the Office of Environment and Heritage would be contacted.
- Reduce navigational hazards by implementation of standard management practices, and daily checking of curtains.
- All construction plant and equipment, including barges, would be refuelled off site in appropriately managed locations.

Emergency Services

The development of a framework for managing risks which considers emergency response procedures, appropriate consultation and communication with emergency services in areas of construction.

Human Health

A site specific Safety Management Plan would be developed by construction contractors. The Plan would identify hazards associated with work on the site and the hazard controls to be implemented so people are adequately protected from risk of injury or illness, including:

- Procedures to comply with all legislative and industry standard requirements for the safe handling and storage of hazardous substances and dangerous goods.
- Procedures for manual handling of heavy loads.
- Procedures for dredging activities.
- Procedures for operation and maintenance of site plant and equipment.

Environmental

The Construction Environmental Management Plan and the supporting sub plans would address the relevant environmental risks and hazards. This would include:

- Details of the hazards and risks associated with the activity.
- Mitigation measures and plans including those identified in this EIS and environmental risk analysis sections.
- Contingency plans as required.

16.5 Visual

16.5.1 Introduction

The DGRs did not list visual impacts as a key issue for the EIS. The environmental risk analysis confirmed that visual impacts from the Project are not likely to be significant, and are therefore not a key issue for the EIS.

The visual assessment has considered the potential impacts that the dredging and foreshore treatment works may have on surrounding areas, and in particular sensitive land uses such as residential areas. The Project would have a minimal visual impact due to the existing industrial nature of the Project area, the distance from sensitive land uses and the minor nature of the works that would be visible above the water. The proposed berths would be dredged and excavated to the required depth. This would not be visible above the water line.

Elements of the Project that would be above the water line and therefore visible from surrounding areas would include sheet pile walls and battered river banks protected by rock revetment to prevent scour and erosion.

Third Party proponents would develop the landside infrastructure adjacent to the berths, together with any berth infrastructure that would be required. These new berths, and any land-based development, would be subject to separate assessment and approval processes.

16.5.2 Existing Environment

The visual surrounds of the Port are characterised by the following features:

- Predominantly flat topography.
- Intense industrial activity.
- Urban development adjoining port and industrial infrastructure.
- Biologically diverse wetlands upstream of the Project site.
- Large areas of dry grasslands on Kooragang Island from extensive landfilling.

The area immediately adjacent to the proposed dredging locations is surrounded by industrial land. Workers, passing motorists, recreational and commercial boaters, and residents with a view of the Hunter River South Arm have views of the proposed berths.

Walsh Point Berth Pocket and Kooragang Island

The proposed Walsh Point berth pocket and proposed Kooragang 1 berth are located at the eastern end of Kooragang Island. The south arm of the river follows the southern boundary of Kooragang Island.

Kooragang Island has been subject to intense development and has been significantly visually altered by this history of development. The river and riverbanks in the area of the proposed berths consist of a combination of protected and unprotected river banks and previous berth developments. Industrial land uses such as an Orica's ammonium nitrate facility adjoin the proposed Walsh Point and proposed Kooragang 1 berth. Other adjoining land uses include a woodchip export facility and vacant industrial land at the southern tip of Walsh Point.

Figure 16.3 shows the northwest view toward Walsh Point from Stockton.

Dyke Point

The proposed Dyke 3 berth is located to the south of the proposed Mayfield berths and the closest of the proposed berths to residential areas. The north-eastern section of the Carrington residential area is located beyond port-side rail and other port related infrastructure to the west of the proposed berth. Warehouses and industrial workshops on Darling Street separate the berth from residential areas.

Figure 16.4 shows the view towards Dyke Point from Stockton.

Mayfield

The proposed Mayfield berths are located on the southern bank of the Hunter River's south arm. These berths are adjacent to the BHPB site, which is the site of the former BHP Steelworks. Intensive industrial development in this locality has significantly modified the landscape. Adjoining land uses include the OneSteel development to the west, and the Port Waratah Coal Carrington Coal loader to the south. Few, if any, natural elements remain in this area.

Figure 16.5 shows the view towards Mayfield from southern side of Kooragang Island.

Figure 16.3 View North West toward Walsh Point from Stockton

Figure 16.4 View towards Dyke Point from Stockton

Figure 16.5 View towards Mayfield from Southern Side of Kooragang Island

Literature Review

The following documents were reviewed as part of the visual assessment:

- GHD (2003) *Proposed Extension of Shipping Channels, Port of Newcastle*, Environmental Impact Statement.
- GHD (2011) *Vibrocore Sediment Sampling South Arm Hunter River,* Review of Environmental Factors.
- Worley Parsons (2011) *Capital Dredging Project (MP10_0203) South Arm, Hunter River* Preliminary Environmental Assessment Report.

Methodology

The assessment considered the Project's potential landscape and visual impacts. The landscape assessment examined potential impacts on the landscape as an environmental resource. The visual assessment considered the Project's potential impacts on the visual amenity of the area and its surrounds.

Methods used in these assessments included:

- Reviewing existing information relevant to the area.
- Visiting the site and its surrounds.
- Assessing and evaluating the visual context of the site, including topography, vegetation, land uses and site history.
- Assessing view sensitivity from surrounding visual catchments, including identified viewing locations.
- Photographic interpretation.

Topography, vegetation and land use are key components of an area's visual character. Site history adds to the context in which a landscape is viewed. The assessment considered the visible elements of the Project that may affect the landscape character and visual amenity of the area.

16.5.3 Potential Impacts

The proposed activities have the potential to affect the visual amenity and landscape features of the area through temporary construction activities, and by introducing new built elements to the landscape.

Construction Impacts

Presence of Dredging Vessel and Disposal of Spoil

The dredging of new berths and the disposal of spoil by truck would have minimal impacts on the visual amenity of the area of the port. Maintenance dredging is undertaken within the port regularly. Dredging activities associated with the Project would be temporary and minor. Stockpiling of spoil material would also be temporary. Stockpiles would be located a significant distance from the nearest sensitive receiver, which would be in Stockton, approximately 400 metres east of the proposed Walsh Point berths.

Sedimentation of Water Column

Sedimentation of the water column is likely to result from the dredging of the new berths. The appearance of the water would change temporarily before the sedimentation disburses. Water adjacent to dredged berth boxes would experience temporary cloudiness and reduction of clarity. This would dissipate readily due to the river current and tidal movements.

Excavation of the Riverbank

Excavation of the batter slopes at the Walsh Point and Kooragang 1 berths would be undertaken on adjacent land. Excavation activities would be short-term and located on the western side of Walsh Point. Stockton is the closest residential area to the proposed Walsh Point berth pocket and Kooragang 1 berth, approximately 750 metres to the east.

Landscape and Visual Amenity Impacts

The completion of the Project would introduce new built elements to the landscape. Potential impacts on the landscape and visual amenity at each of the berth locations are discussed in Table 16-4.

Table 16-4 Visual Impacts from Built Elements

Site	Built Element	Impact on Visual Amenity
Kooragang 1	Sheet pile wall with rock batter protection behind.	Minimal impact. The Kooragang 1 berth is adjacent to the already developed Kooragang 2 site. Views of this berth would only be available from the Mayfield berths. No sensitive receivers would have views of this berth pocket. The Project would produce minimal changes to the existing view for water uses such as recreational fishing and boating.
Walsh Point berth pocket (comprising three berths)	Sheet pile wall with rock batter protection behind.	Minor impact due to the extension of the rock batter to the south of Walsh Point. Unobstructed views of the berth pocket would only be available from the Mayfield berths. Obstructed views of the berth pocket's southern extremity may be available from Stockton. However, views from Stockton would be distant and from open space vantage points. The elements of the berth that would be visible above the waterline would be very minor in scale when viewed from Stockton. The Project would produce minimal changes to the existing view for water uses such as recreational fishing and boating.
Mayfield 1	Sheet pile wall with rock batter protection behind.	Minimal impact due to the existing sheet pile wall located at Mayfield 3 and 4 berths and the existing port infrastructure adjacent. The proposed sheet pile wall will be similar in appearance to the existing sheet pile wall. The industrial land adjoining this berth would obscure views from the residential areas of Mayfield. Views of this berth would only be available from the western side of Walsh Point. No sensitive receivers would have views of this berth. The Project would produce minimal changes to the existing view for water uses such as recreational fishing and boating.
Mayfield 2	Sheet pile wall with rock batter protection behind.	Minimal impact due to the existing sheet pile wall located at Mayfield 3 and 4 berths and the existing port infrastructure adjacent. The proposed sheet pile wall will be similar in appearance to the existing sheet pile wall. The industrial land adjoining this berth would obscure views from the residential areas of Mayfield. Views of this berth would only be available from the western side of Walsh Point. No sensitive receivers would have views of this berth. The Project would produce minimal changes to the existing view for water uses such as recreational fishing and boating.

Site	Built Element	Impact on Visual Amenity
Mayfield 3	Sheet pile wall with rock batter protection behind	Minimal impact as the design will extend the appearance of the existing sheet pile wall and foreshore protection at this site. No sensitive receivers would have views of this berth.
Mayfield 4	Sheet pile wall with rock batter protection behind	Minimal impact as the design will extend the appearance of the existing sheet pile wall and foreshore protection at this site. No sensitive receivers would have views of this berth.
Mayfield 5	Sheet pile wall with rock batter protection behind.	Minimal impact due to the existing sheet pile wall located at Mayfield 3 and 4 berths and the existing port infrastructure adjacent. The industrial land adjoining this berth would obscure views from the residential areas of Mayfield. Views of this berth would only be available from the southern side of Kooragang Island. No sensitive receivers would have views of this berth. The Project would produce minimal changes to the existing view for water uses such as recreational fishing and boating.
Mayfield 6	Sheet pile wall with rock batter protection behind.	Minimal impact due to the existing sheet pile wall located at Mayfield 3 and 4 berths and the existing port infrastructure adjacent. The industrial land adjoining this berth would obscure views from the residential areas of Mayfield. Views of this berth would only be available from the southern side of Kooragang Island. No sensitive receivers would have views of this berth. The Project would produce minimal changes to the existing view for water uses such as recreational fishing and boating.
Mayfield 7	Sheet pile wall with rock batter protection behind.	Minimal impact due to the existing sheet pile wall located at Mayfield 3 and 4 berths and the existing port infrastructure adjacent. The industrial land adjoining this berth would obscure views from the residential areas of Mayfield. Views of this berth would only be available from the southern side of Kooragang Island. No sensitive receivers would have views of this berth. The Project would produce minimal changes to the existing view for water uses such as recreational fishing and boating.

Site	Built Element	Impact on Visual Amenity
Dyke 3	Sheet pile wall with rock batter protection behind.	This berth is adjacent to existing berths, and would not alter the visual amenity of the surrounding area. Carrington residents would not have views of this berth due to existing rail and port infrastructure that intervenes. Views from the western portion of Stockton would be distant and from open space vantage points. The distance to the closest residence is approximately 250 metres. The elements of the berth that would be visible above the waterline would be very minor in scale when viewed from Stockton. The Project would produce minimal changes to the existing view for water uses such as recreational fishing and boating.

16.5.4 Recommended Mitigation Measures

Sedimentation of Water Column

Sediments within the port are constantly resuspended by maintenance dredging, harbour traffic and flood events. Sedimentation of the water column is temporary, with sediments settling out of suspension over time. The duration of settlement depends on river and weather conditions.

Although sedimentation would only have a temporary and minimal impact on visual amenity, mitigation measures will be employed to minimise these impacts. Measures to minimise the visual impacts of sedimentation would include the use of silt curtains during dredging activities, and proper handling and disposal of spoil material.

Stockpiling

Stockpiling spoil material would be temporary. Measures to minimise the potential visual impacts of stockpiling spoil material would include:

- Appropriate site selection with no or minimal views from sensitive receptors.
- Minimising the duration of stockpiling.
- Limiting the height of stockpiles.
- Covering stockpiles with low visibility material such as dark coloured tarpaulins.

Foreshore Treatments

The design has minimised the bulk and scale of the Project's built elements, and matched adjoining port infrastructure where possible.

The foreshore protection system would minimise the impacts on visual and landscape features. This rock revetment would prevent scour and erosion and would be visually consistent with surrounding foreshores.

16.6 Waste Management

Waste management was not listed as a key issue in the DGRs. This section addresses potential sources of waste from the Project, potential impacts as a result of waste, and provides management measures to minimise or eliminate impacts.

The Project would produce waste during the construction of foreshore treatment works. Minimal, if any, waste would be produced from dredging operations. Once construction is complete, there would be no on-going operational wastes generated. This section therefore assesses potential impacts associated with the construction of foreshore treatments. Chapter 13 (Spoil Handling and Disposal) addresses sediment disposal.

16.6.1 Policy Framework

The following guidelines would be used to develop a Waste Management Plan for the construction stage of the Project:

- DEC 1998, *Construction and Demolition Waste Action Plan*.
- DEC 1999, *Environmental Guidelines: Assessment, Classification and Management of Non Liquid and Liquid Waste*.
- Waste Management Authority of NSW 1990, *Waste Planning for Industry: A Guide.*

Ecologically Sustainable Development principles in waste management would also be recognised in the construction of the Project through adherence to the waste hierarchy and by confirming:

- The generation of waste does not exceed the capacity of the receiving environment or the method of disposal.
- The adoption of a whole of lifecycle approach in formulating a waste minimisation and management plan for the Project.

The requirements of the *Protection of the Environment Operations Act 1997*, which are relevant to the Project include:

- Any hazardous waste must be stored in an environmentally safe manner and not come into contact with any incompatible waste.
- Waste must be transported to land that can lawfully receive that waste.
- Transport vehicles must be kept in a clean condition and be constructed and maintained to prevent waste spillage.
- Transport vehicles must be covered when loaded to prevent spilling and loss of waste and to prevent emission of odours.

16.6.2 Potential Impacts

The following wastes would be expected to be generated during construction:

- Demolition waste including concrete, timber and other existing wharf infrastructure to be removed.
- Surplus construction materials such as concrete, steel and timber.
- Liquid wastes such as waste fuels, oils and chemicals.
- Surplus materials used during site establishment such as safety fencing and barriers which may include plastics and metals.
- Wastewater including site run-off and water used to control dust and stockpiles.
- Domestic waste including food scraps, aluminium cans, glass bottles, plastic and paper containers and putrescible waste generated by site construction personnel.
- Ablution waste including waste from toilets and basins.
- Waste oil and fuels.

16.6.3 Mitigation Measures

Construction

To determine waste management options, waste would be classified according to the DECC 1999 Guidelines: *Assessment, Classification and Management of Liquid and Non-Liquid Wastes* into the following categories:

- Inert – including virgin excavated material, vegetation, building and demolition waste, concrete and asphalt.
- Solid – such as food waste and litter.
- Industrial – such as asbestos.
- Hazardous – such as flammable liquids.
- Liquid – such as sewage.

A Waste Management Plan would be prepared as part of the Construction Environmental Management Plan (CEMP) and would provide details of the requirements for handling, stockpiling and disposal of wastes.

16.7 Potential Cumulative Impacts

Cumulative impacts are the effect caused by successively and/or concurrently adding the same impact to produce an accumulated effect. This section describes potentially cumulative impacts from the Project. It also describes the Project's possible impacts from the interaction with other approved projects and known proposals in the area of the Project site.

16.7.1 Construction of the Project

The Project includes the dredging of twelve berths. Dredging of all twelve berths simultaneously is unlikely to occur as a number of proponents may develop the berths. For completeness of the environmental assessment however, the assessment of potential impacts from dredging has been based on the scenario that all twelve sites are to be dredged during a single campaign. The likely environmental impacts would be diminished if dredging activities were not undertaken simultaneously for all berths.

The assessment of the Project's potential impacts considered the interaction between key issues. The EIS chapters closely consider the relationship with other key issues, and assess whether the combination of impacts would have a significant cumulative impact. The assessment determined that the implementation of standard and project-specific measures would adequately manage the potential for cumulative impacts from the construction of the Project.

16.7.2 Adjoining Projects and Proposals

There are a number of existing and proposed projects in the vicinity of the Project site. These projects have the potential to produce cumulative impacts if undertaken at the same time as the construction of the Project. Chapter 3 (Interaction with Adjoining Projects and Proposals) assesses the Project's interaction with a number of projects and proposals. These projects and proposals include (but are not limited to):

- Mayfield Concept Plan (Port Terminal Facilities).
- Intertrade Development.
- Marstel Terminals Bulk Liquids Storage Facility.
- ICL Cement Terminal Mayfield North.
- Extension/Deepening of Shipping Channels.
- Hunter River Remediation Project.
- Newcastle Coal Infrastructure Group Coal Terminal.
- Port Waratah Coal Services Terminal 4.
- Swing Basin.
- Orica – Kooragang Island Facility Expansion.
- Walsh Point – Eastern Star Gas.

The potential for cumulative impacts from adjoining projects will be dependent on the timing of construction activities on these adjoining projects. If there is no construction work occurring at the time of dredging for the Project, there is no potential for cumulative impacts.

Table 16-5 outlines the potential cumulative impacts from the Project, the potential interactions with other projects and recommended mitigation measures.

Table 16-5 Potential Cumulative Impacts and Mitigation Measures

Issue	Potential Cumulative Impact	Mitigation Measure
Key Issues		
Hydrology	The hydrological assessment confirmed that the Project would have minimal hydrological impacts. The assessment and concept design also considered adjoining Projects on the Hunter River such as the NPC Swing Basin, extension of shipping channels in the South Arm by the NSW Maritime Authority, and the Port Waratah Coal Services Terminal 4. The hydrological modelling undertaken for the EIS included the designs for these projects. It assessed the potential combined cumulative impacts of these projects on river hydrology. Modelling confirmed that the Project would not contribute to the cumulative impact of known projects in the vicinity.	The Project's concept design has incorporated design measures to limit potential hydrological impacts. Measures include designing foreshore treatments such as sheetpile walls that do not restrict or alter river flows in the vicinity of the berths.
Sediment and Water Quality	Dredging works would disturb and disperse river sediment. Simultaneous dredging or construction works from nearby projects would contribute to the Project's impact. The Project would not affect water quality in terms of stratification and depletion of dissolved oxygen concentrations. Nearby projects may affect these measures and produce cumulative impacts. The potential for cumulative impacts will depend on the timing of construction activities for all projects. If construction work or dredging does not occur simultaneously there would be no potential for cumulative impacts.	NPC would closely with proponents of known and planned projects prior to construction to determine the timing of works on those projects. If there is a potential for cumulative impacts from the simultaneous construction of adjoining projects, the Construction Environmental Management Plan (CEMP) would be reviewed and updated prior to construction. The revisions to the CEMP would include a revised dredging strategy and sediment control strategies.

Issue	Potential Cumulative Impact	Mitigation Measure
Contamination	The potential for cumulative impacts will be dependent on the timing of construction activities on these adjoining projects. Simultaneous excavation is unlikely produce direct contamination impacts, but may affect other aspects of construction such as spoil management, transportation and disposal.	The CEMP would be revised and amended if risks are identified from adjoining projects.
Spoil Handling and Disposal	Potential cumulative impacts from spoil handling and disposal would primarily relate to water quality, air quality, traffic and contamination.	The CEMP would be revised and amended if risks are identified from adjoining projects.
Noise and Vibration	Construction activities and the haulage of spoil by road would not have a significant impact on sensitive receivers due to the relatively minor scale of works proposed, the timeframe for construction activities and the distances to sensitive receivers. The potential for cumulative construction noise and vibrations impacts would depend on the timing of construction.	NPC would liaise with proponents of nearby projects prior to construction. Noise and vibration management measures in the CEMP would be reviewed and revised if required. Community consultation would be undertaken to inform the community of the construction works.
Aquatic Flora and Fauna	The Project would have minimal impact on aquatic flora and fauna. The potential for cumulative impacts with adjoining projects is considered minor.	Management measures contained within the CEMP would be reviewed and revised if required.
Non-Indigenous Heritage	Items at Walsh Point and Dyke Point would be impacted by the Project. These items have been assessed as locally significant. The Project would not disturb any items of regional, state or national heritage significance. Therefore, the potential for cumulative impacts on adjoining heritage items is low.	Management measures contained within the CEMP and Statement of Commitments would be reviewed and revised if required.
Indigenous Heritage	The Project is located in a highly disturbed and industrial area with a low potential for items of Indigenous heritage to be affected by the Project.	Consultation with the local Aboriginal stakeholders would continue over the course of the Project.

Issue	Potential Cumulative Impact	Mitigation Measure
Other Issues		
Air Quality and Odour	Potential air quality impacts (including odour) from the Project would be minor. The distance to the nearest sensitive receiver would provide an adequate buffer from air quality impacts. The potential for air quality impacts to accumulate with those generated by other nearby projects would depend on timing. Potential cumulative impacts include: ◗ Dust from dredged material stockpiles and dust generated by other projects in the vicinity. ◗ Odour from stockpiled sediments particularly material containing odorous compounds such as polycyclic aromatic hydrocarbons (PAHs). The odour from this material may combine with odours from nearby projects. ◗ Exhaust emissions from a range of mobile and fixed equipment.	Other projects will also have mitigation in place for potential air quality impacts. Management measures in the CEMP would be revised if required. Measures to be revised would include the time that stockpiled material is exposed, transporting material off-site before it dries and becomes a potential dust source, stockpiles will be minimised where possible.
Traffic and Access	The traffic study assessed the Project's impact of the on existing and predicted traffic levels on main arterial routes. The Traffic Study considered the potential cumulative traffic of this Project with other projects in the area, which may utilise the same roads. Traffic associated with the construction works would be minimal. Trucks transporting contaminated materials to Kemps Creek would not add significantly to the traffic volumes. The Project's potential to contribute to impacts from nearby projects would depend on the timing of these projects It is unlikely that all of the identified projects and proposals would be approved and constructed at the same time.	NPC would liaise with proponents of nearby projects prior to construction. Traffic management measures in the CEMP would be reviewed and revised if required. Community consultation would be undertaken to inform the community of the construction works Management measures would include: ◗ Spoil disposal routes would be limited to designated heavy vehicle routes. ◗ Hauling of spoil should minimise the required number of heavy vehicle movements. ◗ The dispatch of trucks from the Project area will be timed outside of peak travel periods. ◗ If substantial construction workers are required, a Workplace Travel Plan would be prepared for staff to minimise car movements into the worksite.

Issue	Potential Cumulative Impact	Mitigation Measure
Economic and Social	The Project and other developments in the vicinity of the have the potential produce cumulative impacts on the local and wider community, including: ◗ Potential negative impacts associated with construction phase works relating to amenity. ◗ The Project would produce beneficial socio-economic results for the local, regional and state economies. The cumulative economic impact of the Project and adjoining projects and would potentially produce significant cumulative benefits.	Mitigation measures addressing amenity impacts associated with the dredging of the berths are provided in the key issues chapters of this EIS and the Statement of Commitments. The CEMP would be reviewed and revised if required. Community consultation would keep the community informed.

17. Statement of Commitments

The DGRs state that the following in relation to a Statement of Commitments is to be provided:

> "*A draft Statement of Commitments (SoC), incorporating or otherwise capturing measures to avoid, minimise, manage, mitigate, offset and/or monitor impacts identified in the impact assessment sections of the Environmental Assessment. The SoC must clearly articulate the desired environmental outcome of the commitment. The SoC must be achievable, measurable (with respect to compliance), and time-specific where relevant."*

The development of the Project, including the concept design and environmental impact statement, has considered the potential environmental impacts. This process has identified the desired environmental outcome. This has allowed for standard and project-specific environmental management measures to be developed and refined in order to avoid, minimise, manage, mitigate, offset and or monitor potential impacts.

The SoC references management and mitigation measures contained within the impact assessment chapters of the EIS, and states the desired environmental outcomes to be achieved. Any proponent or contractor undertaking the detailed design, planning and/or construction of the Project would be required to undertake works in accordance with these commitments, and any conditions of approval.

Table 17-1 contains the SoC for the Project. The SoC follows the order of the key issues listed in the DGRs.

Table 17-1 Statement of Commitments

Key Issue and Reference	Objective	Commitment	Timing
Environmental Management			
EM1	Manage potential environmental impacts	A Construction Environmental Management Plan (CEMP) will be developed. The CEMP will be the overarching environmental management document. Supporting sub-plans will be developed to manage specific issues.	Pre-construction and construction
EM2	Constantly improve environmental management	The CEMP and supporting sub-plans will be monitored, reviewed and updated where necessary.	Pre-construction and construction
EM3	Environmental compliance	The construction contractor will have an Environmental Management System.	Pre-construction and construction
EM4	Environmental compliance	All works will be undertaken in accordance with this SoC, conditions of approval and relevant legislation.	Pre-construction and construction

Key Issue and Reference	Objective	Commitment	Timing
EM5	Minimise the potential for cumulative impacts with adjoining projects	NPC will liaise with the proponents of nearby projects that may be impacted to determine the timing of construction and the potential for cumulative impacts. The CEMP will be reviewed and revised if the potential for cumulative impacts needs to be managed.	Pre-construction and construction
Water Quality			
WQ1	Minimise sedimentation and associated impacts to water quality	A Soil and Water Management Plan (SWMP) and Dredge Management Plan (DMP) will be established as part of the Construction Environmental Management Plan (CEMP). Future proponents would agree the locations for nearfield impact and background level monitoring in consultation with the relevant government agencies prior to works commencing. The Water Quality Management Plan will specify the nearfield and background monitoring locations, as well as turbidity limits at the agreed monitoring locations.	Pre-construction and construction
		A water quality monitoring strategy will be developed as part of the SWMP.	Pre-construction and construction
		Turbidity curtains will be used around landside excavators.	Construction
		Turbidity curtains will be used with cutter-suction dredges and backhoe dredges.	Construction
		A heavy-duty turbidity curtain if required, around some of the environmentally sensitive areas upstream on the South Arm when trailing suction hopper dredges were using overflows.	Construction
		Stockpiles are to be located in bunded areas and covered where feasible.	Construction

Key Issue and Reference	Objective	Commitment	Timing
Contamination			
CON1	Limit the potential for the mobilisation of contaminated material	A Soil and Water Management Plan (SWMP) will be developed as part of the Construction Environmental Management Plan (CEMP). The SWMP will establish procedures for managing contaminated fill and groundwater if they are encountered. The SWMP will detail appropriate procedures for the handling and stockpiling of potentially contaminated material during the works. Provisions for classification and management of any surplus materials that are required to be disposed off-site will also be included. The SWMP will also include a contingency plan for unexpected hazardous materials that may be encountered during site works. The SWMP will detail measures equivalent to (or better than) the current methods (cement stabilisation) to adequately manage contaminated materials. Use of silt curtain or appropriate technology during the dredging operations.	Pre-construction and construction
CON2	Minimise waste and dispose of contaminated material appropriately	Waste will be limited and managed in accordance with relevant legislation. Potentially contaminated material will be managed appropriately, as outlined in the SWMP and CEMP. Contaminated material will be transported and disposed to a waste management facility licensed to accept that classification of waste.	Construction
CON3	Validation testing	Sediments from the berths will undergo validation testing to confirm the presence or absence of contaminants prior to disposal.	Pre-construction and construction
CON4	Sediment Sampling	Additional sediment sampling will be undertaken as part of the Sea Dumping Permit application.	

Key Issue and Reference	Objective	Commitment	Timing
Hydrology			
HYD1	Minimise the potential for impacts to hydrology of the Hunter River, such as the alteration of tidal range and water levels, saline intrusion to upstream water bodies, stratification and anoxia	The detailed design will maintain the measures incorporated into the concept design that eliminate and minimise any impacts to the hydrology of the river.	Pre-construction
Noise and Vibration			
NV1	Inform the community of potential noise and vibration impacts	Appropriate levels of consultation will be undertaken to inform the community of the likely levels and duration of noise and vibration during construction.	Pre-construction
NV2	Inform the community of potential noise and vibration impacts	Consultation will be undertaken in accordance with the Construction Noise Strategy October 2010.	Pre-construction and construction
NV3	Minimise construction noise impacts	A Noise and Vibration Management Plan (NVMP) will be developed as part of the CEMP. A range of mitigation techniques will be implemented, including appropriate timing of construction hours, careful selection of equipment, and consultation with potentially affected sensitive receivers. Compliance with relevant Occupational Health and Safety requirements. Use of broadband reversing alarms (audible movement alarms) will be used as a preference to tonal alarms.	Pre-construction and construction
NV4	Work Ethics	All site personnel are to be aware of the potential for noise impacts to impact on local residents and are encouraged to take practical and reasonable measures to minimise impacts (such as shouting, slamming doors, and reversing).	

Key Issue and Reference	Objective	Commitment	Timing
NV5	Minimise vibration impacts	Mitigation measures for vibration impacts will be included in the NVMP. Measures will include condition inspections and dilapidation assessments being undertaken for any utility, structure or building when vibratory piling is planned within 60 metres. Principles in NSW Office of Environment and Heritage: *Assessing Vibration: A Technical Guideline.*	Pre-construction and construction
NV6	Minimise the potential for cumulative noise impacts with other major construction activities in the region	Cumulative noise impacts will be managed via liaison with surrounding projects.	Pre-construction and construction
Aboriginal Heritage			
AH1	Preserve information about heritage values in the study area	On-going consultation will be undertaken with registered Aboriginal stakeholders.	Pre-construction and construction
Non-Indigenous Heritage			
NIH1	Preserve information about known heritage items within the study area and minimise impacts to these values	Measures for mitigation of impacts to known heritage values will be included in the CEMP.	Pre-construction and construction

Key Issue and Reference	Objective	Commitment	Timing
NIH2	Record heritage values at Walsh Point	Archival recording of the maritime archaeological remains associated with the former engineering works present along Walsh Point. The remains will be recorded following the guidelines stated in "Photographic Recording of Heritage Items Using Film or Digital Capture" and will be undertaken under the direction of a maritime archaeologist. This work will include both video and still photograph. Prior to the demolition and removal of the underwater remnant structures at Walsh Point an archaeological and engineering review, to archival standards, is to be conducted. The review will continue during the demolition of the structures and provide a photographic and engineering record of the structures. Copies of the records are to be submitted to the OEH Heritage Branch and to Newcastle City Council libraries for their records after the demolition of the structures	Pre-construction
NIH3	Record heritage values at Dyke Point	An archival recording (and engineering review to archival standards) will be undertaken for both Crane Base 14 and 15, and the McMyler Hoist prior to their demolition at Dyke Point. The review will continue during the demolition of the structures and provide photographic and engineering record of the structures. The remains will be recorded following the guidelines stated in "Photographic Recording of Heritage Items Using Film or Digital Capture" and will be undertaken under the direction of a maritime archaeologist. The recording will include the above and below water remains of all three items, and will include both video and still photography. Copies of the records are to be submitted to the OEH Heritage Branch and to Newcastle City Council libraries for their records after the demolition of the structures.	Pre-construction

Key Issue and Reference	Objective	Commitment	Timing
NIH4	Notification of heritage actions	Notification will be provided to the Heritage Council, and the Office of Environment and Heritage regarding the demolition of the former McMyler Hoist and Coal Loader, and their removal from the Section 170 Heritage and Conservation Register. As stated in the Heritage Act 1977, under Section 170A(1) notification has to be made in writing to the Heritage Council no less than 14 days before the item is removed from the Section 170 Register or demolition works commence.	Pre-construction
NIH5	Record of archaeological artefacts	Record all archaeological artefacts that are discovered during the works. In the event that an archaeological artefact is found, a heritage expert is to be consulted about appropriate archival recording and if possible preservation.	Pre-construction and construction
NIH6	Stockton beach spoil management	If beach renourishment is found to be a suitable option for Stockton Beach, this will be achieved through bottom dumping (or bow casting) of sands from the dredge (subject to the Commonwealth Historic Shipwrecks Act 1976 being considered).	Pre-construction and construction
Spoil Handling and Disposal			
SHD1	Eliminate or minimise impacts from spoil handling and disposal	NPC will develop a Dredging and Disposal Plan to form part of the CEMP The Plan will include the preparation of a Dredged Material Placement Management Plan, methodology for geotechnical and geochemical validation testing, a waste audit and a monitoring program.	Pre-construction and construction
SHD2	Minimise impacts from stockpiling material	In the event that contaminated sediment is identified, this material will be stockpiled at Walsh Point (or other suitable location). This stockpile location will require the development of a site-specific management plan. The SWMP and measures noted in WQ1 will minimise potential impacts on water quality.	Pre-construction and construction

Key Issue and Reference	Objective	Commitment	Timing
SHD3	Minimise potential impacts of ASS or PASS	In the event that stockpiling is required, an ASS Management Plan will be developed and incorporated into the CEMP to minimise the potential for PASS to be oxidised and for ASS to be disturbed.	Pre-construction and construction
SHD4	Beach renourishment	In the event that the material is suitable for beach renourishment, the following will be implemented by the proponent: ◗ Suitable material will be managed in conjunction with Newcastle City Council and relevant guidelines. ◗ Development of a detailed material transport and placement methodology. ◗ Development of monitoring programs for Stockton Beach and adjacent areas to determine the change in beach profiles.	Pre-construction and construction

Key Issue and Reference	Objective	Commitment	Timing
SHD5	Management of fill material for nearby industrial developments	Investigations to confirm the suitability of material. In the event that the material is suitable for fill, the following will be implemented by the proponent: ◗ A discharge pipeline route (which minimises the impacts associated with the transport of dredged materials to the site) will be investigated. ◗ Development of a Site Reclamation Strategy which is likely to include: - Excavation of localised contaminated or otherwise unsuitable sediments (if required), sequential construction of bunds (both perimeter and internal) to form the settlement ponds, installation of hydraulic controls to facilitate discharge of return water through the ponds, the hydraulic placement of sand in a series of lifts, and finally, the collection and removal of the remaining fines fraction (if required). ◗ Development of a Water Management Strategy to manage the return waters released from the placement of dredged slurry across the reclamation site and ultimate discharge. ◗ Development of Monitoring Programs for the onshore and return water discharge points.	Pre-construction and construction

Key Issue and Reference	Objective	Commitment	Timing
SHD6	Disposal to landfill	Selection of appropriate plant and equipment, namely excavation of potentially contaminated materials using a backhoe dredge. Development of an appropriate construction methodology, where by the backhoe dredge is fitted with a specially designed grab or bucket that minimises turbidity in the water column during dredging operations. Where materials are located high on the river bank, the removal activities are to be isolated from the South Arm of the river as much as is possible. Excavated material is to be tested onsite for classification before transport and disposal using road trucks with tight fitting or sealed tailgates as previously used on similar sites on Kooragang Island and at Mayfield. The onsite handling and treatment of the unsuitable materials will be completed under the existing licence conditions of the potential waste facilities.	Pre-construction and construction
Traffic and Transport			
TT1	Minimise traffic impacts associated with the hauling of dredged material to disposal locations	The spoil disposal route from Newcastle to Sydney will be limited to designated heavy vehicle Pre-construction and construction routes.	Construction
TT2	Manage the volume of spoil material and vehicle movements	Designation of temporary stockpile location for spoil material unsuitable for reuse within Port of Newcastle. Hauling of spoil should use truck and dog combination with capacity of 14 cubic metres each, to minimise required number of heavy vehicle movements. The dispatch of trucks from the Port of Newcastle need to be managed to minimise peak travel periods.	Pre-construction and construction
TT3	Minimise the potential for cumulative traffic impacts with other major construction activities in the region	Cumulative traffic impacts will be managed via liaison with other projects to adjust traffic and transport schedules and routes if required.	Pre-construction and construction

Key Issue and Reference	Objective	Commitment	Timing
Flora and Fauna			
FF1	Minimise the potential impacts on estuarine ecosystems, aquatic fauna, wetlands and mangroves	Measures to control of surface water runoff and sedimentation will be detailed in the CEMP. Measures contained, in Chapter 10 (Hydrology) and Chapter 8 (Sediment and Water Quality) and Chapter 13 (Spoil Handling and Disposal) will limit the potential for impacts on aquatic ecosystems. Installation of silt curtains (with floating booms) around the dredge area. If a dewatering basin is required at Walsh Point (or other suitable location) for treating and stockpiling contaminated sediment, specific management measures will be developed in the CEMP.	Pre-construction and construction
Social and Economic			
SE1	Minimise adverse socio-economic impacts	Mitigation measures contained within the key issues chapters of this EIS will reduce or eliminate adverse impacts.	Pre-construction and construction
SE2	Minimise adverse socio-economic impacts	A Stakeholder Engagement Strategy will be implemented.	Pre-construction and construction
Air Quality and Climate			
AQ1	Avoid or minimise adverse air quality impacts	An Erosion and Sediment Control Plan (ESCP) will form part of the CEMP. Measures contained in the ESCP will minimise air quality impacts during construction.	Pre-construction and construction
AQ2	Avoid or minimise adverse air quality impacts	Management measures contained within Section 16.2 (Air quality) will form part of the ESCP.	Pre-construction and construction
Energy and Greenhouse			
EG1	Reduce greenhouse gas emissions as far as reasonably practicable, and minimise energy use	Reduce the quantity of fuel consumed through optimising construction activities and logistics.	Pre-construction and construction
EG2	Minimise energy use	The Project's detailed design and planning stages will develop options for optimising transportation activities and minimising fuel usage.	Pre-construction and construction

Key Issue and Reference	Objective	Commitment	Timing
Risks and Hazards			
RH1	Minimise risks and hazards associated with the project to avoid adverse impacts to the environment and community	NPC's port safety and management systems will be used to minimise navigational and environmental risk.	Pre-construction and construction
Visual			
VI1	Minimise potential visual impacts during construction	Visual impacts from the Project will be minor and temporary. The duration of construction works will be limited to the shortest period possible. Sedimentation of the water column will be managed through use of silt curtains and appropriate disposal of spoil material. Minimise the potential visual impacts of spoil stockpiling through appropriate site selection, limiting the height of stockpiles, and covering stockpiles with low visibility material.	Construction
VI2	Minimise potential visual impacts after construction	The detailed design will be developed to make the Project visually compatible with adjoining port developments. The foreshore treatments will be designed to minimise the bulk and scale of the Project's built elements, and matched adjoining port infrastructure where possible.	Pre-construction
Waste Management			
WM1	Avoid or minimise potential waste material	Waste management options will be determined according to the DECC 1999 Guidelines *Assessment Classification and Management of Liquid and Non-Liquid Wastes.* A Waste Management Plan will be prepared as part of the CEMP.	Pre-construction and construction
Cumulative Impacts			
CI1	Minimise potential cumulative impacts from within the Project	The CEMP and supporting plans will be developed as a management system for construction. The CEMP will manage potential individual impacts and the potential interaction of these impacts.	Pre-construction and construction

Key Issue and Reference	Objective	Commitment	Timing
CI2	Minimise potential cumulative impacts with other known or planned adjoining projects	The CEMP and supporting plans will be developed and refined prior to construction with due attention paid to known existing or planned projects that may interact with impacts from the Project.	Pre-construction and construction

17.1 Environmental Management

The DGRs state that the EIS should describe measures to be implemented to avoid, minimise, manage, mitigate, offset and/or monitor the impacts of the Project, and the effectiveness of the measures. These measures are contained within the assessment sections of this EIS and in Table 17-1 Draft SoC.

The proponent and construction contractor(s) will operate under an accredited Environmental Management System. The proponent and construction contractor(s) will develop a tailored Construction Environmental Management Plan (CEMP) to manage potential impacts during construction. The CEMP will provide the over-arching framework for environmental management. The CEMP will detail all of the required environmental protection practices, resources and the sequence of activities to minimise impacts. A number of issue-specific sub-plans will support the CEMP.

The CEMP will contain all mitigation and management measures contained within this EIS. The CEMP will address all conditions of approval and applicable legislation and guidelines. It will be continually reviewed and updated during the course of construction so that management measures are as effective as possible. Continual improvement will further reduce potential impacts.

The CEMP would detail the following:

- Roles and responsibilities for planning, approval, implementation, assessment and monitoring of environmental controls.
- Objectives and targets for environmental performance.
- Required licences, approvals and permits.
- The management measures to be implemented at each stage of construction to minimise impacts.
- Monitoring programs and mechanisms to evaluate environmental performance.
- Community consultation and communication procedures.
- Document control procedures.
- Emergency response procedures.
- Training, competence and awareness assessment procedures.
- An environmental auditing program and mechanisms to control the management of any non-conformances.

18. Justification of the Project

The Project has been developed to support trade diversification and facilitate future development of adjacent portside land. The Project would provide future proponents with one of the key approval requirements for developing wharf infrastructure. This approval will provide proponents with increased confidence that portside land can be developed for their intended uses.

The Project's benefits have been identified and potential negative environmental impacts have been assessed. The Project's potential negative impacts would be appropriately managed via the implementation of standard and project-specific mitigation measures. The advantages attributable to the Project would provide a net benefit to the port, city, region and state when the proposed mitigation measures are implemented.

18.1 Achieving Objectives

The Project would assist to achieve NPCs objectives of increasing the port's capacity and diversifying trade. Dredging the proposed berths would provide opportunities to develop trade infrastructure on vacant port-side industrial land. The Project would assist to provide opportunities for trade in non-coal materials.

18.2 Alternatives Considered

18.2.1 The Project

NPC undertakes strategic planning for the management and development of the port. The strategic planning for the port examines a range of factors including trade developments, local, regional and state economic matters, social impacts and environmental constraints. NPC's planning has identified benefits from improving the diversity and capacity of the port.

The Project is a result of the strategic port planning. The Project is an opportunity to improve port diversity and capacity and develop vacant port-side land. It complements other projects in the planning stage and those that have been completed.

18.2.2 The "Do Nothing" Approach

The "do nothing" approach was also considered as an alternative option. This approach would maintain the current port situation where existing berths are nearing their capacity to support non-coal trade. This approach was not pursued as it is seen as a lost opportunity to improve trade diversity and capacity. If the "do nothing" approach was adopted, coal trade's dominance would remain and opportunities for non-coal trade would not be realised.

18.3 Consequences of Not Proceeding

The viability of developing adjoining port land and constructing non-coal related trade infrastructure would diminish if approval for dredging the proposed berths was not granted. This would limit the opportunities to diversify trade within the port and would not improve port capacity.

Potential flow-on benefits to the local economy, together with the broader regional and state economies, would be lost. The Project's direct and indirect benefits justify the development of the proposed berths.

18.4 Principles of Ecologically Sustainable Development

The concept of ecologically sustainable development (ESD) is a framework aimed at achieving appropriate economic and social development, whilst maintaining the long-term integrity of ecological systems. To aid in the interpretation of ESD, four guiding principles are listed in Schedule 2 of the *Environmental Planning and Assessment Regulation 2000*. The four guiding principles of ESD are:

- The precautionary principle.
- Inter-generational equity.
- Conservation of biological diversity and ecological integrity.
- Improved valuation, pricing and incentive mechanisms.

The four guiding principles of ESD, and their relation to Project, are outlined in the following sections.

18.4.1 The Precautionary Principle

The precautionary principle is defined as:

> *Where there are threats of serious or irreversible environmental damage, lack of full scientific certainty should not be used as a reason for postponing measures to prevent environmental degradation. In the application of the precautionary principle, public and private decisions should be guided by:*
>
> (i) *careful evaluation to avoid, wherever practicable, serious or irreversible damage to the environment, and*
>
> (ii) *an assessment of the risk-weighted consequences of various options*

This EIS has examined the Project's potential to cause serious or irreversibly environmental damage. The methods used to assess the level of environmental risk show the appropriate level of investigation so that there is no lack of scientific knowledge. The investigations have adequately assessed potential impacts from the key issues listed in the DGRs. Furthermore, other potential risks not listed in the DGRs have been assessed. Management and mitigation measures have been proposed to eliminate or minimise the environmental risk associated with the Project.

The concept design has avoided potential environmental risks. The proposed berths are appropriately located in previously disturbed areas, and no areas of high environmental significance would be directly or indirectly affected to a serious or irreversible level.

18.4.2 Intergenerational Equity

Intergenerational equity refers to the requirement for the present generation to ensure the health, diversity and productivity of the environment are maintained or enhanced for the benefit of future generations.

The Project would directly contribute to achieving the goal of intergenerational equity via the creation of opportunities for trade in non-coal products. The diversification of trade through the port would have flow on economic benefits to the broader community. The Project would not pose a risk to the diversity or productivity of the environment for present or future generations.

18.4.3 Conservation of Biological Diversity and Ecological Integrity

This principle requires that conservation of biological diversity and ecological integrity should be a fundamental consideration in all development. The Project would not significantly affect the biological diversity and ecological integrity of the locality. An ecological impact assessment was undertaken as part of the preparation of this EIS. The ecological assessment found that the Project would have no significant impact upon threatened species, populations or ecological communities or their habitats.

18.4.4 Improved Valuation and Pricing of Environmental Resources

The Project would assist to achieve NPCs objectives of diversifying trade by the provision of new berths and increasing port capacity. The Project will assist in the development of portside land by providing future proponents with increased confidence that the land may be developed for its intended uses. The Project's benefits would accrue to the local, regional and state economies. Potential negative environmental impacts would be appropriately managed to eliminate or reduce their severity. The Project would not impact on any threatened species, populations or ecological communities or their habitats.

The assessment of the Project's performance against the four principles of ESD found that on balance the Project would produce net benefits. The Project's location and scale are appropriate and therefore the Project is justified.

19. Conclusion

The Project has been declared State Significant Infrastructure (SSI) under Part 5.1 of the *NSW Environmental Planning and Assessment Act 1979* (EP&A Act). This Environmental Impact Statement (EIS) has been prepared in accordance with the DGRs issued by the NSW Department of Planning and Infrastructure under the EP&A Act.

The EIS has identified the impacts that could potentially result from the key issues identified in the DGRs. The environmental risk analysis assessed the potential for other impacts to result from construction of the Project. Environmental management measures have been developed to eliminate or minimise the potential for these impacts to negatively affect the environment.

The assessment of key issues and non-key issues has identified potential impacts and proposed management measures to reduce or eliminate these impacts. The Statement of Commitments provides environmental management objectives and commitments to achieve these objectives. The Construction Environmental Management Plan would provide the framework to implement, review, assess and improve management measures so that the measures are as effective as possible at minimising impacts.

The EIS considered alternatives to the Project and assessed the consequences of not proceeding. On balance, the Project would have a net benefit to the community and the local, regional and state economies. The assessment of the Project's performance against the four principles of ecologically sustainable development confirmed that the Project:

- Has been located and designed with adequate scientific knowledge and applies the precautionary principal.
- Would not limit the potential beneficial use of the environment for future generations.
- Would not negatively affect the conservation of biological integrity or ecological integrity.
- Has adequately valued environmental resources.

The Project has been developed to adequately balance engineering and operational requirements with environmental performance. The concept design has incorporated a range of measures to reduce impacts. The detailed design would provide refinements and measures to further reduce potential environmental impacts.

The Project would assist to increase the capacity and diversity of the port and would facilitate the development on non-coal trade options. Benefits would accrue to the community and the local, regional and state economies. The Project would not have a significant effect on the environment or the community. It is concluded that the Project is justified and should proceed on the basis of the benefits that the Project would create and that the potential impacts can be adequately managed by standard and project-specific management measures.

20. References

AECOM 2009, *Orica – Proposed Ammonium Nitrate Facility Expansion* – Environmental Assessment.

AECOM 2010, *Air Quality Impact Assessment for Newcastle Port Corporation for Mayfield, Steel River and Stockton air quality monitoring stations*.

AECOM 2010, *Mayfield Site Port-related Activities Concept Plan*: *Environmental Assessment.*

Allan, D.T 1869, *Chart of Newcastle Harbour and Port Waratah,* 1:10,000, Drawn and Lithographed with the sanction of the Pilot Board of N.S.W., R.C. Knaggs & Co 1869, [National Library of Australia, internet version http://nla.gov.au/nla.map-f52-v].

ANZECC 2000, *Australian National Guidelines for Cetacean.*

ANZECC 2000*, Water Quality Guidelines for Fresh and Marine Waters.*

ANZECC/ARMCANZ 2000*, Australian and New Zealand Guidelines for Fresh and Marine Water Quality.*

AS2436: 2010, *Guide to Noise and Vibration Control on Construction, Maintenance and Demolition Sites.*

Australian Bureau of Statistics Census Data 2011, Available from, www.abs.gov.au/websitedbs/D3310114.nsf/home/census+data?opendocument#from-banner=LN (accessed August 2011).

ASSMAC 1998, *Acid Sulfate Soil Manual*.

BMT & WBM 2009, *Hunter Estuary Coastal Zone Management Plan.* Prepared for; Newcastle City Council, Port Stephens Council, Maitland, City Council and NSW Department of Environment and Climate Change.

British Standard - BS 6472 1992, *"Guide to Evaluation of Human Exposure to Vibration in Buildings (1 Hz to 80 Hz)".*

CH2MHill 2010, *Hunter River South Arm* – Nearshore Sediment Validation, December 2010.

Christopher Stapleton Consulting Pty Ltd 2007, *Kooragang Island Fuel and Bio-Diesel Facility* – Traffic Impact Assessment*.*

Connel Hatch 2006, *Kooragang Berths K8 and K9 Boreholes for Newcastle Coal Infrastructure Group.*

Connell Hatch 2007, *Newcastle Coal Export Terminal – Road Transport Assessment Newcastle Coal Export Terminal* – Construction Traffic Management Protocol*.*

CSIRO 2005*, Handbook for Sediment Quality Assessment.*

CSIRO 2000, *Sediment Quality Guidelines.*

Dames & Moore 1990, *Sediment sampling*.

Department of Environment and Climate Change 2009, *Waste Classification Guidelines Part 1: Classifying Waste.*

Department of Environment and Climate Change 2009, *Interim Construction Noise Guideline.*

Department of Environment and Climate Change 2009, *Interim Construction Noise Guideline.*

Department of Environment and Climate Change 2008, *Waste Classification Guidelines, Part 1: Classifying Waste.*

Department of Environment and Conservation 1998, *Construction and Demolition Waste Action Plan.*

Department of Environment and Conservation 1999, *Environmental Guidelines: Assessment, Classification and Management of Non Liquid and Liquid Waste.*

Department of Environment and Conservation 1995, *Threatened Species Conservation Act 1995.*

Department of Environment and Conservation 2004, *Threatened Species Legislation Amendment Act.*

Department of Environment and Conservation 2004, *Threatened Biodiversity Survey and Assessment: Guidelines for Developments and Activities*. Working Draft.

Department of Environment and Conservation 2005, *Draft Guidelines for Aboriginal Cultural Heritage Impact Assessment and Community Consultation.*

Department of Environment and Conservation 2005, *Draft Guidelines for Aboriginal Cultural Heritage Impact Assessment and Community Consultation.*

Department of Environment and Conservation 2005, *Interim Guidelines for Aboriginal Community Consultation* – Requirements for Applicants.

Department of Environment and Conservation 2005, *Interim Guidelines for Aboriginal Community Consultation – Requirements for Applicants).*

Department of Environment and Conservation 2005a, *Approved Methods for Modelling and Assessment of Air Pollutants in NSW.*

Department of Environment and Conservation 2006, *Assessing Vibration: A Technical Guideline.*

Department of Environment and Conservation and Department of Primary Industries 2005, *Draft Guidelines for Threatened Species Assessment.*

Department of Environment Climate Change and Water 2000, *Industrial Noise Policy.*

Department of Environment Climate Change and Water 2011, *NSW Road Noise Policy.*

DEWHA 2009, *Matters of National Environmental Significance. Significant Impact Guidelines 1.1.*

Douglas & Partners 1993, *Kooragang Coal Terminal Sampling*.

Douglas Partners 2006, *Kooragang Berths K7 boreholes for Port Waratah Coal Services*.

DPI 2011. Department of Primary Industries Critical Habitat Register. Available from <http://www.dpi.nsw.gov.au/fisheries/species-protection/conservation/what/register> (accessed 25 August 2011).

DSEWPaC 1981, *Environment Protection (Sea Dumping Act).*

DSEWPaC 1999, *Environment Protection and Biodiversity Conservation Act,* (EPBC Act).

DSEWPaC 2009, *National Assessment Guidelines for Dredging.*

DSEWPaC 2009, Department of Sustainability, Environment, Water, Population and Communities Critical Habitat register. Available from <http://www.environment.gov.au/cgi-bin/sprat/public/publicregisterofcriticalhabitat.pl> (accessed 25 August 2011).

DSEWPaC 2011, Hunter Estuary Wetlands. Available from http://www.environment.gov.au/cgi-bin/wetlands/ramsardetails.pl?refcode=24 (accessed 29 August 2011).

DSEWPaC Protected Matters Search Tool 2011, Available from,<http://www.environment.gov.au/epbc/pmst/index.html> (accessed 30 August 2011).

Egis Consulting Australia, December 2000, *Newcastle Steelworks Closure Area,* Summary Site Audit Report.

EMGA Mitchell McLennan 2010, *The Terminal 4 Project: Preliminary Environmental Assessment Report*. Prepared for Port Waratah Coal Services Limited, November 2010.

ENSR Australia Pty Ltd 2008, *Environmental Assessment Scoping report: Planning Approval for Uprating of Ammonium Nitrate Facility, Kooragang Island.* Prepared for Orica Australia Pty Ltd, June 2008.

ERM, September 1996, *PWCS Kooragang Coal Terminal, Stage Three Expansion,* Environmental Impact Statement.

German Standard DIN 4150-3: 1999, *Structural Vibration – Part 3: Effects of vibration on structures.*

GHD 2003, *South Arm Dredging Project, Environmental Impact Statement.*

GHD 2011(a), *Hunter River Remediation Project*, Interim Validation Report – Surgical Dredging Area (SDA) January 2011.

GHD 2011(b), *Hunter River Remediation Project* – Interim Validation Report, Zone 1 February 2011.

GHD 2011(c), *Hunter River Remediation Project* – Interim Validation Report, Zones 2-6 May 2011.

GHD 2011, *Vibrocore Sediment Sampling South Arm Hunter River*, Review of Environmental Factors. Prepared for Newcastle Port Corporation.

GHD 2010, *Orica Australia Ammonium Nitrate Facility Upgrade* – Construction Traffic Management Plan.

GHD-Longmac 1996, *KCT Stage 3 Expansion vibrocoring.*

GHD-Longmac 2001(a), *MPT Stage 1 vibrocoring.*

GHD-Longmac 2001(b), *MPT Stage 2/K7 vibrocoring*.

GHD-Longmac 2001(c), *South Arm vibrocoring.*

GHD-Longmac 2002, *Vibrocoring adjacent to former BHP site.*

Heggies Australia Pty Ltd, July 2006), *Newcastle Coal Export Terminal Construction, Operation and Road Transport Noise* Impact Assessment Report Number 10-4515-R.

Herbert, J.B, and S.B Brahme 1991, *Literature review and technical evaluation of sediment resuspension during dredging.*

Herbich, John B 2000, *Handbook of dredging engineering.*

HLA, 2007, *Kooragang Island Bulk Liquid Storage Facility, Marstel Terminals,* Environmental Assessment.

I&I NSW 2009, *Mapping the habitats of NSW Estuaries,* Fisheries Final Report Series No. 113 ISSN 1837-2112. Department of Industry and Investment. NSW Government.

I&I NSW 2009, *Important Estuary Habitat Mapping. Hunter River:* Map 1. Department of Industry and Investment. NSW Government.

Industry and Investment (I&I) 2011, NSW Threatened and Protected Species Records Viewer Available from www.dpi.nsw.gov.au/fisheries/species-protection/records/viewer (accessed 28 July 2011).

Lands Dept NSW 1865, *Plan of Allotments in Scns 17-24, 30-34, 36-39, 42-50 on Bullock Island and Sketch Showing their positions near the City of Newcastle, Co. Northumberland 1865*, Office no.511.[Land and Water Conservation no. 108492, Internet version: http://parishmaps.lands.nsw.gov.au/pmap.html, CD: PMapMD07, Image no. 10849201].

Lands Dept NSW 1912, *Parish map of Newcastle, County of Northumberland*, Second Edition.

Lands Dept NSW 1889 – 1959, *Parish maps of Newcastle, County of Northumberland,* Editions 1 to 8 [Internet versions: http://parishmaps.lands.nsw.gov.au/pmap.html, CD: PMapMD07, various image nos].

LEP (2011) *Draft Newcastle Local Environmental Plan.*

LEP (2003), *Newcastle Local Environmental Plan.*

Manly Hydraulics Laboratory 2002, *Hunter Estuary Processes Study.*

Mark Waugh Pty Ltd 2009, *Proposed Extension to Orica Works, Greenleaf Road, Kooragang Island, Newcastle, NSW* – Traffic Impact Statement.

NAGD 2009, *National Assessment Guidelines for Dredging*.

NCIG 2006, Newcastle Coal Infrastructure Group Export Coal Terminal: Environmental Assessment. Available from,

www.ncig.com.au/CommunityEnvironment/EnvironmentalAssessment/tabid/100/Default.aspx (Accessed August 2011). Newcastle Coal Infrastructure Group.

NEPC 1999, *Schedule B of the National Environmental Protection Measure.*

Newcastle City Council 2011, Information Sheet, Industrial Filling Used in Carrington. Available from, www.newcastle.nsw.gov.au/laws_and_permits/pollution/contaminated_land *(accessed August 2011).*

Newcastle City Council 2009, *Newcastle Floodplain Planning – Stage 1 Concept Planning Report.*

Newcastle City Council 2009, *Hunter Estuary Coastal Zone Management Plan.*

NPC 2011, *Dredging.* NPC web site, Available from, www.newportcorp.com.au/site/index.cfm?display=111689 (accessed 9 September 2011).

NSW *Coastal Protection Act 1979.*

NSW Contaminated Land Management Act 1997, (amended to the Contaminated Land Management Act (2008)).

NSW Crown Lands Act 1999.

NSW DoP, *Lower Hunter Regional Strategy 2006-2031.*

NSW *Environmental Planning and Assessment Act 1979.*

NSW *Fisheries Management Act 1994.*

NSW Government 2010, *State Plan.*

NSW *Heritage Act 1977.*

NSW Heritage Office, *Assessing Heritage Significance Guidelines.*

NSW Heritage Office, *NSW Heritage Manual.*

NSW Office of Environment and Heritage 2005, *State Environment Planning Policy (Major Projects).*

NSW Office of Environment and Heritage 1997, *Protection of the Environment Operation Act.*

NSW Office of Environment and Heritage 2006-2007, Quarterly; *Air Quality Monitoring Reports* for Newcastle and Wallsend.

NSW Office of Environment and Heritage 2009, *State Environment Planning Policy (Major Project) Amendment (Three Ports).*

NSW Office of Environment and Heritage *Approved Methods air quality criteria.*

NSW Office of Environment and Heritage, *Road Noise Policy.*

NSW Office of Environment and Heritage, *Approved Methods for the Modelling and Assessment of Air Pollutants in New South Wales.*

NSW Office of Environment and Heritage, *Assessing Vibration A Technical Guideline.*

NSW Office of Environment and Heritage, *Interim Construction Noise Guideline July 2009.*

NSW Office of Environment and Heritage, *National Parks and Wildlife Amendment Bill 2010.*

NSW Office of Environment and Heritage, *National Parks and Wildlife Act 1974.*

NSW Office of Environment and Heritage, *Ports and Maritime Administration Act 1995 (Ports Act).*

NSW Office of Environment and Heritage, *State Environmental Planning Policy 14 – Coastal Wetlands.*

NSW Office of Environment and Heritage, *State Environmental Planning Policy 55 – Remediation of Land.*

NSW Office of Environment and Heritage, State *Environmental Planning Policy (Infrastructure) 2007.*

NSW Office of Environment and Heritage, *State-Owned Corporations Act 1989.*

NSW Office of Environment and Heritage, *Waste Avoidance and Resource Recovery Act 2001.*

NSW Office of Environment and Heritage, *Water Act 1912.*

NSW Office of Environment and Heritage, *Water Management Act 2000.*

NSW Office of Water, *Water Management Act 2011.*

NSW Protection of the Environment Operations Act 1997.

NSW Roads and Traffic Authority 2002, *Guide to traffic generating developments Transport Planning Section.* Blacktown, N.S.W.

NSW Roads and Traffic Authority, *Environmental Noise Management Manual 2001.*

NSW TCA (2010) *Construction Noise Strategy (Rail Projects).*

NSW, *Environmental Criteria for Road Traffic Noise 2011.*

NSW, Environmental Planning and Assessment Act 1979.

NSW, *Heritage Act 1977.*

OEH 2011a, Office of Environment and Heritage Critical Habitat Register. Available from <http://www.environment.nsw.gov.au/criticalhabitat/CriticalHabitatProtectionByDoctype.htm> (accessed 25 August 2011).

OEH 2011b, Hunter Wetlands National Park. Available from http://www.environment.nsw.gov.au/nationalparks/parkHome.aspx?id=N1104 (accessed 29 August 2011).

OEH Wildlife Atlas Data Search, Available from, http://wildlifeatlas.nationalparks.nsw.gov.au/wildlifeatlas/watlas.jsp, (accessed 5 August, 2 Sept 2011*).*

Ozcoasts 2011, Australian Online Coastal Information. Available from http://www.ozcoasts.gov.au/indicators/benthic_inverts.jsp (Accessed August 2011).

Patterson Britton & Partners 1996, *Floodplain Management Study.*

Patterson Britton & Partners 2000(a), *South Arm vibrocoring.*

Patterson Britton & Partners 2000(b), *MPT Stage 1 vibrocoring.*

Patterson Britton & Partners 2001, *Surface sampling adjacent to former BHP site.*

Patterson Britton & Partners 2003(a), *Vibrocoring along southern bank of the South Arm of the Hunter River from the former BHP steelworks site to Tourle Street Bridge.*

Patterson Britton & Partners 2005, *Surface sediment sampling in NPC maintenance dredging areas*.

Patterson Britton & Partners 2003(c), *Surface sampling in Kooragang Swing Basin.*

Patterson Britton & Partners 2003(b), *Bulk sampling adjacent to former BHP steelworks site.*

Pennekamp, Joh GS; Epskamp, RJC; Rosenbrand, WF; Mullié, A; Wessel, GL; Arts, T and IK Deibel 1996, "Turbidity Caused by Dredging; Viewed in Perspective", Terra et Aqua, Number 64, September, International Association of Dredging Companies, Netherlands, ISSN 0376-6411, pp. 10-27.

Pringle, A.W 1989, The history of dredging in Cleveland Bay, Queensland and its effect on sediment movement and on the growth of mangroves, corals and seagrass, GBRMPA www.gbrmpa.gov.au/corp_site/info_services/publications/research_publications/rp11/rp11_full.pdf (Accessed August 2011).

Public Works Department 1994, *Lower Hunter Flood Study.*

Robert Carr & Associates 1995, *River and Shoreline sediment sampling*.

Robert Carr & Associates 1999, *MPT Stage 1 sampling.*

Robert Carr & Associates 2000, *MPT Stage 2 sampling.*

Robert Carr & Associates 2007, *Greenleaf Road, Kooragang Island,* Environmental Site Assessment.

Sanderson, Dr Brian; Redden, Dr Anna and Matthew Smith 2002, *Salinity Structure in the Hunter River Estuary.*

Stapes Pty Ltd 2005, *Expansion of the Cargill Oilseed Processing Facility – Environmental Assessment*. Appendix 4 – Traffic Study.

Umwelt Pty Ltd 2009, *Kooragang Coal Terminal Stage 4 Project*, Environmental Assessment.

URS 2004(a), *Human Health Risk and Ecological Risk Assessment of sediments in the South Arm of the Hunter River.*

URS 2004(b), *Vibrocoring for Assessment of Depth of Contamination and Collection of Bulk Materials for Bench Scale Treatment Trials, South Arm Hunter River*.

URS 2006, *Vibrocoring to Assess Depth and Extent of Sediment Contamination in the South Arm of the Hunter River.*

URS 2007, *Final Definition of Sediment in the South Arm of the Hunter River Beyond the Primary Remediation Zone.*

URS 2008, *Hunter River South Arm Additional Sediment Coring in PRZ.*

URS Australia Pty Ltd 2009, *Steel River Glass Wool Manufacturing Plant* – Transport and Accessibility Assessment.

Waste Management Authority of NSW 1990, *Waste Planning for Industry: A Guide.*

Water Conservation no. 108492, Internet version: Available from, http://parishmaps.lands.nsw.gov.au/pmap.html, CD: PMapMD07, Image no. 13914602].

Wilkinson Murray 2009, *Intermodal Good Facility Kooragang Island,* Report 08222 Version A.

Wilkinson Murray 2009, *Intermodal Good Facility Kooragang Island,* Report 08222 Version A.

Wilkinson Murray 2010, *Noise Assessment Mayfield Site Port-Related Activities Concept Plan EA, Report* No. 09077 Version F, Prepared for AECOM Australia Pty Ltd.

Worley Parsons 2011, *Capital Dredging Project (MP10_0203) – South Arm, Hunter River*. Preliminary Environmental Assessment Report. On behalf of Newcastle Port Corporation.

Worley Parsons Resources and Energy 2009, *Area E Maintenance Dredging and Placement of Dredged Material Off Stockton*, Review of Environmental Factors.

Worley Parsons 2010, *Capital Strategic Dredging Project (MP10_0203)* – South Arm, Hunter River, Preliminary Environmental Assessment.

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