18.0 Traffic and Transportation

18.1 Introduction

Surface access would play a key role in linking the Outer Harbour to the rest of its supply chain. Ensuring that surface transport links to the Outer Harbour are adequate, through both road and rail modes, would be crucial in ensuring the efficiency of the overall supply network.

The focus of this section is to review the existing road network in the vicinity of the proposed development, to summarise the level of traffic generation associated with both the Concept Plan and Major Project (Stage 1) and to consider any impacts on the road network. A detailed Traffic Impact Assessment is provided in **Appendix I**.

Detailed investigation of rail infrastructure impacts and opportunities are considered separately in **Section 19**. Information in relation to shipping navigation and access to recreational fishing is considered in **Sections 5.13** and **6.6.15.**

18.2 Existing Environment

The Southern Freeway and the Illawarra Rail Line currently provide the primary road and rail links between Sydney and Wollongong. There also exists a number of east-west transport links, such as Picton Road and Appin Road that provide, or have the potential to provide, access between the Outer Harbour, Sydney Metropolitan area and wider areas.

The main access and haulage route to the Outer Harbour from the Southern Freeway is via Five Islands Road. From Five Islands Road, the most direct access to the Outer Harbour would be via Flinders Street and Old Port Road with local connections via Christy Drive and Foreshore Road. This is shown in **Figure 18-1**.

Figure 18-1: Existing Local Roads and Primary Haulage Routes

Source: AECOM, July 2009, adapted from Google Maps

Due to a decline in operations of the existing jetties in the Outer Harbour, the adjacent local roads are not widely used as they do not cater for any through traffic. The roads would predominantly be used for access to the industrial properties and recreational visitors to the boat harbour and eastern breakwater at the end of Foreshore Road. These local roads have wide lanes, limited on-street parking, few intersections and good visibility and therefore offer spare capacity for increased traffic use.

There is currently an at-grade rail crossing on Old Port Road between Christy Drive and Foreshore Road. Other at-grade rail crossings exist on Foreshore Road however, the rail connection to No. 3 Jetty is not currently operational.

18.3 Traffic Generation Methodology

To determine the traffic movements associated with the activities to be undertaken as part of the Concept Plan and Major Project, the trade forecast scenarios provided by PKPC, which have an emphasis on container trade (which would be increasingly transported by rail), have been applied together with a range of assumptions. These assumptions include the modal split between road and rail, the average payload of trucks and the hours of operation of the proposed terminal.

The mode split of cargo to and from the Outer Harbour would be determined to a large extent by the types of products hauled. In the long-term it is envisaged that the majority of trade handled at the Outer Harbour would be transported to and from the port by rail. Existing rail infrastructure, if upgraded, in the locality of the Outer Harbour would offer a viable transport option and use of rail would reduce the impact on the local community in terms of noise, air quality and congestion on the local road network.

Based on PKPC's previous experience with port related activities, including the Inner Harbour, it has been assumed that 50% of all dry bulk trade, 80% of general cargo and 10% of containers would be transported by road for the Concept Plan.

Average payloads for road vehicles (based on typical road transport) are summarised in **Table 18-1.**

Table 18-1: Average Loading Assumptions

Per Truck	Quantity	Unit
Bulk	35	Tonnes
General Cargo	25	Tonnes
Containers	2	TEU

To determine the traffic movements associated with the proposed development, the modal split and average truck loading assumptions were applied to the port capacity volumes defined in **Table 5-5** to derive truck movements per year.

The traffic impact assessment focuses on the morning and evening peak hours. These are the periods when traffic movements for general traffic on the surrounding network are highest and therefore demands on infrastructure are most important to determine.

Truck movements have therefore been determined for a peak hour situation which assumes that the number of truck movements in the busiest hour is 50% greater than the average hour during the remainder of a typical day. This is on the basis that the terminals would operate for 24 hours per day, 7 days per week, 365 days per year. To consider a worst case, it has been assumed that this peak hour would coincide with the peak movements on the wider network (i.e. during the AM and PM peaks) however, in reality this may not necessarily be the case.

Employee vehicle movements also require consideration. Precise details of employee numbers are currently unknown, but it is envisaged that upon full development (Concept Plan), there would be approximately 200 employees. It has therefore been assumed that there would be 75 employees by 2016 (Major Project).

To determine volumes on the road network, it has been assumed that 10% of employee movements would occur during the peak hours. This is on the basis that employees are likely to work a shift pattern with start / finish times occurring outside the peak hours experienced on the wider road network. Conservatively assuming vehicle occupancy of one vehicle per employee, this equates to 8 peak hour movements in 2016 and 20 peak hour movements in 2036.

The calculation process to derive the truck and employee traffic volumes and the resultant number of vehicles for each development stage is summarised in **Table 18-2**.

Table 18-2: Summary of Vehicles Serving the Outer Harbour Development in peak hour

	Bulk	**General Cargo**	**Containers**
Volume per year	4.25mtpa	2mtpa	1,200,000 teu
Proportion by road	50%[1]	80%	10%
Volume by road	2.125mtpa	1.6mtpa	120,000 teu
Truck loading (per truck)	35 tonnes	25 tonnes	2 containers
Trucks per year	60,714	64,000	60,000
Working days per year	365	365	365
Trucks per day (average)	166	175	164
Hours of operation	24	24	24
Trucks per hour (average)	7	7	7
Peak hour factor	1.5	1.5	1.5
Trucks per hour (peak)	10	11	10
Two-way peak hour truck movements	21	22	21
Total for Major Project (2016)	**29 per hour (bulk only + 8 employee vehicles)**		
Total for Concept Plan (2036)	**84 per hour (bulk, general cargo and containers + 20 employee vehicles)**		

Source: AECOM, January 2010

1 Based on current and future customers the road/rail modal split for dry bulk is more likely to be 35/65. However 50% transport of dry bulk by road has been assumed to adopt a worst case scenario.

The analysis in **Table 18-2** shows that peak hour traffic movements would equate to 29 vehicles per hour (72% trucks) following development of the Major Project and 84 vehicles per hour (76% trucks) upon completion of the Concept Plan.

Following construction of the central portion of the multi-purpose terminal as part of the Major Project, it is anticipated that all operational traffic would use Flinders Street and Christy Drive to access the Outer Harbour. The additional traffic generated by the operation of the Concept Plan is expected to continue to use Flinders Street and Christy Drive for port access, due to the planned closure of the connection between Old Port Road and Foreshore Road at the existing level crossing.

The traffic generation analysis indicates that for activities associated with the Major Project, as well as activities associated with realisation of the Concept Plan, there is unlikely to be a significant increase in the number of trucks accessing the Outer Harbour in the peak hour. These trips would only comprise a very small (1%) proportion of the total trips at nearby intersections.

18.4 Impact Assessment

In order to assess the vehicular traffic impacts of the proposed development, AECOM has used traffic modelling outputs provided by Gabites Porter for the future years of 2016 and 2026. Gabites Porter has been commissioned by the NSW RTA to prepare an update of the Wollongong Shellharbour (WOLSH) Transportation model using TRACKS software.

The existing WOLSH model has been calibrated against the 2001 road network and land use data in the study area. For the purposes of the EA, the RTA requested that the base model be updated to include land use data for 2006. However, 2006 data was unavailable for use at the time of assessment and the RTA has conceded that, due to the extensive delays in the availability of the updated TRACKS models, the RTA would accept the traffic analysis using the existing available TRACKS modelling forecasts (2016 and 2026) given this is the latest modelling available to the proponent for the assessment of the development.

The WOLSH model encompasses the area contained within the Statistical Local Areas of Wollongong and Shellharbour. The area stretches from Dunmore in the south to Sutherland in the north and also includes the major strategic roads that run into southern Sydney. It is bounded by the coast on the east and Illawarra Escarpment to the west.

The 2016 traffic modelling outputs have been used to consider the impact of the Major Project. AECOM used the WOLSH modelling outputs from 2016 and 2026 to derive annual growth factors for the road network. These factors, which have been determined for each assessment link and intersection, have been applied to the 2026 data to estimate traffic volumes for 2036, by which time the Concept Plan is likely to be complete.

18.4.1 Operational Impacts

To consider the future road network performance, AECOM has reviewed the mid-block lane capacities on key links associated with the Southern Freeway as well as assessing the performance of individual intersections on the adjacent network. Network performance was assessed for scenarios ‘with’ and ‘without’ the development traffic so that the level of impact could be confirmed. **Appendix I** provides full details of this traffic impact assessment.

Intersection assessment based on the estimated traffic volumes has been carried out using SIDRA 3.2, a computer based modelling package which calculates isolated intersection performance. The main performance indicators for SIDRA 3.2 include:

- Degree of saturation (DoS) – a measure of the ratio between traffic volumes and the capacity of the intersection;
- Average delay – how long in seconds the average vehicle waits at the intersection; and
- Level of service (LoS) – a measure of the overall performance of the intersection.

The following links / intersections were assessed:

- Southern Freeway on/off ramps;
- Five Islands Road / King Street / Wattle Street;
- Five Islands Road / Flinders Street;
- Five Islands Road / Springhill Road; and
- Springhill Road / Masters Road.

Without Development

The mid-block capacity analysis found that, without the inclusion of traffic generated by development of the Outer Harbour, the on/off ramps associated with the Southern Freeway would have sufficient capacity to accommodate the forecast 2036 traffic volumes. Widening of the Southern Freeway, to three lanes in each direction, has been included in the WOLSH traffic model in order to accommodate the forecast traffic volumes which do not include future development of the Outer Harbour.

Intersection performance modelling indicates that each of the intersections report satisfactory level of service in the 2016 'without development' scenario for both time periods. The degree of saturation results indicate that the Five Islands Road / Springhill Road intersection is operating near capacity in the PM peak hour.

For the 2036 'without development' scenario, all of the intersections, with the exception of the Springhill Road / Masters Road intersection, report satisfactory level of service. As well as the Springhill Road / Masters Road intersection, capacity issues are evident at the intersection of Five Islands Road / Springhill Road despite a satisfactory level of service result. Potential solutions to the capacity issues might include grade separation. However, these works should be considered regardless of the proposed development of the Outer Harbour and are therefore not recommended as a mitigation measure for the proposed development.

With Development

Review of the mid-block capacity on the links associated with the Southern Freeway found that spare capacity would exist on each of the on/off ramps with the inclusion of traffic generated by development of the Outer Harbour (following completion of the Concept Plan).

Intersection modelling that includes the estimated trips generated by the proposed development indicates that the wider road network would experience negligible impacts following completion of the Concept Plan (and therefore impacts from the Major Project would also be negligible). As shown in the detailed Traffic Impact Assessment in **Appendix I**, increases in the Degree of Saturation and Average Delay per Vehicle with the inclusion of development traffic are minimal, and no change occurs to the Level of Service results.

18.4.2 Construction Impacts

Construction traffic would be generated by the various construction activities associated with the Major Project and Concept Plan. Broadly, construction activities include:

- Reclamation and dredging; and
- General construction activities.

The majority of the Concept Plan reclamation and dredging activities would take place during Stage 1. Approximately 3,410,799m^3 of fill is required for reclamation for the Major Project works and would be sourced as follows:

- 650,000m^3 of blast furnace slag sourced locally from Mt Prosser (100% transported by road);
- 150,000m^3 of coal wash sourced locally from BlueScope Steel or from West Cliff Colliery on Appin Road, approximately 30km north west of the Outer Harbour (100% transported by road);
- 1,612,401m^3 from major infrastructure projects such as Sydney Metropolitan Transport Plan projects and other infrastructure projects within Sydney and the greater Sydney region (0% transported by road);
- Potential for a further 1,000,000m^3 of coal wash from local sources including BlueScope Steel and West Cliff Colliery etc) (100% transported by road).

Of the total fill required, it is assumed that 53% (650,000m^3 of blast furnace slag and 1,150,000m^3 of coal wash) would be transported by road. The remaining fill would be transported by rail and barge.

Once in operation, all construction traffic is expected to join the road network via the new link to Christy Drive.

Upon completion of the full development for the Concept Plan, an extension of the new link from Christy Drive would provide access to the container terminals. Consequently, all port related traffic is expected to use Flinders Street and Five Islands Road to provide access with the strategic road network.

A detailed description of the activities associated with construction of the Outer Harbour development is provided in **Section 6**. Drawing on this information, the Traffic Impact Assessment in **Appendix I** provides a detailed review of the construction activities and how this relates to vehicle movements for each future year. To determine the generation of construction traffic, the following assumptions have been made:

- Construction hours based on a 5 day week (260 days per year) and 11 hour days (7am to 6pm);
- Truck loading assumption of $15m^3$ per truck for fill;
- Construction workforce – 1 vehicle per worker; and
- No peak hour loading for network peak (it is assumed the busiest hour for construction vehicles would occur at off-peak times).

The highest volume of construction related vehicles would be generated in 2010, with 23 trucks and eight other workforce vehicles expected per average weekday hour. These volumes are comparable to the number of vehicles generated by the operational phase of the development in 2016 (which would generate 29 vehicles, consisting of 21 trucks and 8 employee vehicles).

By 2016, the volume of traffic on the wider road network would have increased, therefore placing greater demands on road infrastructure provision. At the same time, this operational traffic is expected to use the strategic road network while the majority of construction vehicles (which are predominantly trucks) delivering fill are envisaged to remain on the local network i.e. travelling to/from Mt Prosser and BlueScope Steel. Consequently, review of intersection performance in 2010, to assess the impact of construction related traffic is considered unwarranted and has not been undertaken.

18.4.3 Cumulative Construction and Operational Traffic Movements

The number of weekday average hour construction vehicles in any one year after 2016, when added with the 2016 operational traffic, would not exceed the total forecast operational vehicle movements in 2036. Therefore, assessment of cumulative traffic impacts (construction and operation) for an interim year, between 2016 and 2036 is also not considered to be warranted as operational vehicle movements in 2036 effectively represents the worst case traffic generation scenario.

18.5 Conclusion and Recommendations

18.5.1 Concept Plan

All of the nearby intersections are capable of supporting the effect of traffic that may occur as a result of the activities associated with the three stages of development in accordance with the Concept Plan. Consequently, no mitigation measures are deemed necessary on the wider network to ameliorate the impacts of the proposed Outer Harbour development.

Flinders Street may require enhancement to cater for increased levels of heavy traffic accessing the Outer Harbour. Augmentation might include improvements to pavement strength and improved turning radii for long vehicles. The need for these works could be assessed in more detail as part of subsequent project approvals for Stages 2 and 3 of the Concept Plan.

18.5.2 Major Project

All of the nearby intersections are capable of supporting the effect of traffic that may occur as a result of the activities associated with the Major Project. Consequently, no mitigation measures are deemed necessary on the wider network to ameliorate the impacts of the proposed Outer Harbour development.

Although peak hour traffic volumes generated by the development are unlikely to be significant, the main roads currently accessing the Outer Harbour, namely Flinders Street and Old Port Road, may require enhancement to cater for increased levels of heavy traffic. Augmentation might include improvements to pavement strength and improved turning radii for long vehicles; however, this is unlikely to be required for the construction, reclamation and dredging activities planned to occur as part of the Major Project (Stage 1).

18.5.3 Construction Traffic

The final dredging depth for multi-purpose and container berth basins and boxes would be determined by the type of ships that visit the Outer Harbour, and their required draft, and would be between -15m and -16.5m.

Assessments for construction traffic have been undertaken to address the worst case scenario for transportation of fill material. That is, if the actual and final depth of dredging is -15m there would be less material available for reclamation and more fill material would need to be imported from external sources.

Construction traffic movements are unlikely to pose a greater impact than operational vehicles. However suitable traffic management would be required to minimise construction impacts on pedestrian and vehicle movements and a Traffic Management Plan would be included in CEMPs prepared for each discrete package of construction works. The TMPs would address work practices on site, haulage routes to and from the site, driver protocols, financial penalties and hours of construction as a minimum.

18.5.4 Public Recreation Areas and Boating Harbour

The proposed development would not affect public access to the foreshore. Public access is currently restricted to the boat harbour and boat ramp, Heritage Park and Military Museum. No public access is currently allowed to Red Beach or the jetties and operational berths.

The existing public access arrangements would be retained as part of the Concept Plan. No alterations to the boat ramp and harbour are proposed as part of the Concept Plan or Major Project (Stage 1).

Access in and out of the boat harbour and to other sites of interest would be maintained throughout the duration of the construction activities, reclamation and dredging. Buoys currently located in the Outer Harbour, used to delineate the recreational fishing passage to the boating area, would be retained as a marked separation between the dredging area and the recreational boating area and augmented if necessary.

The existing safety signage for the boat harbour and surrounds would be retained and additional signage would be erected at and around the recreational boating harbour during construction of Stage 1 and the Concept Plan.

Access to the Port offices and public facilities at the southern end of the eastern breakwater would be provided via a new road extension from Darcy Road north along the disused rail corridor. The inclusion of this link as part of the Concept Plan would allow general public and port-related vehicles to be kept separate.

19.0 Rail

19.1 Introduction

The aim of the rail assessment was to ascertain the capacity of the existing rail network to accommodate additional rail movements during both construction and operation of the Concept Plan and Major Project (Stage 1). Mitigation measures and recommendations have been developed with a focus on identifying the infrastructure upgrades that would be required to service the first multi-purpose berth that is operational as part of Stage 1 and the seven berths that are operational for the Concept Plan.

Potential impacts associated with rail movements generated by the proposed development, such as noise and air quality, have been addressed separately in **Sections 21** and **22** of this EA.

19.2 Existing Environment

19.2.1 Overview

The two main railway lines serving Port Kembla are the Illawarra to South Coast Line and the Moss Vale to Unanderra Line. The former links Sydney with the NSW South Coast, whilst the latter provides an east-west connection from Port Kembla through the Illawarra escarpment to the Southern Highlands and the Main South Line. From the Main South Line it is possible to access either Sydney's West or Melbourne (refer **Figure 19-1**).

The railway lines within Port Kembla are owned and operated by a combination of the Port Kembla Port Corporation, RailCorp, and Pacific National. The *Ministerial Vesting orders numbers 47 and 48* describes the ownership of the infrastructure. The port interfaces directly with the RailCorp lines. The Australian Rail Track Corporation (ARTC) controlled Unanderra Line starts about 4km south of the proposed Outer Harbour development.

A schematic of the regional rail network is provided as **Figure 19-2**.

Figure 19-1: Rail Network in the Vicinity of Port Kembla

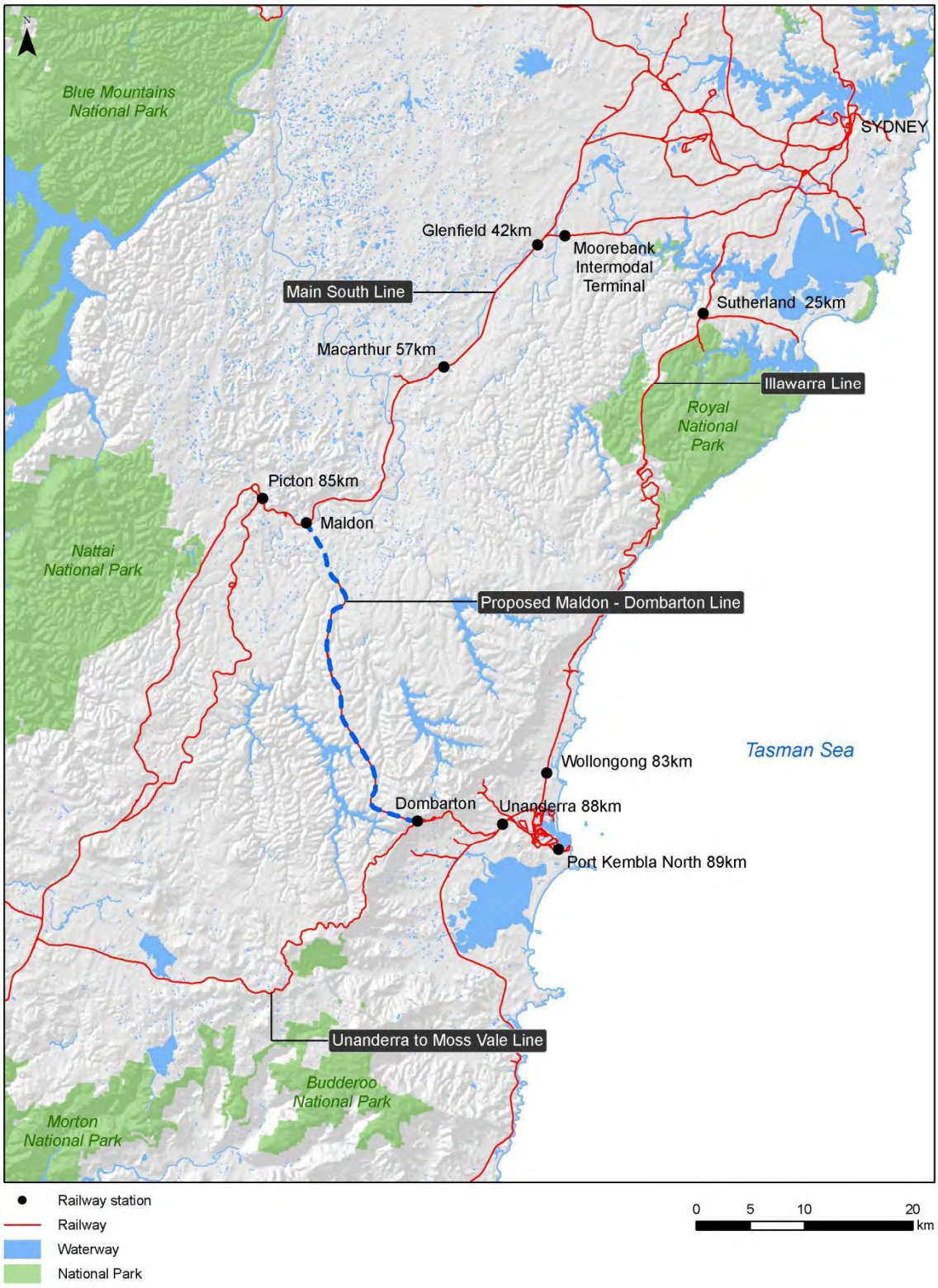
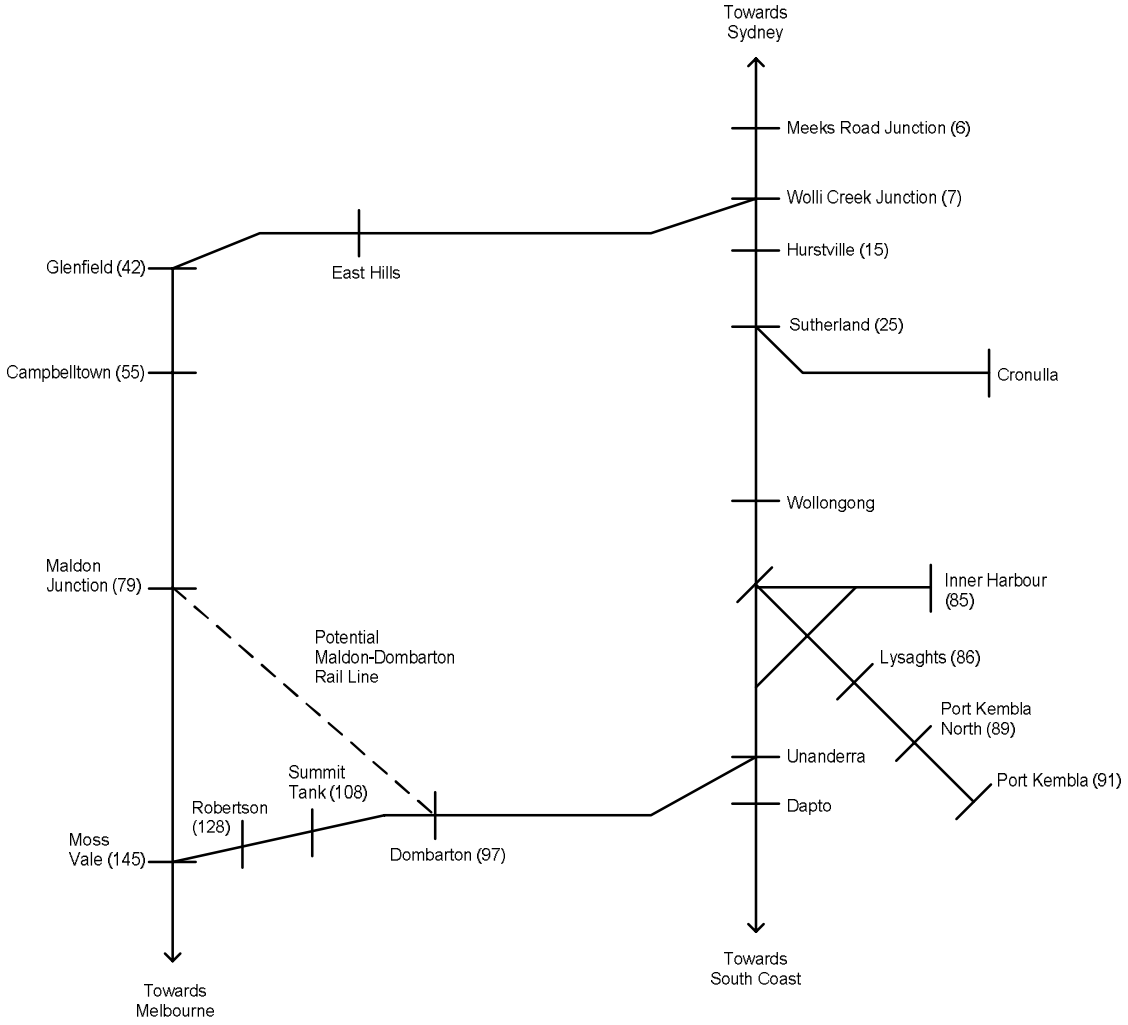


Figure 19-2: Schematic Illustrating the Regional Rail Network



19.2.2 Illawarra South Coast Line

The Illawarra South Coast Rail Line provides the principal rail link between Sydney and Wollongong, for both passenger and freight rail operations. The track between Sydney and Unanderra is double track and south of Unanderra the track becomes a single line with passing loops. The Port Kembla branch line connects with the Illawarra Line at Coniston at Chainage 84.1km, just south of Wollongong.

From a commuter perspective, the passenger line operates as a separate entity within the metropolitan network providing access to Bondi Junction via Sydney CBD. Freight trains diverge from the Illawarra Line to the Metropolitan Freight Network (MFN) at Meeks Road Junction in Sydenham. Through trains proceed north, west and south. Terminating freight trains proceed to Rozelle, Enfield, the Chullora industrial area, Clyde or other minor freight destinations.

A number of coal loops also connect onto the line at various points, namely Coalcliff, Wollongong City, Dapto, Albion Park, Dunmore, Bombo, Kiama, Berry, and Bomaderry.

Rail freight movements on the Illawarra Line focus upon Port Kembla as the ultimate destination, or in some cases, the origin. All rail traffic between Sydney and Wollongong utilises the Illawarra Line and it primarily caters for coal traffic from the Western Coalfields and from colleries located along the line.

A number of other commodities are also handled by rail including:

- Stone and ballast from Dunmore (Shellharbour) to Enfield in Sydney;
- Steel products from Port Kembla to Sydney (for domestic and export via Port Botany) and interstate destinations;
- Flour and grain services from regional NSW and Port Kembla for export, and Bomaderry for domestic production; and
- Containerised freight between Bomaderry and Cooks River.

19.2.3 Moss Vale to Unanderra Line

The Moss Vale to Unanderra Line provides an east-west connection between the Main South Line and the Illawarra Line. The line is currently dedicated to freight and provides an alternative route between Sydney and Wollongong. Although the line allows Port Kembla to Melbourne freight to bypass Sydney, more often than not, due to operational constraints associated with grades, curves and rolling stock issues, trains utilise lines in the Sydney metropolitan area rather than traverse the Moss Vale line.

During the construction and operation of Stage 1 (Major Project) rail movement of fill and dry bulk would be in the direction of the Port only, providing an advantage as only empty units would need to return back up the hill, a movement which is easily achievable.

19.2.4 Maldon - Dombarton Rail Line

The Maldon - Dombarton Rail Link is a partially built rail link between Picton and Maldon, with a tunnel proposed to pass through the Illawarra Escarpment. There is currently significant government interest in completing the construction of this line in order to provide a shorter rail access to Wollongong from the West of Sydney, compared with the Moss Vale Line. At the time of writing, a pre-feasibility study of the route has been completed and the Federal government has allocated $3,000,000 for a feasibility study to be carried out (refer Connell-Hatch *et al.* Maldon – Dombarton Pre-Feasibility Study for Port Kembla Port Corporation July 2009).

It is noted that the Maldon – Dombarton line has not been considered for the Major Project given the timeframes involved. Maldon – Dombarton would however need to be considered as part of Stages 2 and 3 of the Concept Plan (i.e. once the container terminals are operational), as it potentially offers significant advantages for the container freight task.

19.3 Assumptions

Based on information from RailCorp, an average of six freight train paths occur on the Illawarra/ South Coast Line in each direction on an average weekday (pers. comm. Matthew Jones, RailCorp Freight Access Manager, May 2009). Given the unfavourable geography which would make any capacity enhancement very expensive, and the ongoing competition for passenger service usage, it is unlikely that the Illawarra/South Coast Line to South Sydney would be used to transport significant freight volumes in the future.

Most freight paths on the Illawarra line are likely to be used for coal traffic from the Western Coalfields to Port Kembla as well as container services from the South Coast to Sydney. There is a push to create a Coal Supply Chain Group comprising RailCorp, the Coal Mines and PKPC, and there is likely to be a demand to increase coal delivered to the Inner Harbour by an amount equal to the current capacity of the Illawarra Line. As a consequence it is not feasible to rely on the Illawarra Line for the Outer Harbour development freight transport.

The assessment for rail capacity is therefore based on train sizes capable of operating on the Moss Vale to Unanderra Line only.

ARTC is currently funding the construction of the South Sydney Freight Line (SSFL). Once this is complete, there would be an alternate path available for traffic originating west of Auburn to use the Flemington West Junction to enter the SSFL from the west, and travel south to Moss Vale via the SSFL and Main South Line, and onwards to Port Kembla via the Unanderra Line.

Based on preliminary rail studies undertaken during the Outer Harbour Master Planning process, there appears to be adequate rail capacity in the short term (next 10 years) to handle the expected cargo volumes of the multi-purpose berth (Stage 1). However, there is likely to be a requirement for additional capacity post 2020, when Stages 2 and 3 are constructed.

A Port Kembla Outer Harbour *Road and Rail Access* study prepared by AECOM in 2008 as part of the master planning process assessed low, medium, and high growth rates for bulk and container freight in the Sydney region. Given the current uncertainty in market conditions AECOM has selected the medium growth rate as a guide to understanding the future freight task.

The rail capacity and infrastructure assessment for the Concept Plan is based on the following assumptions:

- Seven berths would be constructed
  - Four container berths would produce 300,000TEU pa each
    - 90% of the containers would be moved by rail
    - 60% of the container handling would be in one direction, 40% in the other (experience shows this can vary from export to import over a year)
    - The same trains would be used for loading and unloading of containers, reducing the number of trains required to operate in the new container berths
  - One bulk / dry goods berths would produce 4.25Mtpa of freight each
    - 50% of the bulk / dry goods freight would be moved by rail
    - All of the bulk freight transported by rail is assumed to be export. All dry bulk import is assumed to be moved by road.
  - Two general freight berth would produce 1.0Mtpa of general freight
    - Only 20% of the general freight is taken by rail
- Stage 1 (Major Project) applies to the operation of a single multi-purpose berth
- Rail operation is based on 315 days per year, taking into account closures, etc.
- Bulk freight wagons are capable of 55T load
- Freight wagons can take 3 TEUs each
- Loads are calculated using Class 81 locos.

An assumption of 100% either export or import of containers generates a far worse case for train demand than the above, however experience shows that no port operates in one direction only. The above assumption is consistent with the actual worst case seen at Port Botany (February 2009 – 56% export, 44% import).

Train lengths are determined by using the *Rail Infrastructure Corporation's Train Operating Conditions Handbook* to understand the maximum load per locomotive, and maximum length of train allowed on each section of route.

The following loads apply for a Class 81 Locomotive.

Table 19-1: Table of Loads Applicable to Illawarra and Unanderra Lines

Location (railway nomenclature)	Tonnage Per Locomotive (Class 81)	Loads
Sydney to Port Kembla (Illawarra DOWN)[1]	1130T	Loaded train direction. Equivalent of 4 locomotives, 44 wagons (940m)
Port Kembla to Sydney (Illawarra UP)[2]	1995T	Empty bulk trains only
Moss Vale to Port Kembla (Unanderra UP)[3]	1840T	Loaded train direction. Equivalent of 3 locomotives, 75 wagons (1495m)
Port Kembla to Moss Vale (Unanderra DOWN)[4]	750T	Empty bulk trains only

1. Sydney to Port Kembla is the Illawarra DOWN direction.

2. Port Kembla to Sydney is called the Illawarra UP direction.

3. Moss Vale to Port Kembla is called the Unanderra UP direction (even though it is physically down the hill).

4. Port Kembla to Moss Vale is the Unanderra DOWN direction (up the hill).

The maximum length of train that can operate on the Unanderra Line is 1500m, however this length of train would not fit into any of the current loops on the line, which restricts operation of trains on the single track, and severely reduces the number of trains that can run per day. The maximum axle load is 25T per axle.

For the Unanderra Line, a practical maximum of 749m has been assumed, as this is consistent with the longest possible train that can fit into the Mount Murray Loop. Looking at loads, this equates to a two locomotive 37 wagon rake (749m long, 703m rake) for the Unanderra Line.

The maximum length of train that would therefore enter the Outer Harbour to service the first multi-purpose berth is therefore 749m. This is a maximum wagon rake of 703m.

19.4 Methodology

The environmental assessment methodology for rail network capacity and infrastructure upgrades has been split into three parts:

- Assessment of the infrastructure impacts and changes required in order to support the operation of the total development (Concept Plan).
- Assessment of the infrastructure impacts and changes required in order to support the construction of Stage 1 (Major Project).
- Assessment of the infrastructure impacts and changes required in order to support operation of the first multi-purpose berth for Stage 1 (Major Project).

19.5 Impact Assessment

19.5.1 Concept Plan

For the Concept Plan the freight task broken down per berth is currently forecast as detailed in **Table 19-2**:

Table 19-2: Rail Task for Concept Plan

Berth type	No. of berths	Freight task per berth	Modal split	Train load per wagon	Train consist	Freight load per train	Number of trains per day
Bulk / Dry Goods	1	4.25 (Mtpa)	35% road / 65% rail[1]	55 T	2 loco 37 wagon	2035T	4.3
General Cargo	2	1 (Mtpa)	80% road / 20% rail	37.5 T	2 loco 37 wagon	1362T	1.0
Container	4	300,000[2] TEU	10% road / 90% rail	3 TEU	4 loco 42 wagon	126 TEU	16.4
Total	**7**	**n/a**	**n/a**	**n/a**		**n/a**	**21.2**

1 Modal split has been calculated based on current and future customer information obtained from PKPC. The road assessment has assumed a modal split for dry bulk of 50/50 to assume a worst case scenario for road. By comparison this rail assessment has assumed a modal split for dry bulk of 35/65 which represents a conservative scenario for rail.

2 Total capacity per berth is 300,000TEU however 180,000TEU one way has been assumed as this represents a worst case scenario for rail.

Transport of Dry Bulk and General Cargo

The bulk freight would be unloaded via a dumper on the Port Kembla Balloon Loop. With the addition of general cargo, the number of trains would increase from 4.3 to 5.3 per day. Given the likely capability of the dumper, this does not raise any concerns regarding infrastructure changes. The likelihood of needing to hold trains in the South Yard would increase, as there is a general freight train every second day to consider.

The general freight is likely to be loaded and unloaded from the No. 6 Jetty sidings, which are 434m long. The train is likely to be 749m long, therefore it needs to be broken and shunted into the sidings. This would most likely be done in the South Yard and a siding would need to be extended to accommodate the train length.

Transport of Container Freight

Moving 16.4 container trains in and out of the port per day is a considerable task. This is exacerbated by the fact that the container rail siding is not long enough to accommodate the full length of a container train. There is a need to either split or shunt trains to achieve the loading and unloading task on the wharf. The container terminals would require four roads for loading and unloading, plus two roads in and out of the Port. Two sidings to join and separate trains would also be required to support this operation. None of this infrastructure currently exists.

The current view of the operation is that a 1016m train comes into a new siding somewhere around South Yard, is split into two, and the two halves run into two of the loading sidings on the wharf. After loading, the halves run back to the siding to reform and leave. This type of shuttle arrangement is highly efficient from an operational sense, but comes at an economic cost of requiring more rolling stock. If shunting is to be performed, then turn around times for trains would be increased dramatically. This has to be balanced against the cost of having less powered rolling stock.

The only way to work out which is the more efficient is to undertake a design for the infrastructure, then model it dynamically. The results of the modelling are highly dependent on market forces and demand, something which can change quite drastically depending on the state of the Australian economy.

At this point in time, the infrastructure required to support the movement of 1.2M TEU per annum would include a new entry and exit road from Port Kembla North Station to the container terminals, plus four sidings on the wharf, and two sidings between.

It is proposed that a concept design for this rail infrastructure upgrade be undertaken prior to seeking project approval for the operation of the container berths as part of Stages 2 and 3 of the Concept Plan. At this point a supplementary assessment would need to be undertaken to consider the impacts that the change to infrastructure and operation would have.

Port Connections

The connections to the Port need to be enhanced in order to support the predicted number of train services. There are two options that can be considered to achieve this.

- **Option 1 - Upgrade of the Unanderra Line**

The *Port Kembla Outer Harbour Master Plan – Road and Rail Access Issues* report prepared by AECOM for PKPC in 2008, demonstrates that there are approximately 16 paths available on the Unanderra Line and none on the Illawarra Line. Capacity enhancement would therefore be required before additional container terminals are brought into operation at the Outer Harbour during Stages 2 and 3.

For the Concept Plan there are four proposed container berths, each moving 300,000 TEU per annum. Unlike trains accessing the multi-purpose berths, trains in this instance leave Port Kembla loaded. The majority of container throughout at the Port would be imports thus resulting in loaded trains that would be operating against the gradient on the Moss Vale to Unanderra Line.

A typical container train would require one locomotive per 11 wagons, a very inefficient ratio. A four locomotive 42 wagon train might be the longest practical length of train at 1016m. Each berth would require 4.1 of these trains per day to move the goods from the Port (16.4 trains per day in total).

One option would be to upgrade the existing Port Kembla to Moss Vale line to provide additional capacity which might include infrastructure improvements to reduce track gradients, lengthening passing loops or double tracking.

ARTC has indicated a willingness to undertake the upgrade of the four existing loops to 1060m length to support the operation of the Outer Harbour. A capacity study is required to determine whether this alone is sufficient to support the full operation of the Concept Plan. However the current anecdotal evidence is that it would be.

This option has a longer travel time to Sydney compared with the Dombarton Link, discussed below, therefore train cycle times are lower, and more rolling stock is required to service the Port. It is estimated that the cost for the additional rolling stock required for using the Unanderra Line is likely to be in the order of $50M and upgrade of the Unanderra Line is also likely to be $50M. This is in contrast to the cost for completion of the Maldon Dombarton link which is around $500M.

- **Option 2 - Completion of the Maldon – Dombarton Link**

The alternative, and vastly more complex and expensive option, would be to provide a new dedicated rail freight access to the Port through the completion of the Maldon and Dombarton rail link. The development of the Outer Harbour could provide the support required for the completion of the link.

If completed, this link would have the advantage that it would bypass much of the existing rail freight network and provide direct access to South West Sydney, which is expected to become the main industrial area in Sydney in the next two decades. Provision of this link would enable a much larger rail mode share from the Port, for the bulk and general freight berths, thereby reducing the number of trucks on the road by some considerable margin. It would also support the development of Wollongong in general, as a place to live and work.

Whichever rail option is pursued, it would need to be supported by the development of an intermodal facility at the other end of the line from the Port. It is understood that there are plans for the development of such infrastructure in a number of locations in South West Sydney. For example, Wingecarribee Shire Council already has plans to develop an intermodal terminal in the vicinity of Moss Vale, adjacent to the junction with the Main South Line. Likewise, there are a number of other sites currently proposed for intermodal facilities such as in the vicinity of Moorebank near Liverpool. It is important that these sites are planned carefully in order to take maximum advantage of any expansion at Port Kembla and supporting road and rail infrastructure.

Infrastructure Australia (IA) is currently funding a $3M study to look at business drivers behind a possible Maldon – Dombarton Link. IA is also separately funding a study into the Moorebank Intermodal Terminal, but looking at it from the perspective of an inland port for Botany and an interstate intermodal for ARTC. There is potential for that study to be widened to take into account the Outer Harbour development, and how Moorebank Intermodal Terminal can support it.

It is proposed that the Concept Plan for the Port uses the economic information from the Maldon – Dombarton study as a basis for the future freight task for the Outer Harbour. This would help to determine the likelihood of the above freight task case occurring, before carrying out a more detailed capacity enhancement study of the Unanderra Line (and potentially Maldon – Dombarton Line).

19.5.2 Major Project

Construction

At this stage, all sources of fill for the Outer Harbour have not been confirmed. It is likely that as major infrastructure projects take place in the Sydney Basin and beyond, fill would be directed to the Port by road, barge and/or rail. An unloading area near the Outer Harbour foreshore has been identified to facilitate delivery of fill by rail.

It is estimated that of the approximate 3,400,000m^3 of fill required for the reclamation process, approximately 2,600,000 m^3 would need to be imported over a period of seven years. Peak activities are likely to occur in 2014 when the multi-purpose berth is operating and reclamation activities associated with Stage 1b and 1c are still occurring. Based on potential sources of fill that would be available in the next few years, it is assumed that approximately 1,100,000m^3 of fill would be imported by rail with the balance supplied by road and barge.

The source of some of this fill could potentially be the cut from Sydney Metropolitan Transport Plan's light rail tunnelling operation. At this point it is assumed that this cut is brought to the surface at White Bay, and trains run to Port Kembla from White Bay. The preferred option would be to barge the spoil from White Bay to Port Kembla. However, for this impact assessment, and analysis of rail capacity, it is assumed that 100% of this fill would be delivered by rail as a worst case scenario. That said, ARTC has recently taken the White Bay Goods Line out of service, and the points are spiked and clipped. Therefore a discussion would need to be held with ARTC to return this track (and signalling control) back to service for a period of 3-4 years during the tunnelling phase.

The 1,100,000m^3 of fill equates to 1722 fully loaded trains, over seven years (approximately 0.8 trains per day). The trains would run around the balloon loop and manually unload next to the stockpile area (which takes about three hours). The No. 6 Jetty sidings would be reserved for export/import of general cargo. Unloading of fill would be handled from the balloon loop. The trains won't need to enter the South Yard, unless waiting for another train to leave, so conservatively it is safe to assume that they might hold in the South Yard for one hour per day.

Operation

Rail freight generated by the first multi-purpose berth is estimated to be in the order of 2.75 Mtpa by 2015, to an ultimate demand of 4.25 Mtpa from 2020 onwards.

Based on knowledge of current customers, it is expected that 0.75 Mtpa would originate in Lithgow, and 2 Mtpa in Southern NSW for the 2015 case. It is assumed that the additional 1.5 Mtpa of bulk freight for the 2020 case would be imported and moved by road. A total of 2.75 Mtpa equates to the 65% assumed to be transported by rail for operation of the first multi-purpose berth.

Table 19-3 provides a breakdown for servicing the first multi-purpose berth:

Table 19-3: Operation of First Multi-purpose Berth

Berth Type	Freight Task (Mtpa)	Modal Share	Train load per wagon	Train consist	Freight Load per train	Number of trains per day
Bulk / dry goods from Sydney	1.5	100% road	n/a	n/a	n/a	n/a
Lithgow sands	0.75	100% rail	55T	2 locomotive 37 wagon	2035T	1.2
NSW south coal	2.0	100% rail	55T	2 locomotive 37 wagon	2035T	3.1
Total	**4.25 (2.75 by rail)**	**n/a**	**n/a**		**n/a**	**4.3**

Moving 0.75 Mtpa of sand from Lithgow would require trains to run through the Blue Mountains to Sydney, turning off the Main West at Flemington Junction to head south on the SSFL to Moss Vale. The supplier would be responsible for negotiating and securing train paths with RailCorp.

The Unanderra line currently uses eight paths per day, and the 50% load point is estimated to be 22 paths per day (in each direction). A total of 50% of design capacity is generally accepted to be a comfortable operating condition. Therefore there is no issue with the use of the Unanderra line for the construction of Stage 1. The longest loop on the Unanderra Line (764m at Mount Murray) would serve as a passing point for trains, with a second train held at Dombarton on the dual track section.

It is therefore possible that in 2014, a total of 3.35 Mtpa of bulk dry goods cargo and fill (2.75Mtpa of bulk freight and 0.6M tpa of fill) needs to be brought into the Port via the Unanderra Line. This equates to 5.1 trains of 750m length per day, in each direction to and from the Port. There is currently capacity on the Moss Vale-Unanderra line to accommodate this. The current access agreement for the Unanderra Line would need to be extended from 4.3 to 5.1 trains per day to support the additional train movements associated with construction and operation of Stage 1.

Outer Harbour Infrastructure

The existing Port Kembla Gateway sidings would be adjacent to the first multi-purpose berth. There are two sidings approximately 434m long each (clearance point to buffer stop). Each siding is currently used by the Port Kembla Gateway operator, to provide copper ore for export (two trains per week).

There are two rail yards in close proximity to the Port Kembla Gateway sidings; the North Yards which are out of service, and the South Yards which are currently operated by Pacific National to support BHP Billiton and BlueScope Steel. The longest road in the North Yard is approximately 460m long and the longest in the South Yards is 684m long.

The multi-purpose berth would be loaded according to cargo type:

- General freight would be unloaded from the Port Kembla Gateway sidings and transferred to the multi-purpose berth;
- Dry bulk freight will be loaded onto ships via a system of conveyors from stockpiles at the multi-purpose berth. The stockpiles would be built using a similar train dumper and conveyor system. The dumper would be placed on the Port Kembla Loop, between the South Yard and the Port Kembla Gateway sidings, on the waterfront. This type of system would be able to unload a 37 wagon train in approximately 45-50 minutes.

General freight trains would be 749m long, and would therefore need to be broken up in a siding prior to entry to the Port Kembla Gateway sidings. Bulk freight trains would not to be broken up, as they run around the Port Kembla Balloon Loop and unload at low speed from the loop.

Given that a total of 4.3 trains per day are required to move the bulk dry goods to the port, it is feasible that no holding roads or sidings are required to hold trains while unloading is taking place, as there is potential in the operating window for several hours between trains.

The only issue is the BlueScope steel trains that currently operate in the loop, as well as the copper concentrate export trains. If one of these trains is in the loop when a bulk dry goods train arrives, it would need to be held somewhere, and it is sensible that this be in the near vicinity. As such it is prudent to have one holding road of around 780m length alongside the balloon loop.

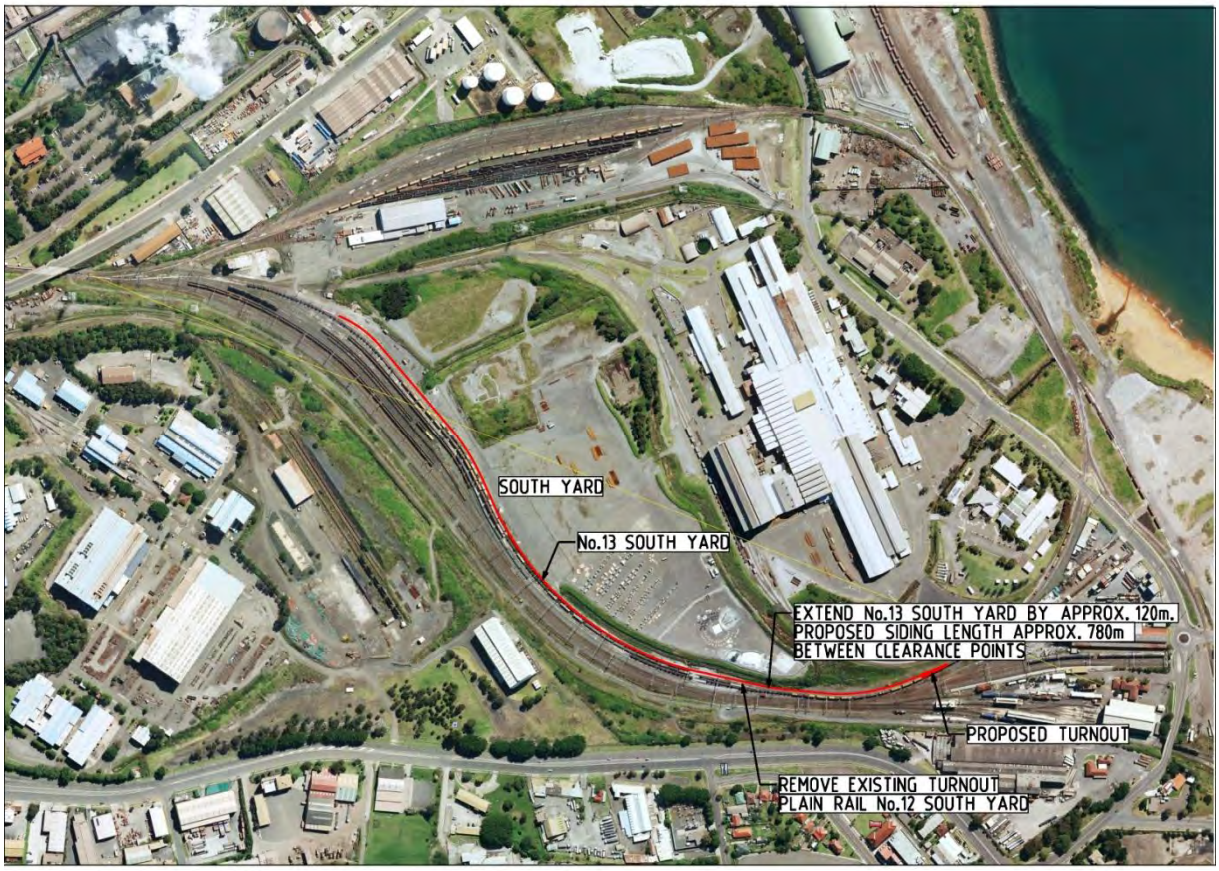
To support this, the options are either to extend one road in the South Yard to 780m, or construct a brand new siding around Port Kembla North Station.

The first option is technically and economically superior. In order to support the operation of the multi-purpose berth, one road would need to be extended by approximately 120m to support holding trains (refer **Figure 19-3**).

PKPC would need to enter into discussion with the operator to discuss shared use of the sidings.

It should be noted that the above operating case is an assumption based on the maximum length of train that can access the Port. It remains to be seen if the train operators would need to run trains of that length. The length of train depends on market conditions that would occur at the time that the berth comes into operation.

Figure 19-3: Pacific National South Yard Showing Proposed Extension of the No. 13 Rail Siding



19.6 Mitigation Measures

19.6.1 Concept Plan

Prior to being able to confirm network capacity and identify the infrastructure upgrade required to support the Concept Plan, a number of steps need to be taken including the following:

- Participate in the Maldon Dombarton Study, ensuring that the Outer Harbour is included as a main destination for goods in the Maldon Dombarton Study.
- Liaise with RailCorp regarding access from the Outer Harbour to the Unanderra Line (a distance of 4km), to ensure sufficient paths are available to allow the freight task to be undertaken via the Unanderra line.
- Undertake a rail Master Plan for the Outer Harbour.

19.6.2 Major Project

Mitigation measures to be implemented for activities associated with rail for the Major Project include:

- Obtain agreement with Pacific National (PN) to allow use of one road, in the South Yard. It is likely the existing rail infrastructure would need to be upgraded to extend No. 13 rail siding in South Yard by approximately 120m which would result in a 780m long siding between clearance points. An existing turnout would be removed where the existing siding joins the main line and a new turnout installed at the point where the new siding would join the main line.
- Obtain agreement from RailCorp to allow the use of one train path per day, in each direction, from Lithgow to Flemington West Junction.
- Obtain agreement from ARTC to allow the use of five train paths per day, in each direction, on the Unanderra Line.
- Review the need to install a material handling system for unloading the trains at Port Kembla Gateway.

19.7 Summary

Based on preliminary studies undertaken during the Outer Harbour Master Planning process, there appears to be adequate rail capacity in the short term to handle the expected cargo volumes of the multi-purpose berth and construction activities associated with Stage 1. However, there is likely to be a requirement for additional capacity post 2020, when Stages 2 and 3 of the Concept Plan are constructed and become operational.

20.0 Socio-Economics

20.1 Background

20.1.1 Economic Significance of Port Kembla

The proposed Outer Harbour development supports the goals set for economic growth and employment generation in the Illawarra Region. Around 47,600 new residents and 30,000 new jobs are anticipated in the Illawarra Region by 2031, concentrating growth around existing centres (primarily Wollongong) and supported by existing infrastructure (*Illawarra Regional Strategy 2006-2031)*.

Manufacturing is the main economic driver of the Illawarra Region, producing a $6 billion annual turnover (*Illawarra Regional Strategy 2006-2031*). The expansion of port operations provides a significant opportunity to support investment in the manufacturing sector, as well as develop corporate support services in the region, strengthening the role of Wollongong as a regional centre (*Illawarra Regional Strategy 2006-2031*).

One of the key objectives outlined in the Regional Strategy is to increase employment self containment. Key employment lands such as the Port will be developed to increase job opportunities locally and to reduce the proportion of residents commuting outside the region for work.

The Regional Strategy estimates that expansion of the Port (including both the Inner and Outer Harbour) along with the associated growth and relocation of car imports and general cargo will boost the local economy by around $200 million per annum and will secure approximately 1,000 jobs directly through activities such as port operations, stevedoring, pilotage, maintenance and cargo handling and indirectly through business, finance, information technology, retail, transport, logistics and other support services. The direct and most of the indirect services will employ a labour force in the Wollongong LGA and Illawarra Region.

20.1.2 Demographic Profile

At the 2006 Census, the Wollongong LGA recorded a population of 184,212 people, up from 180,358 at the 2001 Census. Wollongong City Council recently reported a population of 197,929 for 2009 (Wollongong City Council, 2008). This represents an annual population growth rate of 1.43% between 2001 and 2006 and 2.48% between 2006 and 2009. The forecast growth rate of the Wollongong district (including Shellharbour and Kiama) is 12% by 2027 (approximately 0.6% annually) (Australia on the Move, 2009).

The area of influence of the Port would be much wider than the Wollongong LGA, generally comprising the Illawarra Region (refer **Table 20-1**). The region's population has grown from 269,000 in 1976 to 394,000 people at the time of the 2006 Census. In 2008, the population recorded was 408,059 (IRIS Research). According to the *Regional Strategy 2006-2031*, the population is expected to increase by 47,600 people to 455,659 by the year 2031.

Table 20-1: Population, Growth Rates and Forecasts for Wollongong LGA and the Illawarra Region

	2001 Census	2006 Census	Annual growth since 2001	2008/09	Annual growth since 2006	Forecast	% Growth
	Population	Population		Population		Population increase	
Wollongong LGA	180,358	184,212	1.43%	197,929	2.5%	23,750 by 2027	0.6% annually
Illawarra Region	380,036	394,000	0.7%	408,059	1.2%	47,600 by 2031	0.8% annually

Source: Australian Bureau of Statistics, website accessed 25th August 2009; IRIS research [1] website accessed 25th August, 2009; and the *Illawarra Regional Strategy 2006-2031*.

The age profile of the Wollongong LGA does not differ significantly from that of the Illawarra region or the state, although Wollongong has a higher proportion of people aged 65 years and over (ABS 2006 Census).

In the Wollongong LGA, average weekly income is higher than the wider Illawarra Region and lower than the Australian average. Wollongong average weekly incomes are $391 for individuals, $933 for households and $1,149 for families, compared with $388, $872 and $1,083 respectively in the Illawarra Region and $466, $1,027 and $1,171 respectively Australia-wide.

20.1.3 Industry Base

The region's major industry has traditionally involved manufacturing and mining, with manufacturing as the main economic driver. Port Kembla industrial area is the largest in the southern hemisphere. Other major sources of employment in the region include construction, retail trade, education and training and health care, social assistance and tourism.

20.1.4 Employment Activity and Labour Force Characteristics

The total labour force was recorded at 83,551 people in Wollongong LGA and 173,019 people in the Illawarra Region at the time of the 2006 Census.

The 2006 Census recorded an unemployment rate of 7.3% (6,266 people) for Wollongong LGA and 7.5% (12,665) for the Illawarra Region. These rates are higher than the Australian average of 5.2% which to a large extent relates to the decline in manufacturing and traditional blue collar employment opportunities in the area. This is an improvement on the 2001 Census which recorded unemployment rates of 9.1% and 8.9% for Wollongong and the Illawarra respectively.

20.1.5 Direct and Indirect Impacts of the Port

The *Port of Port Kembla Economic Impact Study* (EconSearch, 2009) was undertaken to assess the economic impacts of the Port Kembla Inner Harbour Development and provides some important insights into the economic impacts that may affect the proposed development. The study was undertaken using the general framework for port impact studies developed by the Bureau of Transport Economics (2000).

The study estimates the economic impact of port-related activity (defined as activity undertaken by firms and organisations in moving cargo through the Port and in providing goods and services to directly facilitate the movement of cargo through the port) at the regional and State levels. Port impact was measured in terms of output, value added, household income and employment. The study includes estimates of direct and indirect or 'flow-on' effects to other sectors of the regional and state economies.

The study found that in terms of output, the Port operations in a representative year would generate a total impact on the Illawarra economy of $839 million and around $1,010 million on the NSW economy as a whole.

The value added to the Illawarra region is estimated to be $452 million and $532 million State wide (including direct and flow-on effects). This is approximately 2.2 per cent of gross regional product (GRP) and 0.1 per cent of NSW gross state product (GSP).

Household income generated by the operation of the Port in a representative year totalled $239 million in the Illawarra region and $284 million in NSW. In total up to 2,984 full time equivalent jobs are created by the Port, representing 2.1 per cent of total employment in the Illawarra region (direct and indirect). The estimated employment effect in NSW is in the order of 4,524 full time equivalent (FTE) jobs, which is around 0.1 per cent of total employment in the state.

A comparison of the breakdown of the output, value added, household income and equivalent full-time jobs between the region and NSW is provided in **Table 20-2**.

Table 20-2: Economic Impact of the Port (Inner Harbour), Representative Year (Illawarra and NSW).

Measure	Direct effects	Flow-on Effects		Total Impact	
	Illawarra/ NSW	Illawarra Region	NSW	Illawarra Region	NSW
Output[1] ($m)	499	341	512	839	1,010
Value added ($m)	280	172	252	452	532
Household income ($m)	148	91	135	239	284
Employment (number of jobs, full time equivalent	2,190	1,673	2,334	3,863	4,524

Source: Adapted from EconSearch (2009) Tables 4 and 5

An annual total of 1,041 commercial ship visits to the Inner Harbour Port is anticipated in a representative year. Each ship call has a significant benefit contributing approximately $434,000 in added value to the Illawarra economy and $511,000 to the State (refer **Table 20-3**).

Table 20-3: Average Impact per Ship Call for the Port (Inner Harbour) , 2005/06

Indicator	Illawarra Region	New South Wales
Output	$806,000	$971 ,000
Value added	$434,000	$511,000
Household income	$230,000	$272,000
Jobs (full-time equivalent)	3.7	4.3

20.1.6 Land Use

To encourage job containment in the region and support the projected growth in jobs, the *Illawarra Regional Strategy* recognises that employment lands need to be identified and secured to accommodate an additional 30,000 jobs in the region.

The *Port Kembla Land Use Strategy Project* produced an LEP and DCP to provide a framework for development of areas in the proximity of the Port, for a range of port-related purposes and to prevent further fragmentation and rezoning of land for other land uses. The Port precinct is considered to contain “key employment lands and infrastructure”.

The growth of port activities will require support in business, finance, information technology, retail, transport and logistics, which will be an important source of employment and economic activity. It is likely that these will be located in commercial centres, particularly Wollongong. An important facilitator of this will be links to centres and between employment lands.

[1] i.e. the total value of the goods and services produced

20.2 Methodology

The socio-economic impact assessment comprises a high-level desktop analysis of the macro impacts of the proposed Outer Harbour development on a local, regional and State-wide level. The assessment uses existing data, including the *Port of Port Kembla Economic Impact Study* (EconSearch, 2009), *Port Kembla Outer Harbour Master Plan - Road and Rail Access Issues* (AECOM 2008), *Illawarra Regional Strategy 2006-2031*, *Port Kembla Land Use Strategy* (SKM, 2007) and Australian Bureau of Statistics (2006 Census). Other sources are used to supplement this material and are referenced where applicable.

The *Port of Port Kembla Economic Impact Study* (Econsearch, 2009) provides an economic analysis for the year 2007/08 and for a representative year. A representative year was included as the study produced results that were atypical due to two factors. First, the trade in motor vehicles from the Inner Harbour commenced that year and the number of units and ship visits was around 20-25 per cent of expectation in future years. Secondly, the drought severely impacted grain trade and there were only two ship visits for the year compared with an average of 42 ships per year for the preceding six years. For this reason, the figures used in this assessment are based on the data from a representative year unless otherwise stated.

20.3 Impact Assessment

20.3.1 Social Impact

Concept Plan

The effect of Port growth would have a significant economic impact on output, employment and earnings in the Illawarra, South Coast region and throughout NSW. The development of the Outer Harbour as part of the Concept Plan, would act as both a short term and long term stimulus to the local economy. In the short term, activities associated with dredging, reclamation, construction works and operation of the central portion of the multi-purpose terminals and berth (Stage 1) would be expected to generate a large number of jobs within the Illawarra region as well as contribute a significant amount of value added to the economy.

In the longer term for Stages 2 and 3, further dredging and reclamation, construction and operation of container terminals and berths and construction of new road and rail infrastructure would generate direct employment at the Port as well as indirect employment in supporting services and ancillary activities in the local economy. It is anticipated that support services would be located within the Wollongong regional centre.

Social impacts that may be experienced during development of the Concept Plan include:

- Demolition of No.3 Jetty, of which the landward end is at times used for recreational fishing.
- Increased noise and air emissions from road traffic during construction and operation.
- Increased noise and air emissions from port activities.
- Altered visual amenity.

The preferred mode of transport during construction and operation is rail or barge. Residual traffic issues would be addressed in a Traffic Management Plan(s) to be prepared as part of the CEMP(s) and OEMP(s) for the Concept Plan. Hydrology and water quality, noise and visual amenity issues are addressed in **Sections 14, 21** and **23** of this report, respectively.

Potential social issues identified during the detailed design and construction phases of the project would be managed through ongoing community consultation. Many of the issues provide for opportunities to engage the community in positive interactions to enhance their local area.

Major Project

Construction activities to be undertaken as part of the Major Project, including dredging, reclamation, construction and operation of the central portion of the multi-purpose terminals and berth and rail upgrade, would directly generate a large number of jobs within the Illawarra Region. Operation of the terminal and berth would generate direct and indirect employment and provide long term stimulus to the local economy.

Social impacts that may be experienced during development of the Major Project include:

- Demolition of No.3 Jetty, of which the landward end is at times used for recreational fishing.
- Increased noise and air emissions from road traffic during construction and operation.
- Increased noise and air emissions from construction works and operation of the multi-purpose terminals.
- Altered visual amenity.

20.3.2 Economic Impact

Concept Plan

The Concept Plan would be constructed in discrete stages that reflect market demand over a 25 to 30 year period. The estimated total cost of the Concept Plan development is $700 million (in 2008 Australian dollars). The cost estimate divided into activities to be undertaken as part of Major Project and those for Stages 2 and 3 of the development is provided below.

- Stage 1 (Major Project) $400.7 million
- Stages 2 and 3 $299.3 million
- **Total Concept Plan** **$700.0 million**

Trade forecasts for low, medium and high growth forecasts by commodity for the Port (Outer Harbour) were provided by PKPC for the Master Plan and are summarised in **Table 20-4**.

Table 20-4: Trade Forecasts by Commodity

	Bulk ('000 tonnes)	**General ('000 tonnes)**	**Containers ('000 TEU)**
Low Trade Growth			
2015	874	109	55
2020	1,013	127	63
2030	1,362	1,184	85
Medium Trade Growth			
2015	1,227	116	116
2020	1,566	148	148
2030	2,551	1,423	241
High Trade Growth			
2015	2,299	123	184
2020	3,224	172	258
2030	6,342	1,713	507

Source: Port Kembla Port Corporation, 2007

The Concept Plan has been developed to meet the forecast growth in trade. It also has a vital role to play in the NSW Ports Growth Plan (NSW Government, 2003), the aim of which is to distribute the benefits of port growth more equitably between Sydney, the Hunter and Illawarra regions and provide long term capacity for bulk goods, containers and general cargo, to enhance the economic efficiency of NSW ports.

The Concept Plan would generate economic and social impacts in two areas. In the short to medium term, the construction of port facilities would provide employment opportunities for the region. In the long term, the movement of additional cargo would provide employment opportunities and generate revenue that would have considerable economic impacts on the Illawarra Region and NSW.

20.3.3 Construction Impacts

The cost estimate for the Concept Plan development is $700 million. Average annual expenditure over the duration of the Concept Plan is estimated to be approximately $30 million and the impact from construction expenditure is expected to fluctuate considerably over the construction period.

It is anticipated that the construction activities for the Concept Plan would generate over 236 FTE jobs per year in the Illawarra region and over 390 throughout the State, predominantly in the building and construction, trade, manufacturing and finance and business sectors. Based on Concept Plan cost estimates the net contribution to the economy from the construction activities is estimated to average almost $26 million per annum in GRP and over $43 million per annum in GSP (**Table 20-5**).

Table 20-5: Average Annual Employment and Economic Activity Impacts from Concept Plan Port Construction Expenditure

Impacted sector	Illawarra		New South Wales	
	Average annual employment (fte jobs)	Average annual GRP ($m)	Average annual employment (fte jobs)	Average annual GSP ($m)
Total impact (direct + indirect)	236	25.6	390	43.1

Source: Adapted from EconSearch 2009[2] Table 7.2

20.3.4 Operational impacts

The Concept Plan has been developed to meet the forecast growth in trade shown in **Table 20-4** above. Achievement of these trade volume forecasts for principal growth commodities would have a significant economic impact on the Illawarra region and NSW, as illustrated in **Table 20-6** below.

Table 20-6: Potential Employment and Economic Impacts of Concept Plan Operations

	2035/36
Employment impact (direct and indirect)	
Illawarra Region	1,252
Total NSW	1,470
GRP impact $m (direct and indirect)	
Illawarra Region	134
Total NSW	160

Source: Adapted from EconSearch 2009 Tables 7.4 and 7.5 using estimates for 'other' cargo

[2] The GRP and GSP have been based on the Concept Plan cost estimate and derived from the percentage expenditure attributed to the Outer harbour Development compared with 'other' projected development expenditures in the *Port of Port Kembla Economic Impact Study* (EconSearch, 2009) . The number of FTE jobs has been increased in line with the cost estimate for the Concept Plan compared with the projected estimate in the *Port of Port Kembla Economic Impact Study* (EconSearch, 2009).

20.3.5 Major Project

Construction Impacts

Development of the central portion of the multi-purpose terminals, dredging works, reclamation, road and associated infrastructure services is estimated to cost $400.7 million. Expenditure would be incurred by PKPC, Government and private operators. Average annual expenditure from this stage of the development is estimated to be approximately $45.8 million and the impact from construction expenditure is expected to fluctuate considerably over the construction period.

It is anticipated that the construction activities for the Major Project would generate over 180 FTE jobs per year in the Illawarra region and over 297 throughout the State, predominantly in the building and construction, trade, manufacturing and finance and business sectors. Based on Project cost estimates, the net contribution to the economy from the construction activities is estimated to average almost $20 million per annum in GRP and over $32 million per annum in GSP (**Table 20-7**).

Table 20-7: Average Annual Employment Impacts from Planned Major Project Port Construction Expenditure

Impacted sector	Illawarra		New South Wales	
	Average annual employment (fte jobs)	Average annual GRP ($m)	Average annual employment (fte jobs)	Average annual GSP ($m)
Total impact (direct + indirect)	180	19.5	297	32.8

Source: Adapted from EconSearch 2009[3] Table 7.2

Operational Impacts

The trade volume forecasts for principal growth commodities would have a significant economic impact on the Illawarra region and NSW. The forecast growth in containers and bulk cargo in the Outer Harbour following completion of the facilities provided by the Major Project would be substantial. EconSearch estimates that an additional 3.0 million tonnes of 'other' cargo would move through the Port in 2018/2019 compared with the 'representative' year (which is based on trade in 2007/08 but adjusted as described in **Section 20.2**). The central portion of the multi-purpose terminals could potentially handle all of this additional cargo. The economic impact of this change in trade is presented in **Table 20-8** below.

Table 20-8: Potential Employment and Economic Impacts of Outer Harbour Major Project Operations

	2018/19
Employment impact (direct and indirect)	
Illawarra Region	384
Total NSW	451
GRP impact $m (direct and indirect)	
Illawarra Region	41
Total NSW	49

Source: Adapted from EconSearch 2009 Tables 7.4 and 7.5

[3] The GRP and GSP have been based on the current project cost estimate and derived from the percentage expenditure attributed to the Outer harbour Development compared with 'other' projected development expenditures in the *Port of Port Kembla Economic Impact Study* (EconSearch, 2009) . The number of FTE jobs has been increased in line with the current estimate for the first stage (Major Project) of the Outer Harbour development ($400.7 million) compared with the projected estimate in the *Port of Port Kembla Economic Impact Study* (EconSearch, 2009).

20.4 Summary

20.4.1 Concept Plan

The overall impact of the Concept Plan on the social and economic characteristics of the area would be positive. The proposed development would also have a long term positive impact on the competitive environment for NSW ports.

The $700 million dollar development would support economic growth in the Illawarra region and NSW as a whole through both long term and short term impacts. Construction of the proposed development would take place over a 25 to 30 year period and would generate significant direct and indirect employment opportunities for the Illawarra Region as well as in NSW as a whole. Development of the Concept Plan would also provide long-term stimulus to the local economy and contribute a significant amount of added value to the economy.

The major social impacts of the Concept Plan include construction and operational noise, increased traffic during construction and operation, associated safety and access issues, water quality issues, and the altered visual amenity of the Port. Mitigation measures to minimise these impacts have been developed where possible and included in each relevant section of this EA.

20.4.2 Major Project

The overall impact of the proposed Major Project on the social and economic characteristics of the area would be positive. The proposed development would also have a long term positive impact on the competitive environment for NSW ports.

In the period up to 2018, for construction activities to be undertaken as part of the Major Project, over 180 direct and indirect employment opportunities per year would be generated in the Illawarra Region and over 297 in NSW as a whole. Trade flows through the central portion of the multi-purpose terminals would potentially generate 384 extra FTE jobs in the Illawarra Region and 451 in NSW as a whole.

The Major Project would also increase regional and State income through construction. Net contribution from the proposed development is estimated to add $19.5 million to the Illawarra's GRP and $32.8 million to GSP per year during construction.

There would be social impacts associated with the Major Project, including increased road traffic during construction and operation; increased noise from construction works and operation of the multi-purpose terminals and berth; water quality and hydrological impacts during dredging and reclamation, and altered visual amenity during dredging, reclamation and construction and operation of the terminal. Mitigation measures to minimise these impacts have been developed where possible and included in each relevant section of this EA.

21.0 Noise and Vibration

21.1 Introduction

An acoustic assessment of the likely construction and operational activities associated with the proposed development of Port Kembla Outer Harbour has been summarised in this section and is included as **Appendix J**.

This assessment has considered likely construction and operational noise scenarios associated with the overall Concept Plan and Major Project. At this stage detailed construction and operational methodology for the development is not available. The assessment has therefore been carried out based on likely site activities that have been confirmed in discussions with PKPC.

21.2 Existing Environment

Three loggers were used to continuously measure background noise levels between Thursday 18th September 2008 and Wednesday 24th September 2008. The loggers were located at 7 Wentworth Street, 14 O'Donnell Street and 2 Reservoir Street, Port Kembla. The logger located at 2 Reservoir Street experienced technical difficulties and as such only gathered reliable data for the period Thursday 18th Sept 2008 to 21st September 2008. These locations are considered to be representative of the sensitive receivers in the area.

An additional logger was used to continuously measure road traffic noise levels between Thursday 18th September 2008 and Wednesday 24th September 2008. The logger was located at 43-57 Five Islands Road, adjacent to the carriageway. The locations of the loggers relative to the Outer Harbour development are illustrated on **Figure 21-1**. Logger locations relative to sensitive receiver locations are illustrated on **Figures 21-2** to **21-4**.

The data from the noise loggers enables the calculation of an Assessment Background Level (ABL), which represents the single figure background noise level representing each assessment period (day, evening and night) for each day. The Rating Background Level (RBL), which is the median value of the ABL values for the period over all of the days, was then determined using measured ambient noise levels shown in **Table 21-1**.

Graphical representation of the logging results are shown in the *Acoustic Assessment Report* (**Appendix J**).

21.2.1 Sensitive Receivers

The logger located at 7 Wentworth Road was affected by traffic noise from the nearby Five Islands Road (see **Table 21-2**). This location has been assumed to be representative of residential properties adjacent to or in close proximity to the more heavily used roads in the area. This has been designated Sensitive Catchment Area 1(SCA1).

The logger located at 14 O'Donnell Street is considered to be representative of residential properties located further away from the more heavily used roads in the area. This has been designated Sensitive Catchment Area 2 (SCA2).

Figure 21-1: Location of Noise Loggers Relative to Outer Harbour Development

Table 21-1: Summary of Ambient Noise Levels dB(A)

Logger Location	**Day**		**Evening**		**Night**	
7 Wentworth Road	L_{A90}	L_{Aeq}	L_{A90}	L_{Aeq}	L_{A90}	L_{Aeq}
Thurs 18th September 2008			48	52	45	52
Fri 19th September 2008	50	56	47	56	49	53
Sat 20th September 2008	47	55	39	54	37	50
Sun 21st September 2008	43	67*	45	53	46	53
Mon 22nd September 2008	49	56	48	52	44	51
Tues 23rd September 2008	43	53	40	48	43	51
Wed 24th September 2008	47	54	46	51	48	53
RBL	**47**		**46**		**45**	
Log Average L_{Aeq}		**61**		**53**		**52**
14 O'Donnell Street	L_{A90}	L_{Aeq}	L_{A90}	L_{Aeq}	L_{A90}	L_{Aeq}
Thurs 18th September 2008	37	42	42	50	44	51
Fri 19th September 2008	41	46	39	50	39	50
Sat 20th September 2008	26	39	34	50	38	48
Sun 21st September 2008	40	44	39	52	42	50
Mon 22nd September 2008	35	45	40	50	39	47
Tues 23rd September 2008	31	43	37	50	39	55
Wed 24th September 2008	39	45	40	55		
RBL	**37**		**39**		**39**	
Amended RBL	**37**		**39**		**37****	
Log Average, L_{Aeq}		**44**		**52**		**51**

- * Result of noisy afternoon activity

** Note: The NSW Department of Environment, Climate Change and Water (DECCW) Industrial Noise Policy (INP) application notes recommends that when higher background noise levels (RBL) occur in the night time assessment period, that the criteria are generally set to the lower evening or daytime criteria in accordance with community expectations.

Table 21-2: Summary of Traffic Noise Levels at 7m from Five Islands Road dB(A)

Day Time - ECRTN Timebase			
15 hr Leq, (7am to 10pm)	70.9	1 hr Leq	72.8
Night Time - ECRTN Timebase			
9hr Leq, (10pm to 7am)	67.5	1 hr Leq	70.6

Figure 21-2: Sensitive Receivers and Noise Logging Locations

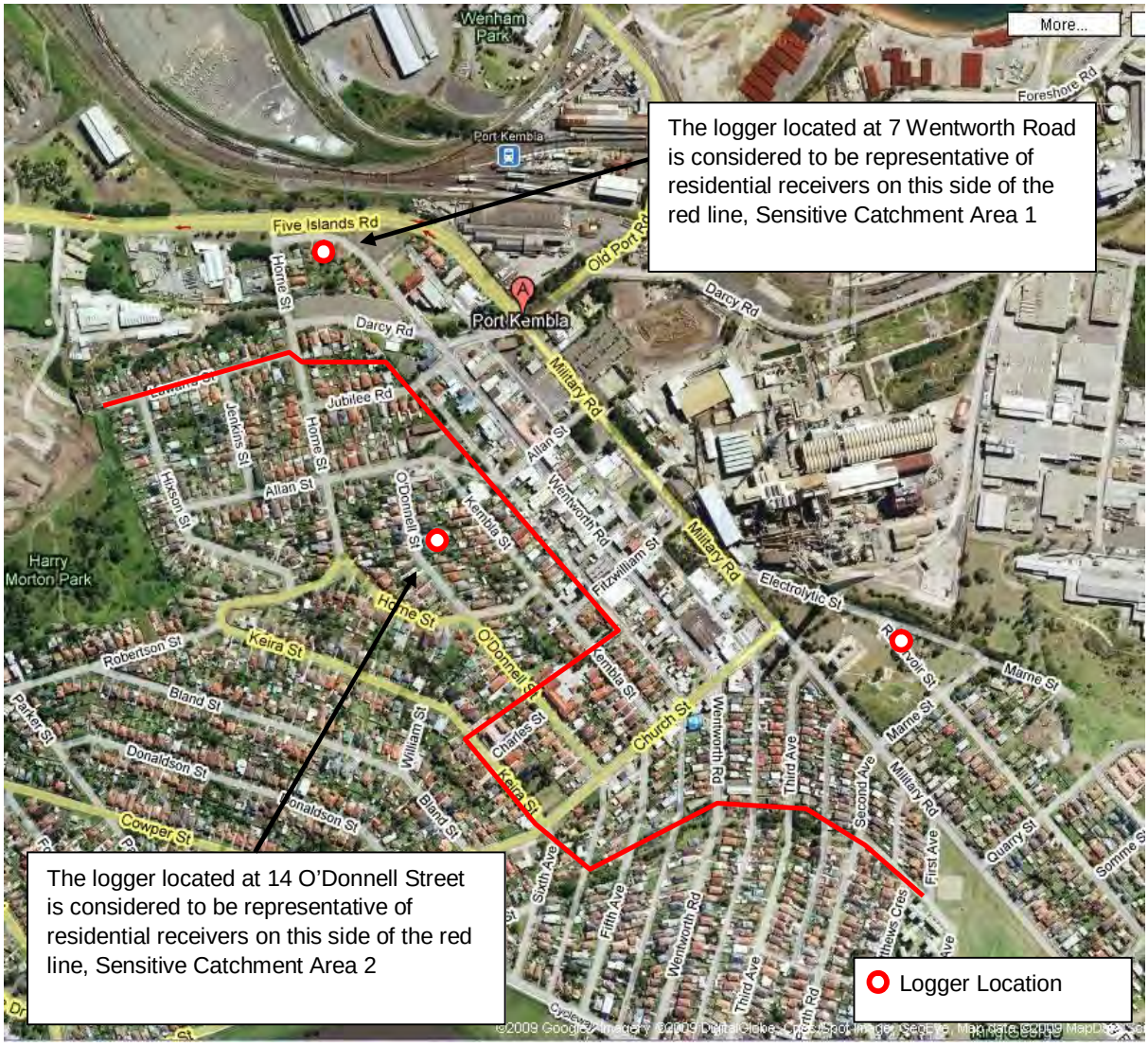


Figure 21-3: Five Islands Road Noise Logging Location and Most Affected Traffic Noise Receivers

Figure 21-4: Masters Road Traffic Noise Receivers

21.3 Methodology

21.3.1 Construction noise criteria

The NSW DECCW *Interim Construction Noise Guidelines* (ICNG) state that noise level objectives must be set for the daytime and evening periods with noise levels measured as shown in **Table 21-3**.

Table 21-3: Noise at Residences using Quantitative Assessment

Time of Day	Management Level $L_{Aeq\ (15min)}$*
Recommended standard hours: Monday to Friday 7 am to 6 pm Saturday 8 am to 1 pm No work on Sundays or public holidays	Noise affected RBL + 10 dB
Outside recommended standard hours	Noise affected RBL + 5 dB

* Noise levels apply at the property boundary that is most exposed to construction noise, and at a height of 1.5 m above ground level. If the property boundary is more than 30 m from the residence, the location for measuring or predicting noise levels is at the most noise-affected point within 30 m of the residence. Noise levels may be higher at upper floors of the noise affected residence.

For the purposes of this assessment it has been assumed that the construction activities would take place during recommended standard working hours (07.00 am – 6.00 pm Monday to Friday and 8.00 am – 1.00 pm Saturday), with the exception of dredging plant that would be operational 24 hours a day. The plant assumed for use in the construction modelling is shown in Table 18 of **Appendix J**.

Construction noise management levels for the most affected residential receivers are shown in **Table 21-4**. Criteria for other sensitive land uses, such as schools, hospitals or places of worship are shown in Table 5 in **Appendix J**.

Table 21-4: Construction Noise Management Levels – Residential Receivers

Receivers	Background Noise Level, $L_{A90\ Day}$ dB(A)	Daytime Noise Management Levels L_{Aeq} dB(A)	Background Noise Level, $L_{A90\ Evening}$ dB(A)	Evening Noise Management Levels L_{Aeq} dB(A)	Background Noise Level, $LA_{90\ Night}$ dB(A)	Night time Noise Management Limit L_{Aeq} dB(A)
Sensitive Catchment Area 1	47	57	46	51	45	50
Sensitive Catchment Area 2	39	49	40	45	37	42

21.3.2 Operational Noise Criteria

Any noise generated within the PKOH development site boundary, including noise from plant, truck movements, rail movements (including Stabling Yard activities), loading/unloading activities, and mechanical services or associated with site buildings must be assessed in accordance with the Industrial Noise policy (INP).

The assessment procedure for industrial noise sources has two components, which are:

- Controlling intrusive noise impacts in the short term for residences; and
- Maintaining noise level amenity for particular land uses for residences and other land uses.

Intrusive Noise Impacts

The INP states that the noise from any single source should not intrude greatly above the prevailing background noise level. Industrial noises are generally considered acceptable if the equivalent continuous (energy-average) A-weighted level of noise from the source (L_{Aeq}), measured over a 15 minute period, does not exceed the background noise level measured in the absence of the source by more than 5 dB. This is termed the *Intrusiveness Criterion*.

The *Rating Background Level* (RBL) is the background noise level to be used for assessment purposes and is determined by the methods given in Section 3.1 of the INP. Adjustments are to be applied to the level of noise produced if the noise at the receiver contains annoying characteristics such as tonality or impulsiveness.

Protecting Noise Amenity

To limit continuing increases in noise levels, the maximum ambient noise level resulting from industrial noise sources should not normally exceed the acceptable noise levels specified in *Table 2.1* of the INP. That is, the background noise level should not exceed the level appropriate for the particular locality and land use. This is termed the *Amenity Criterion*.

For a residential receiver in an urban area, the recommended acceptable and maximum noise levels from industrial sources are shown in **Table 21-5**.

Table 21-5: Recommended L_{Aeq} Noise Levels from Industrial Noise Sources

Type of receiver	Indicative Noise Amenity Area	Time of Day	Recommended L_{Aeq} Noise Level dB(A)	
			Acceptable	Recommended Maximum
Residence	Urban	Day	60	65
		Evening	50	55
		Night	45	50

Cumulative Impact

Environmental noise criteria must consider the cumulative impact from all operational activities associated with the Concept Plan and Major Project. As PKPC is seeking concurrent Concept Plan and Major Project approval, the operational activities associated with Major Project (Stage 1) have been assessed on both a standalone basis and as part of the overall Concept Plan.

The criteria for assessment of the Concept Plan and the Major Project are the same.

Final Environmental Noise Criteria

A summary of the environmental noise criteria is given in **Table 21-6**.

Table 21-6: Environmental Noise Criteria

Receiver	Period	RBL (L_{A90})	Ambient (L_{Aeq})	Intrusive Criterion RBL + 5	Amenity Criteria	Final Environmental Criteria dB(A)
Sensitive Catchment Area 1	Day	47	61	52	52	52
	Evening	46	53	51	43	43
	Night	45	52	50	42	42
Sensitive Catchment Area 2	Day	39	51	44	60	44
	Evening	39	45	44	48	44
	Night	37	46	42	37	37

Note: The Final Environmental Criteria used is the lowest of each of the Amended Intrusive and Amended Amenity criteria at sensitive receivers. Ambient levels are the Log Average, L_{Aeq} at each residence.

As the noise emissions from the proposed development would be dominated by relatively constant activities during the assessment periods, the $L_{Aeq,\ period}$ has been assumed to be equal to the assessed $L_{Aeq,\ 15\ min}$ for the worst case operational scenario. This ensures compliance with both criteria at sensitive residential receivers and represents a conservative assumption.

The criteria above are applicable for all the operational noise sources within the multi-purpose and container terminals at the residential receivers most likely to be affected.

Meteorological Effects

Certain meteorological effects, such as source to receiver wind speeds of less than 3 m/s and thermal inversions, can increase the impact at noise sensitive receivers. Meteorological data sourced from the DECCW Wollongong monitoring station between July 2006 and June 2007, and summarised in the Air Quality report submitted as part of this EA (refer **Appendix K**), has been reviewed.

This data set indicates that F class temperature inversions occur for approximately 34% of the time, principally during the winter months. A screening test indicates that the occurrence of F-class temperature inversions has the potential to increase the noise impact at sensitive receivers by more than 3 dB(A). F-class temperature inversions have therefore been included in all night time modelling scenarios.

The data set indicates that source to receiver (i.e. north easterly) wind speeds of less than 3m/s occur for approximately 17% of the time. This is below the 30% requirement specified by the INP to indicate that adverse wind conditions are a feature of the area. However, in order to produce a worst case (conservative) assessment, adverse wind conditions have been included in the daytime modelling.

A more detailed account of the existing meteorological conditions in the vicinity of the proposed development is included in Section 5 of **Appendix K**.

Sleep Disturbance Criteria

The INP has recently been updated with application notes which discuss sleep disturbance. The INP application notes consider it appropriate that $\mathbf{L_{Amax} \leq L_{A90} + 15}$ be used as a screening criterion to assess the likelihood of sleep disturbance and as a result the sleep disturbance criteria are as follows:

- Sensitive Catchment Area 1 is L_{Amax}<60 dB(A).
- Sensitive Catchment Area 2 is L_{Amax} <52 dB(A).

Rail Noise Criteria

The DECCW '*Interim Guideline for the Assessment of Noise from Rail Infrastructure Projects'* (IGANRIP) recommends that rail infrastructure projects with the potential for noise and vibration impacts should be compared against the airborne and ground borne noise trigger levels to decide whether assessments of impacts and feasible and reasonable mitigation measures are necessary.

The airborne noise criteria for *Redevelopment of Existing Rail Line* near to residential receivers are shown in **Table 21-7**. The airborne noise criteria receivers other than residential are given in **Appendix J**. The ground borne noise criteria for residential and other receivers are given in **Table 21-8**.

Table 21-7: Airborne Rail Traffic Noise Trigger Levels for Residential and Educational Receivers

Receiver	Time of day	Noise trigger levels dB(A)
		Development increases existing rail noise levels and **resulting rail noise levels exceed:**
Residential	Day (7 am – 10 pm)	65 $L_{Aeq(15h)}$ 85 L_{Amax}
	Night (10 pm – 7 am)	60 $L_{Aeq(9h)}$ 85 L_{Amax}

Comment: These numbers represent external levels of noise that trigger the need for an assessment of the potential noise impacts from a rail infrastructure project. An 'increase' in existing rail noise levels is taken to be an increase of 2 dB(A) or more in L_{Aeq} in any hour or an increase of 3 dB(A) or more in L_{Amax}.

Table 21-8: Ground-borne Rail Traffic Noise Trigger Levels for Residential and Educational Receivers

Receiver	Time of day	Noise trigger levels dB(A)
		Development increases existing rail noise levels by 3 dB(A) or more *and* **resulting rail noise levels exceed:**
Residential	Day (7 am – 10 pm)	40 L_{Amax} (slow)
	Night (10 pm – 7 am)	35 L_{Amax} (slow)
Schools, educational institutions, places of worship	When in use	40 – 45 L_{Amax} (slow)

21.3.3 Road Traffic Noise Criteria

The development would generate increased truck and light vehicle movements therefore the impact of increased road movements on sensitive receivers has been assessed using the DECCW 'Environmental Criteria for Road Traffic Noise' (ECRTN).

The two primary roads in the study area that the proposed development may impact are Five Islands Road and Old Port Road. Roads are classified depending on how they function within the surrounding road network. In this case Five Islands Road would be classified as an arterial road and Old Port Road as a sub arterial road. Results for Five Islands Road have been used to provide a 'worst case' (conservative) assessment of the impacts to major roads. Road traffic noise criteria for arterial and sub – arterial roads are shown in **Table 21-9**.

Table 21-9: Road Traffic Noise Criteria for Arterial/Sub-arterial Roads

Period	Parameter	Criterion dB(A)
Day (7.00 am – 10.00pm)	$L_{Aeq,\ 15hr}$	60
Night (10.00 pm – 7.00am)	$L_{Aeq,\ 9hr}$	55

Existing traffic noise adjacent to Five Islands Road is in excess of the ECRTN criteria for daytime and night-time. In cases where noise from an existing road already exceeds the above criteria, Table 1 of the ECRTN recommends that '*traffic arising from the development should not lead to an increase in existing noise levels of more than 2 dB*'. The road traffic noise criteria have therefore been adjusted to existing noise levels +2 dB(A) (refer to **Table 21-10**).

Table 21-10: Daytime and Night-time Existing Traffic Noise and Adjusted Road Traffic Noise Criteria used in the Assessment

ECRTN Timebase	Road traffic noise criteria dB(A)	Existing road traffic noise dB(A)	Adjusted road traffic noise criteria (existing +2 dB(A))
Day Time (7am to 10pm)	60	71	73
Night Time (10pm to 7am)	55	68	70

21.3.4 Vibration Criteria

Construction Blasting Criteria

The Australian and New Zealand Environment Conservation Council (ANZECC) *Technical Basis for Guidelines to Minimise Annoyance due to Blasting Overpressure and Ground Vibration* has been adopted by the DECCW as comfort criteria. The guidelines are not intended to be structural damage criteria, however they do provide a conservative approach to assessing blasting impacts.

The ANZECC guidelines criteria are summarised in **Table 21-11**.

Table 21-11: ANZECC Guideline Blast Criteria Summary

	ANZECC Guidelines
Noise	≤ 115 dB(linear) peak for 95% of total number of blasts in 12 months ≤ 120 dB(linear) peak for any blast
Vibration	≤ 5 mm/sec PPV for 95% of total number of blasts in 12 months ≤ 10 mm/sec PPV for any blast

Airblast will have no impact during the construction stage of the or Concept Plan or Major Project as all blasting is to take place under a minimum water depth of 5 m. The acoustic impedance mismatch between air and water means that the vast majority of acoustic energy from an underwater blast will be reflected at the water surface. The minimal amount of energy that is not reflected is likely to be at a low sound pressure level at infrasound frequencies, and as such would not be perceptible by the nearest receivers.

Building Exposure to Vibration

DIN Standard 4150 - Part 3 - Structural Vibration in Buildings - Effects on Structures (DIN 4150) provides recommended maximum levels of vibration that reduce the likelihood of building damage caused by vibration as shown in **Table 21-12**. DIN 4150 states that damage will not necessarily occur when buildings are exposed to levels of vibration greater than those shown. These levels are generally accepted to be conservative.

Table 21-12: DIN 4150: Structural Damage Safe Limits for Building Vibration

Type of Structure	Guideline values for Peak Particle Velocity (PPV) in mm/s in horizontal plane of highest floor at all frequencies
Dwellings and buildings of similar design and/or occupancy	5
Buildings used for commercial purposes, industrial buildings, and buildings of similar design	10
Structures that, because of their particular sensitivity to vibration, cannot be classified under lines 1 and 2 and are of great intrinsic value (e.g. listed buildings under preservation order)	2.5

British Standard 7385: Part 2 1993 Evaluation and Measurement of Vibration in Buildings quantifies three different levels of damage to structures:

- **Cosmetic** – The formation of hairline cracks on drywall surfaces, or the growth of existing cracks in plaster or drywall surfaces; in addition, the formation of hairline cracks in mortar joints of brick/concrete block construction;
- **Minor –** The formation of large cracks or loosening and falling of plaster or drywall surfaces, or cracks through bricks/concrete blocks; and
- **Major** – Damage to structural elements of the building, cracks in support columns, loosening of joints, splaying of masonry cracks, etc.

BS 7385 provides guidance on assessing the possibility of vibration-induced damage in buildings due to a variety of sources and sets guide values for building vibration based on the lowest vibration levels above which damage has been credibly demonstrated. These levels are judged to give a minimum risk of vibration-induced damage, where minimal risk for a named effect is usually taken as a 95% probability of no effect.

The standard states that there is a major difference between the sensitivity of people in feeling vibration and the onset of levels of vibration which may damage the structure. The levels of vibration at which people are likely to comment are below levels of vibration which damage buildings, except at lower frequencies.

The full assessment method presented takes into account the magnitude, frequency and duration of recorded vibration together with consideration of the type of building which is exposed.

Although the criteria contained within BS7385 are useful when appraising the relative severity of structural vibration, it is important to note that they are not intended to be adopted as acceptable or non-acceptable limits for vibration. The criteria in BS7385 are shown in **Table 21-13** below.

Table 21-13: Transient Vibration Guide Values for Cosmetic Damage

Type of Building	Peak component particle velocity in frequency range of predominant pulse	
	4 Hz to 15 Hz	15 Hz and above
Reinforced or framed structures Industrial and heavy commercial buildings	50 mm/s at 4 Hz and above	
Unreinforced or light framed structures. Residential or light commercial type buildings	15 mm/s at 4 Hz increasing to 20 mm/s at 15 Hz	20 mm/s at 15 Hz Increasing to 50 mm/s at 40 Hz and above
NOTE 1 Values referred to are at the base of the building. NOTE 2 For unreinforced or light framed structures at frequencies below 4 Hz, a maximum displacement of 0.6 mm (zero to peak) should not be exceeded.		

Note where the dynamic loading caused by continuous vibration results in dynamic magnification due to resonance the guide values in Table 21-13 may need to be reduced by up to 50 %, especially at the lower frequencies where lower guide values apply.

BS 7385 asserts that minor damage is possible at vibration magnitudes that are greater than twice those given in **Table 21-13** above, and that major damage to a building structure may occur at values greater than four times the stated values.

Human exposure to vibration

Long term exposure to vibration in buildings may cause annoyance. The levels at which annoyance occurs are much lower than the structural damage criteria in buildings. *British Standard 6472-1992 Evaluation of Human Exposure to Vibration in Buildings (1 Hz to 80 Hz) and NSW DECC* publication *'Assessing Vibration – A Technical Guideline'* provides guidance on human response to vibration. *BS 6472* defines levels of building vibration associated with a "low probability of adverse comment" from occupants, and the applicable levels for daytime activities are presented in **Table 21-14** below.

Table 21-14: Vibration (PPV) with "low probability of adverse comment" (1 Hz to 80 Hz)

Building Type	Peak Floor Vibration (X, Y Horizontal)	Peak Floor Vibration (Z Vertical)
Residential	0.8 mm/s to 1.6 mm/s	0.3 mm/s to 0.6 mm/s

Vibration Dose Values (VDV) may also be used to assess the likelihood of complaints of intermittent vibration. The values and corresponding likelihood of response is presented in **Table 21-15** below. The VDV should be determined from a measurement obtained over the full exposure to vibration.

Table 21-15: Vibration Dose Values ($m/s^{1.75}$) and the Various Degrees of Adverse Comment Expected

Location	Low Probability of Adverse Comment	Adverse Comment Possible	Adverse Comment Probable
Residential buildings 16 hour day	0.2 to 0.4	0.4 to 0.8	0.8 to 1.6

21.4 Impact Assessment

21.4.1 Modelling and Assumptions

Construction and operational noise activities were modelled using SoundPLAN v7.0 modelling software. The environmental noise impact at the sensitive receivers was assessed using an implementation of the CONCAWE algorithms.

A list of sound power levels for the plan/machinery included in the construction noise model is presented in Tables 18 and 20 of **Appendix J**. Sound power levels for plant and machinery included in the Concept Plan and Major Project operational noise models are presented in Tables 24 and 22 in **Appendix J**, respectively.

F-class temperature inversions (2m/s drainage flow) have been included in all night time modelling scenarios and source to receiver (north easterly) wind speeds of less than 3 m/s have been included in all daytime and evening modelling scenarios.

Noise contours for the day time periods generated by the assessment of both the Concept Plan and the Major Project are represented in **Figures 21-5** and **21-6**. Daytime noise contours are also representative of evening noise contours. Noise contours for night time periods for both the Concept Plan and Major Project are included in **Appendix J**.

In determining the noise impact assessment for construction and operational noise the following assumptions have been made:

- Construction and operational noise levels used are representative of likely site activities.
- Changes to the modelled scenarios may result in changes to the predicted noise impact levels.

Figure 21-5: Noise Contours - Concept Plan - Day

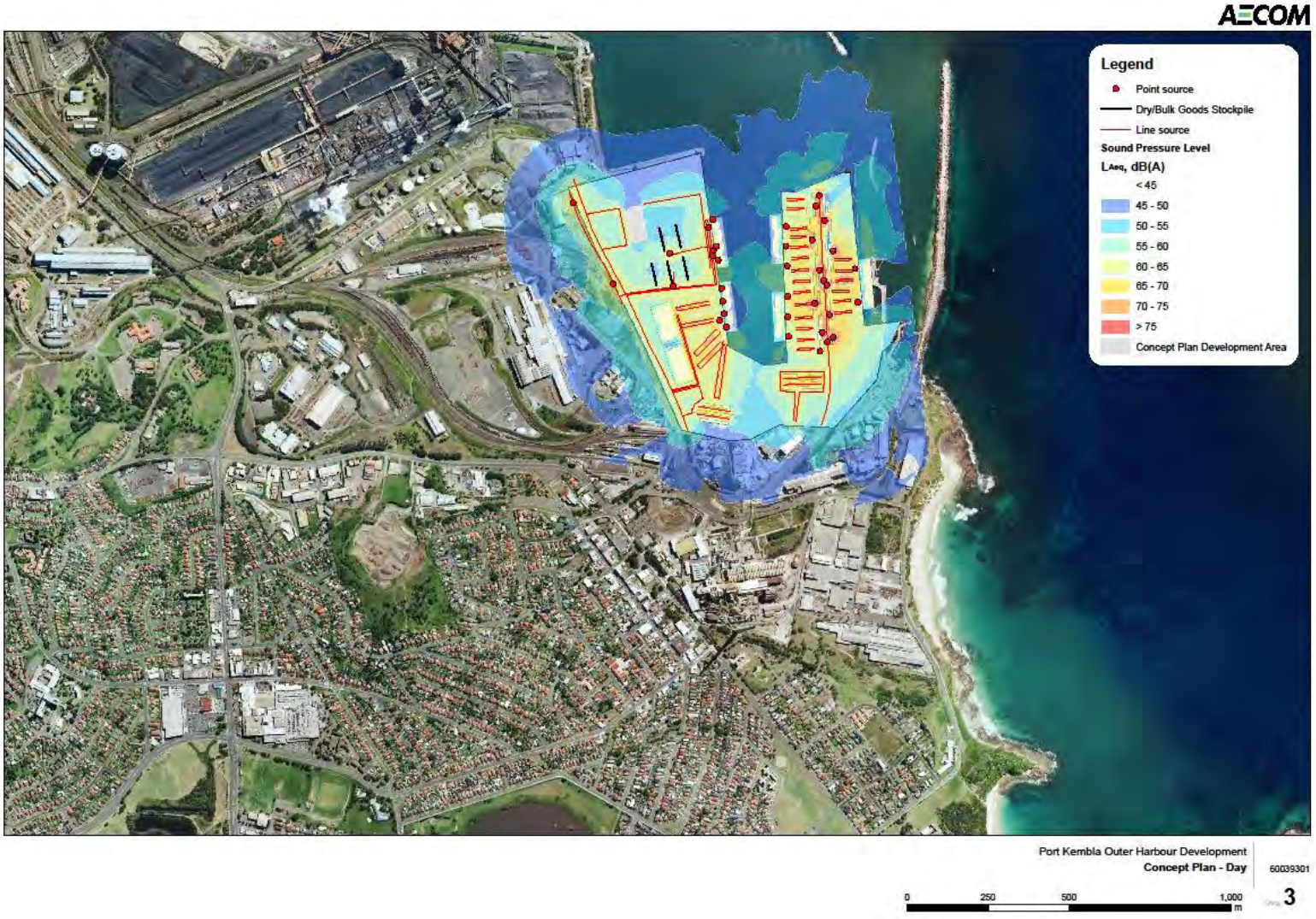


Figure 21-6: Noise Contours - Major Project – Day

21.4.2 Concept Plan

Construction Noise

Noise and vibration would occur as a result of construction activities undertaken as part of the Concept Plan, including dredging, reclamation and blasting (Stage 1 and 3), construction of road and rail infrastructure (all Stages), construction traffic movements (all Stages) and piling (Stage 3). Plant and equipment used in the assessment are presented in Table 24 of **Appendix J**.

A detailed noise and vibration assessment has been undertaken for construction associated with Stage 1 (Major Project) and further detailed assessments of construction noise and vibration impacts for Stages 2 and 3 would be conducted as part of separate project approvals for those works in the future.

The impact of increased traffic associated with construction works has been assessed at the worst affected receivers near Lake Avenue (adjacent to Five Island Road) and along Gladstone Avenue (adjacent to Masters Road) at Cringila. The increase in noise levels due to construction traffic is predicted to comply with the road traffic noise criteria for the worst peak hour flow rate, therefore noise impacts would not be significant.

Operation Noise

Operational noise impacts would occur as a result of activities associated with the operation of the multi-purpose and container terminals that would produce significant noise include:

- Materials and goods exporting – exports would arrive by train and be unloaded to conveyor systems, stockpiles and container stacks, which would then be transferred onto ships.
- Materials and goods importing – imports would be unloaded from ships by cranes into hoppers or onto shuttle carriers to trucks or trains, which transport materials/goods from site.
- Transport of goods/materials, by road and rail, to and from Port Kembla Outer Harbour.

The operational noise assessment scenario for the Concept Plan development is predicted to comply with the daytime and evening environmental noise criteria at all noise sensitive receivers. The model predicts exceedance of the night time environmental noise criteria of:

- 1 dB(A) at the four closest noise sensitive receivers on Military Road, in Sensitive Catchment Area 1.
- Between 1-4 dB(A) at a large number of noise sensitive receivers in Sensitive Catchment Area 2.

The extent of the modelled exceedances is shown on the *Concept Plan – Night* noise contour plan included in **Appendix J**. The vast majority of the modelled exceedances are in the 1-2 dB(A) range, with less than fifteen modelled exceedances of 3 dB(A) and four modelled exceedances of 4 dB(A).

It is important to note that the assessment represents the results of modelling a worst case scenario and assumes all three terminals are working at maximum capacity at the same time with peak traffic flow rates for each terminal occurring coincidentally while there is an F-class temperature inversion in effect. This scenario is highly unlikely in reality. Furthermore, the modelled exceedances are not the result of any large individual impacts but rather the cumulative impact of a large number of relatively low noise impacts.

It is recommended that the ground-borne noise impact resulting from rail movements at the South Yard associated with the Concept Plan is assessed following the rail infrastructure planning study scheduled for 2010.

Sleep Disturbance

The noise impact from container 'clang' associated with operations at the container terminal are predicted to comply with the sleep disturbance criteria at all receivers and would not have adverse impacts on sensitive receivers (refer to Table 28 of **Appendix J**). The sounding of train horns is predicted to result in exceedence of the sleep disturbance criteria.

Road Traffic Noise

The predicted impact from increased heavy vehicles passing the worst affected residences is less than 2 dB(A), which complies with the ECRTN criteria. Therefore there are unlikely to be impacts on sensitive receivers as a result of increased road traffic associated with Concept Plan operation.

21.4.3 Major Project

Construction Noise

The acoustic impact at sensitive receivers resulting from construction activities has been assessed based on a likely construction scenario. The assumed scenario is considered to be representative of likely site activities and the impact has been assessed based on the 'worst case' conditions i.e. the shortest distance between source and receivers and the noisiest activities occurring concurrently.

Construction activities associated with the Major Project that would produce significant noise include:

- Dredging activities.
- Construction works to upgrade rail infrastructure in the South Yard, including extension of the No.13 railway siding and turnout installation and removal.
- Traffic movements associated with construction works and transport of reclamation fill material from external sources.
- Construction of the shipping berths at the multi-purpose and container terminals.

With the exception of dredging activities, construction activities would not be undertaken outside of standard day time working hours. The assessment for the evening and night time periods therefore assumes that only the dredging is in progress. Reclamation fill material would be sourced from both dredging and imported to site from various external projects.

The construction noise impact resulting from dredging and general construction works is predicted to comply with the daytime, evening and night time construction noise criteria at all nearby sensitive residential and commercial receivers. Therefore noise impacts from construction works undertaken under the Major Project would not be significant.

The noise levels associated with South Yard construction works are modelled to exceed the daytime noise management level by up to 13 dB(A) at the closest noise sensitive receivers (Wentworth Road and Military Road). Exceedences of up to 3 dB(A) would occur at receivers located further from the works (Jubilee Road) (refer **Table 21-16**).

This is considered to be a worst case assessment and it is unlikely that this level of exceedance would persist. It is likely that the actual noise level will be significantly less than the modelled value following careful consideration of the construction methodology at the construction management plan stage.

Table 21-16: Modelled Construction Noise Levels at the South Yard

Receivers	Daytime Construction Noise Management Levels dB(A)	Conditions	South Yard
Wentworth Road (SCA1)	57	Neutral	**68 (11)**
		Wind 3 m/s	**70 (13)**
Military Road (SCA1)	57	Neutral	**63 (6)**
		Wind 3 m/s	**65 (8)**
Jubilee Road (SCA2)	49	Neutral	**50 (1)**
		Wind 3 m/s	**52 (3)**

Road Traffic Noise

Road traffic associated with the construction phase would add an additional 23 heavy vehicles per hour during the peak flow period. All additional traffic would pass the worst affected receivers at Cringila. The increase in noise levels due to construction traffic at the worst affected receivers is predicted to be less 0.4 dB(A), which complies with the road traffic noise criteria (i.e. a less than 2 dB(A) increase) for the worst peak hour flow rate. Therefore there would be no significant impact on sensitive receivers resulting from construction traffic.

Blasting and Operational Vibration

Construction blasting of rock associated with the dredging process can result in ground vibration, which can impact on human comfort and can cause damage to structures, architectural elements and services.

The vibration levels resulting from blasting associated with the dredging works have been predicted at receivers in SCA1 and SCA2 for charges ranging from 1 kg to 60 kg. The results have been assessed against the long term structural damage safe limits in DIN 4150. This assessment is considered to be appropriate as the structural resonance frequency of the potentially affected receivers is not known and therefore it is likely that the results are conservative.

The predicted vibration levels associated with blasting to be undertaken as part of the Major Project application, comply with the criteria at all sensitive receivers. The predicted vibration level at the closest industrial/commercial facility on Old Port Road exceeds the criteria when a 60 kg charge is assumed (**Table 21-17**). By using charges smaller than 60kg and time delaying the charges, and considering the conservative nature of the assessment criteria, cosmetic damage to the industrial/commercial facilities would be unlikely to occur.

Table 21-17: Predicted Vibration at Closest Industrial/Commercial Receivers, with a K_g =5000

Site	Minimum Distance to Blasting (m)	Predicted PPV (mm/s)						
		1 kg Charge	5 kg Charge	10 kg Charge	15 kg Charge	20 kg Charge	30 kg Charge	60 kg Charge
Closest Industrial /Commercial Receiver	200	1.0	3.8	6.6	9.1	11.4	15.8	27.5

It is considered unlikely that there will be any vibration impact at nearby sensitive receivers as a result of operations within the site boundary due to the nature of the activities and the distance to the closest receivers.

The impact of operational vibration resulting from rail movements at the South Yard associated with the Major Project has been assessed and is considered to be inconsequential at the closest vibration sensitive receivers.

It is recommended that the operational vibration impact resulting from rail movements associated with the Concept Plan is assessed following the rail infrastructure planning study scheduled for 2010.

Operational Noise

Activities associated with the operation of the multi-purpose terminals as part of the Major Project that would produce significant noise include:

- Materials exporting – export materials would arrive by train and be unloaded directly to a mobile conveyor system that feeds stockpiles. Materials from stockpiles would be transferred by wheeled loader onto another mobile conveyor system which would feed directly onto the ships.
- Materials importing – materials would be unloaded by ship cranes or occasional quayside cranes and loaded directly into hoppers which would feed directly into trucks, or mobile hoppers connected to a conveyor system taking materials directly to the cement production facility. (Operational activities within the cement production facility building envelope have not been assessed as this facility would be subject to a separate application for planning approval and separate acoustic assessment).
- Transport of goods/materials, by road and rail, to and from Port Kembla Outer Harbour, including operation of the upgraded South Yard.

There is no predicted exceedence of the daytime, evening or night time environmental criteria in SCA1 or SCA2 resulting from Major Project operational activities at the multi-purpose terminals.

When assessed against the overall night time environmental noise criteria, which is controlled by the more stringent amenity criterion, the impact of assumed operations at the South Yard is predicted to result in exceedances of up to 4 dB(A) at the closest noise sensitive receivers under adverse weather conditions. However, there would be only one rail movement associated with the Major Project in any 24 hour period. In addition, Stabling Yard activities (such as shunting, decoupling and idling locomotives) are likely to be of limited duration. In light of this, the impact has been assessed against the more appropriate intrusiveness criterion.

When assessed against the night time intrusiveness criterion, Stabling Yard activities associated with the Major Project are predicted to comply at all nearby noise sensitive receivers. The predicted noise level at the closest receivers matches the measured existing background noise levels, which are affected by existing rail operations in the South Yard. The impact of development of the South Yard for the Major Project is therefore considered to be acceptable.

It is important to consider that trains are currently operational in the South Yard twenty four hours per day and that the Major Project would not increase the number of rail movements as it would utilise existing Pacific National rail movements. Given that this is an existing situation and that the proposed activities would not result in increased noise levels at nearby sensitive receivers, the impact is considered to be reasonable.

As no additional trains will operate as a result of the Major Project the ground-borne noise impact at nearby receivers will be unchanged from existing levels. This complies with the IGANRIP criteria in Table 8 of **Appendix J**.

Sleep Disturbance Assessment

The NSW Environmental Criteria for Road Traffic Noise (ECRTN). concludes that:

> *Maximum internal noise levels below 50-55 dB(A) are unlikely to cause awakening reactions; and*
>
> *One or two noise events per night, with maximum internal noise levels of 65-70 dB(A), are not likely to affect health and wellbeing significantly.*

Noises that could potentially result in sleep disturbance would likely result from metal container ‘clangs’ and sounding of train horns. Impacts on the closest noise sensitive receivers from metal ‘clangs’ and train horns being sounded at the northern end of the South Yard were assessed together (**Table 21-18**).

There are predicted exceedences of the sleep disturbance criteria by up to 11 dB(A) at receivers on Wentworth Avenue, up to 8 dB(A) at receivers on Jubilee Road and by up to 7 dB(A) at receivers on Military Road. The noise impact generated by metal ‘clangs’ was assessed alone and shown to comply with the sleep disturbance criteria (**Table 21-19**). Therefore exceedences of the sleep disturbance criteria are attributable to the sounding of train horns.

Table 21-18: Predicted Sleep Disturbance – Including Metal 'Clang' and Train Horns

Receiver	Background L_{A90} dB(A)	Sleep Disturbance Screening Criterion dB(A)	Predicted night time impact at receivers dB(A)	Predicted Exceedance dB(A)
5-7 Military Road	45	60	67	7
15 Wentworth Avenue	45	60	71	11
1 Jubilee Road	37	52	60	8

Table 21-19: Predicted Sleep Disturbance – Without Train Horns

Receiver	Background L_{A90} dB(A)	Sleep Disturbance Screening Criterion dB(A)	Predicted night time impact at receivers dB(A)	Predicted Exceedance dB(A)
5-7 Military Road	45	60	50	-
15 Wentworth Avenue	45	60	47	-
1 Jubilee Road	37	52	47	-

There would only be one train movement every 24 hours associated with the Major Project and the maximum predicted external noise level at a noise sensitive receiver is 71 dB(A). The ECRTN concludes that one or two noise events with a maximum internal noise level of 60-65 dB(A) are unlikely to cause awakening reactions. As an open bedroom window generally provides an approximate attenuation of about 10 dB(A), the predicted internal noise level would be 61 dB(A). Therefore it is unlikely that train horn noise resulting from the Major Project would cause sleep disturbance or significantly affect health and wellbeing. Nonetheless the use of a visual signalling system or similar should be investigated as an alternative to the sounding of train horns at the South Yard.

Road Traffic Noise

The road traffic noise assessment (Section 4.6 of **Appendix J**) provides data on the number of vehicle movements associated with operational activities at the site. Traffic movement figures for 2016 with and without the Major Project have been assessed.

All operational traffic generated by the Major Project would travel along Flinders Street and Five Islands Road towards the F6 Freeway. The most potentially affected receivers would be located at Cringila, situated around Lake Avenue, adjacent to Five Islands Road and along Gladstone Avenue, adjacent to Masters Road. The predicted increases in noise level resulting from the increase in heavy vehicle movements associated with the Major Project are shown in **Table 21-20**.

Table 21-20: Predicted Traffic Noise Level Increases Stage 1

	2016 'Do Nothing' Heavy Vehicle Numbers	2016 with Development Heavy Vehicle Numbers	Predicted Increase in Noise Levels dB(A)
AM			
Cringila Receivers	258	272	0.2
Masters Road Receivers	200	209	0.2
PM			
Cringila Receivers	228	242	0.3
Masters Road Receivers	217	225	0.2

As the existing traffic noise levels already exceed the ECRTN criteria, the road traffic noise criteria were set to existing noise levels plus 2dB(A). The maximum predicted increase in noise level resulting from increased traffic flow associated with the Major Project is 0.3 dB(A), which is within the ECRTN + 2dB(A) criteria. Therefore the predicted impact arising from increased heavy vehicle movements associated with the Major Project would be acceptable.

Rail Traffic Noise

The noise impact resulting from increased rail movements on the main Illawarra line (i.e. not within the South Yard), as a result of an additional one train movement per day arising from operations associated with the Major Project, is predicted to be less than 2 dB(A). This complies with the IGANRIP criteria in Table 8 of **Appendix J**.

21.5 Mitigation Measures

21.5.1 Concept Plan

Construction Noise

The impact of increased traffic associated with construction works and construction traffic has been assessed at the worst affected receivers near Lake Avenue (adjacent to Five Island Road) and along Gladstone Avenue (adjacent to Masters Road) at Cringila. The increase in noise levels is predicted to comply with the road traffic noise criteria for the worst peak hour flow rate, therefore noise impacts would not be significant.

Guidelines set out in the DECCW guidance document '*Interim Construction Noise Guidelines*' would be implemented during all construction stages of the Concept Plan to ensure that the impact at receivers from construction noise and is minimised as far as is reasonable and feasible.

PKPC is committed to the selection of acoustically considerate plant where possible and the use of noise reducing measures such as silencers, multi-frequency reversing alarms, visual system reversing warnings, enclosures and shrouds.

All construction works would be undertaken using best practicable means to mitigate noise impact at sensitive receivers, in accordance with the DECCW "*Draft Construction Noise Guidelines*". Mitigation measures could include:

- Community notification
- Operation of plant in a quiet and efficient manner
- Informing workers about minimising noise
- Efficient handling of complaints.

Further detailed noise assessments of construction noise associated with Stage 2 and 3 of the Concept Plan would be carried out as part of separate project approvals in the future.

Operation Noise

Predicted operational exceedances, resulting from cumulative impact of a large number of relatively low noise impacts, are difficult to mitigate using standard mitigation measures such as acoustic barriers. It is likely that the opportunity to reduce the predicted noise exceedances would present itself at several stages of the Concept Plan detailed design phase. This additional assessment would look at operations in greater detail and allow management controls to be put in place with a view to reducing noise emissions at night.

PKPC is committed to the selection of acoustically considerate equipment where possible and the use of noise reducing measures such as silencers, multi frequency reversing alarms, visual system reversing warnings, enclosures and shrouds to lower noise at receivers to levels lower than those predicted in the assessment. It is also likely that emerging technologies over the next 25 years would present the opportunity to further reduce the predicted noise impact.

It is understood that a major rail infrastructure planning study for Port Kembla Outer Harbour is to be undertaken in 2010. An assessment of the acoustic impact arising from changes to the rail infrastructure associated with the Concept Plan would be carried out to complement this planning study.

Further detailed noise assessments of operational noise associated with Stages 2 and 3 of the Concept Plan would be carried out as part of separate project approvals in the future.

21.5.2 Major Project

Construction

The construction noise level emission and the potential annoyance to sensitive receptors would depend on the final selection of equipment, type of operation, activity duration and the time of day at which works are conducted.

Guidelines set out in the DECCW guidance document '*Interim Construction Noise Guidelines*' would be implemented to ensure that the impact at receivers from construction noise is minimised as far is reasonable and feasible.

PKPC is committed to the selection of acoustically considerate plant where possible and the use of noise reducing measures such as silencers, multi-frequency reversing alarms, visual system reversing warnings, enclosures and shrouds.

It is unlikely that there would be adverse impact at nearby noise and vibration sensitive receivers resulting from blasting activity. Vibration impacts on industrial/commercial receivers would be minimised through careful blast planning, including using smaller charges and using smaller charges on a time delay.

Noise Management Plans would be included as part of each CEMP prepared for the Major Project to minimise the noise impact at sensitive receivers.

The construction schedule for the South Yard rail works, including working hours and types of plant working simultaneously, would be carefully considered at the construction planning stage, to reduce the predicted impact of construction noise associated with the South Yard upgrade.

All construction works would be undertaken using best practicable means to mitigate noise impact at sensitive receivers, in accordance with the DECCW "*Draft Construction Noise Guidelines*". Mitigation measures could include:

- Community notification
- Operation of plant in a quiet and efficient manner
- Informing workers about minimising noise
- Efficient handling of complaints.

Operation

A revised noise impact assessment would be carried out should the finalised operational scenario differ significantly from that used for modelling purposes within this assessment.

Noise Management Plans would be prepared as part of each OEMP prepared for site operations.

As the sounding of train horns is predicted to result in significant exceedances of sleep disturbance screening criteria, the use of a visual signalling system or similar option as an alternative to sounding horns would be considered, to reduce the noise source and reduce predicted sleep disturbance.

21.6 Summary

21.6.1 Concept Plan

Construction and operational noise impact assessments have been carried out based on plant and activities likely to be associated with the Concept Plan.

During construction, noise impact resulting from dredging and general construction works is predicted to comply with the daytime, evening and night time construction noise criteria at all nearby sensitive residential and commercial receivers. The noise levels associated with South Yard construction works are predicted to exceed the daytime noise criteria at the closest noise sensitive receivers but it is unlikely that this level of exceedance would persist.

There are predicted night time operational exceedances, resulting from cumulative impact of a large number of relatively low noise impacts, as well as impacts associated with rail operations. The noise impact from operation of the container terminals is predicted to comply with the sleep disturbance criteria and there are no significant impacts predicted from increased heavy vehicles passing residential receivers.

The operational scenario modelled to produce the predicted noise levels is considered to be extremely conservative and likely to occur on only one or two days a year.

It is recommended that vibration levels resulting from rail movements at the South Yard associated with the Concept Plan are assessed following the rail infrastructure planning study scheduled for 2010.

21.6.2 Major Project

The construction noise impact resulting from dredging and general construction works is predicted to comply with the daytime, evening and night time construction noise criteria at all nearby sensitive residential and commercial receivers.

The noise levels associated with South Yard construction works are predicted to exceed the daytime noise criteria by up to 13 dB(A) at the closest noise sensitive receivers. This is considered to be a worst case assessment and it is likely that this level of exceedance would be in short bursts. It is likely that the predicted noise level would reduce following careful consideration of the construction methodology at the construction management plan stage.

The predicted vibration levels associated with blasting to be undertaken as part of the Major Project comply with the criteria at all sensitive receivers.

The predicted vibration levels resulting from rail movements associated with the Major Project are considered to be inconsequential.

Appropriate noise management and mitigation measures would be considered and implemented during construction, to ensure that noise and vibration impacts are minimised. Noise Management Plans would be prepared and implemented as part of each CEMP prepared for the works to ensure that operation noise impacts are minimised and effectively managed.

22.0 Air Quality

22.1 Introduction

Activities associated with the proposed Outer Harbour development have the potential to impact on the air quality in both the immediate vicinity and surrounding areas during both the construction and operational phases of the development. A qualitative air quality impact assessment (AQIA) was undertaken to investigate the local and regional air quality characteristics in the vicinity of the Outer Harbour, to determine the capacity of the air shed to absorb emissions from the proposed Outer Harbour development (refer to **Appendix K**).

A quantitative air quality assessment involving air dispersion modelling was also completed to predict the potential air quality impacts from both Concept Plan and Major Project (Stage 1) refer to (**Appendix K**).

22.2 Methodology

22.2.1 Pollutant Assessment Criteria

In NSW the DECCW *Approved Methods for the Modelling and Assessment of Air Pollutants in New South Wales* (DECC, 2005) (refer **Table 22-1**) is the primary source of pollutant criteria. The Commonwealth National Environmental Protection (Air Toxics) Measure (Air Toxics NEPM) provides additional criteria for air quality (refer **Table 22-2**). The AQIA compares all three documents to the background data available from local monitoring stations. Background data included Existing Ambient Air Quality and Meteorological Data.

Table 22-1: NSW DECCW Approved Methods Air Quality Impact Assessment Criteria for Pollutants of Concern

Pollutant	NSW DECCW Air Quality Criteria		Averaging Period
	pphm	µg/m^3	
Carbon monoxide (CO)	8,700 2,500 900	100,000 30,000 10,000	15 minutes 1 hour 8 hour
Benzene	0.009	0.029	1 hour
Nitrogen Dioxide (NO_2)	12 3	246 62	1 hour Annual
Sulfur Dioxide (SO_2)	25 20 8 2	712 570 228 60	10 minute 1 hour 24 hour Annual
PM_{10}	- -	50 30	24 hour Annual
Ozone (0_3)	10 8	214 171	1 hour 4 hours
Lead (Pb)	-	0.5	Annual
Units	**g/m^2.month**	**g/m^2.month**	
Deposited Dust	2 *	4 **	Annual

ppm: parts per million

pphm: parts per hundred million

µg / m^3: micrograms per cubic metre

mg / m^3: milligrams per cubic metre

* The maximum increase in deposited dust

** The maximum total deposited dust level

Table 22-2: Air NEPM Air Quality Standards

Pollutant	Air NEPM Standards	Averaging Period
Carbon Monoxide	9.0 ppm	8 hour*
Nitrogen Dioxide	0.12 ppm 0.03 ppm	1 hour* Annual
Sulfur Dioxide	0.20 ppm 0.08 ppm 0.02 ppm	1 hour* 24 hour* Annual
PM_{10}	50 μg/m^3	24 hour**
$PM_{2.5}$	25 μg /m^3 8 μg /m^3	24 hour (advisory only) Annual (advisory only)
Photochemical Oxidants (as Ozone)	0.10 ppm 0.08 ppm	1 hour* 4 hour*
Lead	0.50 μg /m^3	Annual

ppm: parts per million

μg / m^3: micrograms per cubic metre

* Not to be exceeded more than one day per year

** Not to be exceeded more than five days per year

22.2.2 Ambient Air Quality

Ambient background pollutant concentrations were investigated for the area surrounding the Outer Harbour development. These levels were analysed to determine the degree to which emissions from the proposed development could contribute to pollution levels without exceeding regulatory limits.

The AQIA reviewed the results from Dust Deposition Gauges located to the east and west of the Outer Harbour. Ambient pollutant concentrations for criteria pollutants (where available) and toxic air pollutants from nearby DECCW monitoring sites were used to examine the existing ambient air quality in the assessment area.

In order to gain a general idea of the existing ambient air quality in the assessment area, reference was made to the following documents:

- Ambient Air Quality Research Report (1996-2001); Dioxins, Organics, Polycyclic Aromatic Hydrocarbons and Heavy Metals (2002), NSW Environment Protection Authority (EPA), Sydney.
- Quarterly Air Quality Monitoring Reports, DECCW, Sydney (refer to Section 4 of Appendix K).

22.2.3 Meteorology

Meteorological data was sourced from the DECCW Wollongong Monitoring Station located at the Army Barracks on Gipps Street. Continuous hourly averaged data was sourced from DECCW to assess the wind speed and direction in the general vicinity of the development site.

22.3 Wind

Wind rose diagrams which show the frequency of occurrence of winds by direction and strength for the Wollongong monitoring station for the period July 2006 to June 2007 for annual and seasonal data were complied and assessed.

22.4 Stability Classes

An important aspect of plume dispersion is the atmospheric turbulence level in the region of the plume. Turbulence acts to increase the cross-sectional area of the plume due to random motions, thus diluting or diffusing a plume. For traditional dispersion modelling using Gaussian plume models, categories of atmospheric stability are used in conjunction with other meteorological data to describe atmospheric conditions and thus dispersion. The assessment reviewed the stability classes for the Wollongong monitoring station data and its potential impact on the local air shed.

22.4.1 Air Dispersion Modelling

Dispersion modelling was undertaken to predict the potential air quality impacts from the Concept Plan and Major Project. An Emissions Inventory, containing all the emissions information required to undertake dispersion modelling was generated using construction and operational information supplied by PKPC and the emission factors supplied in relevant documents (Commonwealth 2008a and 2008b, EPA 1997a). The AUSPLUME dispersion model was used in the AQIA. Model inputs include meteorology, source characteristics, modelling scenarios and pollutant emissions data.

The DECCW considers sensitive receptors to be areas where people are likely to either live or work, or engage in recreational activities. On this basis, representative sensitive receptors were positioned at 10 locations surrounding the site. The receptors were chosen from local residential and commercial buildings.

For more detailed information on the air dispersion modelling methodology, refer to Section 6 of Appendix K.

22.4.2 Pollutants of Concern

Pollutants that have been identified to be of concern and that have been investigated in this assessment include:

- Carbon monoxide (CO).
- Nitrogen oxides (NO_x reported as NO_2).
- Sulphur dioxide (SO_2).
- Particulate matter: PM_{10} (particles less than 10 µm in diameter) and $PM_{2.5}$ (particles less than 2.5 µm in diameter).
- Toxic Air Pollutants (benzene, toluene, and xylenes).
- Odour (in terms of nuisance effects).

A description of these pollutants of concern, their potential threat to human health and their likely sources, are in detailed in Section 2.5 of Appendix K.

Of the pollutants listed above toxic air pollutants and odour were assessed qualitatively only. They have been omitted from the dispersion modelling due to their low background levels and/or low likelihood of emission from the Outer Harbour development. As the available assessment criteria in NSW for $PM_{2.5}$ is only an advisory standard and as DECCW do not recognise any assessment criteria in their guidelines, $PM_{2.5}$ has not been assessed further in this assessment.

22.5 Existing Environment

22.5.1 Overview

The Outer Harbour development is located on a thin coastal strip with a steep escarpment approximately 8 km to the west of the Port. The escarpment is a major influence on meteorology and air quality in the region. It can steer or deflect winds, changing the apparent direction at the surface. It can also lead to the decoupling of winds above and below the escarpment. As a result an inversion can form at the top of the escarpment, limiting the dispersion of pollutants in the Illawarra region.

22.5.2 Sources of air pollution and sensitive receivers

The Port is dominated by heavy and light industry, with some mixed commercial use and residential areas. Sources of air pollution identified include point sources (specifically stack sources), ground level sources such as construction sites, fugitive emission sources (for example, petroleum storage tanks and transport corridors) and motor vehicle sources at construction sites and on transport corridors.

Potentially significant sources of air pollution in the vicinity of the Outer Harbour (criteria pollutants, toxic air pollutants, dust and odour) include:

- BlueScope Steel.
- Orica.
- Incitec Limited (fertiliser manufacturer).
- GrainCorp Operations Limited.
- Port Kembla Coal Terminal.
- Various light industrial sources (steel workshops, equipment hire etc).

Various “Sensitive Receptors” were identified in the area and are considered to be those that have the potential to be impacted on by the proposed development. Sensitive receptors are typically defined as areas where people currently live or work, or may do so in the future. Sensitive land uses such as schools, hospitals, nursing homes, and recreational areas can also be classified as sensitive receptors. A full list of these sensitive receptors identified for this assessment is detailed in Sections 2.3 and 6.1 of Appendix K.

22.5.3 Ambient Air Quality

Monitoring results from Dust Deposition Gauges (DDG), located to the east and west of the Outer Harbour development, showed that although the average dust concentration from all the measured samples for both locations were below the NSW DECCW criteria, individual monthly results showed exceedences of the criteria for both gauges. Generally the DDG results from the west location are higher than those from the east location, most likely due to the west gauge being situated closer to industrial areas which are potential sources of dust emissions.

The NSW EPA Ambient Air Quality Research Project (2002) observed trends from four monitoring stations in the Illawarra region over five years for PAHs, heavy metals, and organic compounds. Winter months are more conducive to higher PAH pollutant levels. This is due to less mixing in the atmosphere, due to stronger and more frequent temperature inversions, resulting in pollutants being trapped in a shallow layer at the ground, as well as increased use of solid fuel heaters for home heating. Levels of heavy metal pollutants, of which copper, lead, manganese, nickel, vanadium and zinc accounted for 95% of the total metal concentration, were well below recognised international standards and ambient air quality goals. The project concluded that Wollongong CBD had good air quality with respect to organic and heavy metal air toxic levels.

Based on the available information on ambient air quality, one major concern was identified as to the existing air quality in and around the assessment area. Exceedences of the air quality criteria and goals were presented in the DECCW quarterly monitoring particulate matter results for both PM_{10} and $PM_{2.5}$. As the PM2.5 criteria is advisory this assessment will only focus on the PM_{10} results. There may be some health effects associated with this pollutant at exceedence levels. Particles smaller than 10µm have the potential to enter the human respiratory system and penetrate deeply into the lungs, causing adverse effects.

More detailed ambient air quality information is presented in Section 4 of Appendix K.

22.5.4 Meteorology

Wind

In general, offshore winds from the south west dominate in the morning and onshore winds (predominantly from the north east) dominate in the afternoon. Winds are highest during daylight hours with a peak average speed occurring around 1pm to 3pm and pollution would be dispersed by winds more effectively in the daytime than at night. The wind speed frequency distribution by wind speed category data shows that there is a relatively even spread of wind speeds between 0.5 and 6 m/s, with very little winds less than 0.5 or greater than 8 m/s. No winds were recorded for wind speeds greater than 10 m/s.

Stability Classes

As a general rule, unstable (or convective) conditions dominate during the daytime and stable flows are dominant at night. This diurnal pattern is most pronounced when there is relatively little cloud cover and light to moderate winds. The frequency distribution of estimated stability classes in the Wollongong meteorological shows a total of 50% of hours were either A, B or C class under the Pasqual-Gifford scheme where A is unstable thorough to F which is stable. Impact Assessment

22.5.5 Potential Sources of Air Pollution

Potential sources of air pollution that may occur as part of the construction activities associated with the Outer Harbour development and the operational use of the multi-purpose and container terminals could result from:

- General construction – Construction activities such as dredging, reclamation, construction of new access roads and rail upgrades, provision of service infrastructure and development of terminal facilities have the potential to impact on air quality. Earthworks, movement of vehicles over unsealed roads and uncapped reclamation areas could result in increased dust generation. Increased vehicle pollution (oxides of nitrogen, carbon monoxide and particulates) could result from the use of dredging equipment, bulldozers, haul trucks, trains delivering fill and increased private vehicles of workers.
- Dredge spoil – During the construction phase of the development spoil would be dredged from the bottom of selected areas of the harbour and used to fill those areas of the harbour that are to be reclaimed for the development. The dredging process would ensure that dredged sediments remain wet at all times and will be placed below water in the harbour immediately after dredging. As such, this activity is not expected to be a source of odour from the site.
- Increased vehicle emissions – The construction activities associated with reclamation (including material haulage to the site) and dredging, as well as the construction and operation of the terminals would see an increase in vehicle traffic (particularly truck based transport) to the area leading to a potential increase in pollutants from fossil fuel combustion.
- Ship loading and mooring – One of the primary uses of the reclaimed and developed land would be for the loading and unloading of bulk materials and general cargo to and from ships, including the transfer of material from trains and trucks. The transfer of such materials is a potential source of dust emission into the atmosphere. As well there is the contribution from windblown dusts from stockpiles or unclean areas. Auxiliary engines and boilers used during ship mooring are potential contributors to the local air quality. The engines and boilers from ships emit a number of pollutants including oxides of nitrogen, carbon monoxide, particulate matter (dust), and sulphur dioxide.

22.5.6 Concept Plan

Construction

Potential increases in pollutant levels resulting from construction activities, including dust, vehicle emissions and odours throughout the three stages of development of the Concept Plan would be short term and localised, and is not expected to have long term adverse impacts on the surrounding area. In addition, current areas of unsealed land that are prone to windblown dust impacts would be sealed for uses such as dry bulk and container storage, decreasing the potential emission of dust from these particular areas.

The vehicle emission increases during the construction of each of the three stages would have the potential to create short term pollution impacts from emissions such as particulates, NO_x and carbon monoxide but is not expected to have long term adverse impacts on the surrounding area.

Operation

The increase in vehicle and ship emissions due to the operational phase of the Concept Plan has the potential to contribute to existing and long term pollutant levels in the surrounding area. However, the modelling results showed that with the exception of 24 hour average PM_{10} and 1 hour NO_2, all modelled pollutants met the DECCW criteria at the discrete sensitive receptors (refer to Section 6.2 of Appendix K).

The predicted PM_{10} ground level concentrations (GLCs) show that with the operation of the Concept Plan development there are likely to be additional exceedences in addition to the number of exceedences that already occur in the Wollongong air shed. There was one exceedence of the PM_{10} annual average criteria predicted for the cumulative results (none for the isolated results) (refer to Table 21 in Appendix K). Existing ambient concentrations of 24 hour PM_{10} already exceed assessment criteria and the DECCW Approved Methods (DEC, 2005) states that where existing ambient air pollutant concentrations exceed impact assessment criteria "a licensee must demonstrate that no additional exceedences of the impact assessment criteria will occur as a result of the proposed activity". Concept Plan operations would therefore be expected to cause short term localised increases in fine particulates, as a result of combustion processes associated with motor vehicles, and is not expected to have long term adverse impacts on the surrounding area.

The modelling predicted that the NO_2 1 hour criteria would be exceeded at one of the sensitive receptor locations as a result of Concept Plan operation when considered cumulatively with background NO_2 concentrations and in isolation. The NEPM for Ambient Air Quality (EPHC, 2003) provides the goal for the maximum allowable days of exceedence for NO_2 as one day per year. For the receptor where there is predicted to be an exceedence of the criteria (refer to Table 17 of Appendix K), there is only twenty-one hours out of the year where the concentration exceeds the limit, which is less than the allowable 24 hours (one day as listed in the NEPM). On this basis the long term impacts are not expected to be adverse.

The Concept Plan modelling scenario is considered a worst case assessment of the typical operational emissions and is likely to be a conservative estimate of likely impacts. It is assumed in the modelling that all of the Concept Plan operations would be simultaneously active 24 hours a day for 365 days of the year (refer to Section 6 of Appendix K). Activities such as train, truck and ship movements are likely to be of an intermittent nature, and together with equipment 'down-time' caused by maintenance, shift breaks, public holidays etc, it is considered unlikely that all construction activities would occur simultaneously during the worst case meteorological conditions required to cause the modelled maximum predicted GLCs. The predicted maximum GLCs are therefore considered conservative and the likely impact the Concept Plan would have on the local community is expected to be less than that predicted in the modelling.

22.5.7 Major Project

Construction

In general PM_{10} is generated by natural events such as bush fires and dust storms as well as by diesel and petrol motor vehicles and other combustion processes that burn fossil fuels, such as power generation, industrial processes and domestic solid fuel heaters. The development associated with the Major Project (Stage 1 of the Concept Plan) would increase vehicle use and hence has the potential to contribute to the PM_{10} ambient levels in the region.

Onshore afternoon winds may have some effect on pollutant transport by transporting pollutants from the development towards inland areas. Wind speeds are highest during daylight hours, therefore pollution would be dispersed by winds more effectively in the daytime than at night. This may lead to higher near field pollution concentrations during the night if 24 hour operating activities are assumed.

Consistent with the expected occurrence of moderately unstable conditions at coastal locations, stability classes for Wollongong were A,B, or C for 50% of hours. This would likely result in greater atmospheric mixing and dilution of pollutants in the region.

The modelling results show that with the exception of PM_{10} (24 hour average) and NO_2 (1 hour average) time periods, all selected pollutants met the DECCW criteria at the modelled discrete sensitive receptors (refer to Tables 16 and 17 in Appendix K).

The predicted PM_{10} GLCs show that there are likely to be additional exceedences in addition to the number of exceedences that already occur in the Wollongong air shed. There was one predicted exceedence of the PM_{10} annual average criteria of the modelled receptors (refer to Table 16 in Appendix K).

The modelling predicted that the NO_2 1 hour criteria would be exceeded at one of the sensitive receptor locations as a result of construction during Stage 1 when considered cumulatively with background NO_2 concentrations. The NEPM for Ambient Air Quality (Commonwealth, 2003) provides the goal for the maximum allowable days of exceedence for NO_2 as one day per year. For the receptor where there is predicted to be an exceedence of the criteria (refer to Table 17 of Appendix K), there is only three hours out of the year where the concentration exceeds the limit, which is less than the allowable 24 hours (one day as listed in the NEPM).
The modelling results suggest that the Major Project construction has the potential to increase short term (24 hour average) PM_{10} emissions from construction stockpiles and an increase in trains and trucks during construction. These operations would be expected to cause short term, localised increases in particulate matter and not expected to have long term adverse impacts on the surrounding area.

Operation

Operation of the central portion of the multi-purpose terminals, including ship loading, truck/train filling and hauling and bulk materials stockpiling for the Major Project, has the potential to increase pollutant emissions and therefore air quality. The modelling undertaken showed that with the exception of PM_{10}, all modelled pollutants met the DECCW criteria at the discrete sensitive receptors (refer to Tables 18 and 19 of Appendix K).

The predicted PM_{10} GLCs show that there are likely to be additional exceedences in addition to the number of exceedences that already occur in the Wollongong air shed. There were no exceedences of the PM_{10} annual average assessment criteria. Major Project operations would be expected to cause short term localised increases in fine particulates but is not expected to have long term adverse impacts on the surrounding area.

The Major Project modelling scenario is considered a worst case assessment and is likely to result in conservative estimate of likely impacts. It is assumed in the modelling that the all of the Major Project operation activities would be simultaneously active 24 hours a day for 365 days of the year. The predicted maximum GLCs are therefore considered conservative and the likely impact of the Major Project application on the local community is expected to be less than that predicted in the modelling.

22.6 Mitigation Measures

22.6.1 Concept Plan

Construction

Construction activities undertaken throughout the three stages of the Concept Plan would cause short term, localised increases in pollutants and are not expected to have long term adverse impacts on the surrounding area.

Monitoring of ambient air quality would be undertaken during the Concept Plan construction works and appropriate air quality management plans (AQMP) would be prepared and integrated into each CEMP prepared for the staged works.

As part of the Concept Plan, areas of currently unsealed land that are prone to windblown dust impacts would be sealed for uses such as dry bulk and container storage, decreasing the potential emission of dust from these particular areas.

In addition to undertaking construction activities in accordance with best practice, dust mitigation measures that would be implemented during construction include:

- Trucks carrying spoil, sand and/or other loose materials would be covered to avoid generating wind-blown dust.
- Wetting down or use of surfactant on stockpiles (where practicable).
- Wetting down of site surfaces, especially during dry weather, including excavation sites, haul roads, spoil stockpiles and other exposed areas.
- Vehicular access would be confined to designated access roads.
- Instantaneous dust monitoring at the boundary. The location of an instantaneous dust monitor (such as a TEOM) at the boundary of the site most affected by dust impacts can alert site personnel when elevated dust levels occur.

The vehicle emission increases during the construction phase would have the potential to create short term pollution impacts such as localised increases in particulates but is not expected to have long term adverse

impacts on the surrounding area. Mitigation measures would be implemented to minimise the impact of vehicle emissions during construction, including:

- Construction equipment, plant and machinery be regularly tuned, modified or maintained to minimise visible smoke emissions.
- Construction vehicles only left idling when required for construction works.
- Construction site speed limits be implemented.

Operation

The modelling results for the Concept Plan suggest that operations have the potential to increase short term (24 hour average) PM_{10} emissions from material stockpiles and an increase in trains, trucks and ships. Long term PM_{10} predictions (annual average) were predicted to slightly exceed the assessment criteria at one receptor only. Operations would be expected to cause short term localised increases in fine particulates (increased number of PM_{10} exceedences) (refer **Figure 22-1**).

The impacts of the operation phase can be limited by implementing site specific 'best practice' dust mitigation measures which would be incorporated into the AQMPs for each stage. Mitigation measures would include the following:

- Sealing roads and areas susceptible to windblown dust impacts.
- Vehicles carrying loose materials would be covered to avoid generating wind-blown dust.
- Wetting down and/or using surfactants on site surfaces, especially during dry weather, including haul roads, material stockpiles and other exposed areas.
- Instantaneous dust monitoring at the boundary of the site most affected by dust impacts can alert site personnel when elevated dust levels occur.
- Stabilising of reclaimed surface areas set aside for future terminal development.

Further analysis and atmospheric dispersion modelling will be undertaken for Stages 2 and 3 of Concept Plan. The reporting of this modelling would be included in separate project applications for Stage 2 and 3 of the Concept Plan.

Figure 22-1: Concept Plan – Operation – Predicted PM_{10} 24 Hour Average GLC in Isolation from Background

22.6.2 Major Project

Construction

The construction of the first multi-purpose berth, new road corridor, reclamation and dredging has the potential to increase particulate emissions through earthworks or through the increase in vehicles use during construction. Construction activities for the Major Project would be expected to only cause short term, localised increases in pollutants and is not expected to have long term adverse impacts on the surrounding area. Due to the conservativeness of the modelling approach it is expected that the actual NO_x impacts of the development would be less than that predicted by the modelling.

Notwithstanding the conservative nature of the modelling, monitoring of ambient NO_x levels would be undertaken during the Major Project construction works and an appropriate air quality mitigation plan (AQMP) would be prepared and integrated into the CEMP.

The modelling results suggest that the Major Project has the potential to increase short term (24 hour average) PM_{10} emissions from construction stockpiles and the increase in trains. The impacts of the construction phase can be limited by implementing site specific 'best practice' dust mitigation measures which would be incorporated into the AQMP. Mitigation measures would include the following:

- Transport loads and materials would be covered to avoid generating wind-blown dust.
- Site surfaces would be wetted down, especially during dry weather, including excavation sites, haul roads, spoil stockpiles and other exposed areas.
- Vehicular access would be confined to designated access roads.
- Instantaneous dust monitoring would be undertaken at the site boundary. The location of an instantaneous dust monitor (such as a TEOM) at the boundary of the site most affected by dust impacts would alert site personnel when elevated dust levels occur.

During construction, increased vehicle emissions would create short term pollution impacts such as localised increases in particulates but is not expected to have long term adverse impacts on the surrounding area. Mitigation measures would be implemented to minimise the impact of vehicle emissions during construction, including:

- Construction equipment, plant and machinery regularly tuned, modified or maintained to minimise visible smoke emissions.
- Construction vehicles only left idling when required for construction works.
- Construction site speed limits implemented.

The dredge spoil managed during the Major Project was highlighted as a potential source of odour from the site. Dredging operations have been designed so that the spoil would remain wet at all times and would be placed below water into the reclamation area. The spoil would not be stockpiled on land and hence is therefore not expected to be a source of odour from the site.

Operation

The operation of the central portion of the multi-purpose terminal has the potential to increase particulate emissions through the increase in ship and vehicle emissions and other combustion processes that burn fossil fuels, from material stockpiles areas or direct release of pollutants from future port related activities.

The modelling results for the Major Project suggest that the operation has the potential to increase short term (24 hour average) PM_{10} emissions from material stockpiles and an increase in trains, trucks and ships. Long term PM_{10} predictions (annual average) were predicted to meet the criteria. Operations would be expected to cause short term localised increases in fine particulates only (increased number of PM_{10} exceedences) (refer **Figure 22-2**).

The impacts of the operation phase would be limited by implementing site specific 'best practice' dust mitigation measures which would be incorporated into the OEMP for Stage 1. Mitigation measures would include the following:

- Sealing roads and areas susceptible to windblown dust impacts.
- Vehicles carrying loose materials would be covered to avoid generating wind-blown dust.
- Wetting down and/or using surfactants on site surfaces, especially during dry weather, including haul roads, material stockpiles and other exposed areas.

- Instantaneous dust monitoring at the boundary of the site most affected by dust impacts can alert site personnel when elevated dust levels occur.
- Stabilising of reclaimed surface areas set aside for future terminal development.

Figure 22-2: Major Project – Operation – Predicted PM_{10} 24 Hour Average GLC in Isolation from Background

22.6.3 Other potential mitigation measures

Whilst direct mitigation measures (primarily relating to particulates) have been identified for Stage 1 and the total development, additional measures are available to minimise the emission of other pollutants such as SO_2 and NO_X. The following measures would aid in the reduction of combustion related emissions over time:

- Fuel and vehicle emission standards have and will continue to improve, leading to lower SOx, NOx and particulate emissions. In 2008 the Marine Environment Protection Committee (MEPC) of the International Maritime Organization (IMO) unanimously adopted amendments to the MARPOL Annex VI regulations to reduce harmful emissions from ships. (see http://www.imo.org/ environment/mainframe.asp?topic_id=233 for details). Some of the main changes include:
  - Progressive reductions in SO_x emissions from ships, with the global sulphur cap reduced initially to 3.50% (from the current 4.50%), effective from 1 January 2012; then progressively to 0.50 %, effective from 1 January 2020.
  - Progressive reductions in NO_x emissions from marine engines.
- A Fuel Standards Consultative Committee was established under the Fuel Quality Standards Act 2000 as a formal consultation mechanism to promote uniformity in Australian fuel standards, to facilitate investment in new fuels and technology, and to be a champion for new fuel standards. From an historical perspective, fuel standards have been modified a number of times since the Fuel Quality Standards Act 2000 came into force in 2002 with the introduction of uniform fuel standards. An example of action taken on fuel standards since their inception in 2002 can be noted in the committee's action in reducing the national standard for sulphur content in diesel. The allowable content in 2002 was set at a maximum of 500ppm, which was reduced to 50ppm in 2006 and further reduced to 10ppm in 2009. There has been no further action proposed as of the date of this report for fuel standards but given the historical trends toward further tightening of standards further improvements in fuel quality could be expected (although the scope and nature of these changes cannot be predicted at this stage).
- Berth design would include allowance for alternative marine power (AMP) for vessels (also known as cold-ironing) while at berth. The success of AMP would depend upon suitable international standards being adopted for the supply of shore-based electricity to ships and a "critical mass" of vessels to be equipped so as to receive shore power. The adoption of alternative marine power would effectively remove emissions from ship boilers whilst at berth, eliminating a significant source of NO_X and particulate emissions.
- Possible adoption of programs such as the "Green Award" to offer incentives for less polluting vessels to call at Port Kembla. A Green Award ship meets high, but manageable technical and managerial requirements and confirms the high quality of the vessel. Crude oil tankers, product tankers and bulk carriers with a minimum deadweight of 20,000 ton may apply for inspection and certification.

22.7 Summary

The assessment of the Concept Plan and Major Project has identified short term localised particulate and NO_2 impacts from construction and operational activities. There are no other significant regional exceedences of relevant air quality guidelines. There are no specific impacts shown from the meteorological data analyses that would adversely affect air pollution in the area immediately surrounding the development.

Concept Plan

Construction activities would cause short term, localised increases in pollutants and is not expected to have long term adverse impacts on the surrounding area. Monitoring of ambient air quality would be undertaken during the Concept Plan construction works and appropriate AQMPs would be prepared and integrated into the CEMP.

The modelling results for the Concept Plan operations suggest that the short term NO_2, and PM_{10} concentrations may exceed the DECCW criteria at some discrete receptors. NO_2 concentrations are not expected to exceed the assessment criteria for a significant proportion of the year and are considered acceptable for the project.

Dust impacts of the operation phase can be limited by implementing site specific 'best practice' dust mitigation measures which would be incorporated into the AQMP for the site.

Major Project

The modelling results for the Major Project construction suggest that the short term NO_2, and PM_{10} ground level concentrations may exceed the DECCW criteria at discrete receptors close to the development boundary. NO_2 concentrations are not expected to exceed the assessment criteria for a significant proportion of the year and are considered acceptable for the construction period of the project.

The modelling results for Major Project operations suggest that only short term PM_{10} concentrations are likely to exceed the DECCW criteria at some discrete receptors.

Dust impacts of the construction and operation phases would be limited by implementing site specific 'best practice' dust mitigation measures which would be incorporated into respective AQMPs for each package of works.

23.0 Landscape and Visual Amenity

23.1 Introduction

A landscape and visual impact assessment has been undertaken to identify the potential visual impact associated with the proposed Outer Harbour development. The assessment comprised a qualitative review to establish the landscape character and existing visual context in the vicinity of a range of viewing locations of the Outer Harbour. A review of designated scenic areas and representative viewing locations in the immediate, local and regional area has been conducted to establish the sensitivity of the visual resource and zone of visual influence.

The assessment has considered potential visual impacts associated with future development activities on the local and regional character and quality of existing landscape units and on views to and from the Port during the land reclamation, dredging, and other general construction activities.

A series of photographs have been taken from representative view locations in the immediate, local and regional areas to the north, west and south of the Port to illustrate the likely visual impact associated with the progressive development of the Concept Plan and Major Project.

A copy of the full Landscape and Visual Assessment report is included as **Appendix L** of this EA.

23.2 Existing Environment

The visual envelope of the Port of Port Kembla is typical of an active port. The proposed Outer Harbour development is located in the south eastern part of the Port.

The landscape character of the Outer Harbour is predominantly industrial and commercial. Visual features of this landscape unit include built up areas comprising commercial and industrial premises that range in size, building style and features. Heavy industry, such as BlueScope Steel steelworks, dominates the vista and beyond are the developments in the Inner Harbour, including GrainCorp grain silos and coal terminal.

The Outer Harbour is also characterised by existing infrastructure typical of an active port precinct, including the eastern and northern breakwaters and three jetties. In the surrounding area, the 198m tall smoke stack at the former copper smelter and refinery site in Port Kembla, owned by Port Kembla Copper Pty Ltd, can be seen from many regional viewpoints. The smoke stack is currently the subject of an impact assessment under Part 3A of the *EP&A Act* 1979 and, if approval is granted, the stack would be demolished sometime in 2010 (Port Kembla Copper, 2009).

The hard structures and heavy industrial character of the Outer Harbour is juxtaposed with a relatively natural landscape comprising a large expanse of open water within and outside the Outer Harbour, the strip of sandy beach and riparian vegetation associated with Red Beach and Salty Creek. The heavy industrial character of the wider precinct area is also in contrast to the Illawarra Escarpment which provides a natural backdrop to the port area to the west and north-west.

The location of the Outer Harbour makes it visible to many users of coastal areas to the north and south of the Port, including the Wollongong beaches and elevated lookouts at Mt Kiera, Mt Bulli and Hill 60.

23.3 Assessment Criteria

The visual assessment has been based on consideration of the visibility of the proposed development and the capacity of the existing landscape to absorb the new infrastructure. These two assessment criteria have been described in more detail below:

23.3.1 Visibility

Visibility is a measure of the extent that a proposed development is visible in surrounding areas. In considering the visibility of a proposed development a range of factors including the number of viewers, the length of viewing time, and the viewing distance are taken into account.

For the purposes of this assessment viewing distance has been divided into three categories:

- Immediate vicinity (within 1km).
- Local area (between 1km and 4km).
- Regional area (greater than 4km).

Length of view has been divided into three categories:

- Short (a few seconds).
- Moderate (a few minutes up to an hour).
- Long (longer than an hour).

23.3.2 Visual Absorption Capacity

Visual absorption capacity is the ability and extent to which an existing landscape is able to absorb a new development without creating a major change in the general visual envelope. With regard to the proposed development, the capacity of the existing Port related infrastructure and associated industry, such as BlueScope Steel steelworks, to absorb additional port infrastructure is high. For the purposes of this study, the capacity of a landscape to absorb new development has been divided into three categories:

- Low.
- Moderate.
- High.

By comparing the visibility and absorption capacity of a view it is possible to determine a level of visual impact as defined in **Table 23-1**.

Table 23-1: Level of Visual Impact

Level of Visual Impact			
	Visibility		
Visual absorption capacity	***Low***	***Moderate***	***High***
High	Low	Low-Moderate	Moderate
Moderate	Low	Moderate	High
Low	Low	Moderate	High

23.3.3 Viewing Locations

Impacts on the landscape character and visual setting surrounding the Outer Harbour are outlined in each of the view locations considered as part of the visual assessment in **Appendix L**. View locations from popular local and tourist locations, including lookouts and coastal areas, as well as view locations from neighbouring residential areas have been considered. Publicly accessible views have been included only and no views have been considered from within privately owned premises.

Each of the viewing locations has been assessed through consideration of the location of the view, likely type of viewers, context of the view, likely number of viewers, distance of view from proposed development, likely length of view, extent that the proposed development is visible from the view, and the capacity of the surrounding area to absorb the proposed development.

Each of the viewing locations considered as part of the visual assessment in **Appendix L** are presented in **Figure 23-1** and include:

Immediate Vicinity:

1. Outer Harbour lookout.
2. Gloucester Boulevard, Port Kembla.
3. Gallipoli Street, Port Kembla.

Local Area:

4. Hill 60 Park.
5. Blaxland Avenue and Flagstaff Road intersection.
6. Panorama Estate, Lake Heights.
7. Wollongong Golf Course.

Regional Area:

8. Sublime Point Lookout.
9. Bulli Lookout.
10. Bulli Pass.
11. Bulli Beach.
12. Bellambi Pool.
13. Corrimal Beach.
14. Wollongong North.
15. Lions Park, Wollongong.
16. Mt Keira.

Figure 23-1: Locations of Viewpoints Considered for Visual Impact Assessment

23.4 Visual Impact Assessment

A broad account of visual impacts associated with both construction and operation phases of Concept Plan and Major Project together with a summary of visual impacts based on viewing location.

23.4.1 Concept Plan

Construction

The proposed Concept Plan would be constructed wholly within the existing Outer Harbour area. During construction there would be temporary visual impacts relating to the introduction of plant and equipment such as dredging and earthmoving equipment. There would also be visual impacts associated with the construction of terminals and berths, new road and rail infrastructure, construction lighting, stockpiling, and areas of newly reclaimed surface. The existing heavy industrial activity within the port area would assist with absorbing the potential impact associated with the dredging, reclamation and general construction activities to be undertaken as part of the Concept Plan development.

Reclamation and dredging activities, creation of hardstand areas and infrastructure to support port operations would be progressively developed as part of the Concept Plan. Delivery of the Concept Plan would be largely driven by market trade demand and progressively completed in a number of sequential stages, and would be subject to separate project approvals and further detailed assessments prior to operation.

Operation

Activity and infrastructure associated with the operation of the new container terminals and multi-purpose terminals, berths and new rail and road infrastructure will have visual impacts on the landscape. The main visual impacts would result from increased port infrastructure such as cranes, forklifts and trucks; increased area of hardstand resulting from land reclamation; increased shipping and rail movements into and out of the harbour; and increased terminal lighting. An artist's impression of the operational Concept Plan is illustrated below (**Figure 23-2**) as context for the Visual Assessment.

Figure 23-2: Concept Plan - Artist's Impression (as illustrated in Section 5)

The staged development of the terminals, berths, port infrastructure and road and rail infrastructure will mean that operational visual impacts will occur progressively during the extended timeframe of the Concept Plan. These impacts will be permanent however they will occur within the context of the existing heavy industry, port infrastructure and port activities in the Outer Harbour.

23.4.2 Major Project

Construction

A multi-purpose terminal, constructed on reclaimed land surface comprising compacted gravel or similar compactable material, would be constructed and operational as part of the Major Project (Stage 1). Another non-operational berth on the future western container facility would also be constructed. Dredging and reclamation to facilitate the construction of further multi-purpose and container facilities would be undertaken as well as the construction of road, rail and services infrastructure to support the operating multi-purpose terminal and construction access to the container terminal.

Visual impacts during construction would include temporary impacts associated with:

- General construction activities, site compound, construction lighting, stockpiles, construction machinery and plant.
- Dredging machinery and activities in the centre and east of the Outer Harbour.
- Increased land area as a result of land reclamation for the multi-purpose terminals and future container terminals.
- Construction works for the multi-purpose terminal and berth and container berth; and
- Works associated with the upgrade of rail infrastructure in the South Yard.

Operation

The central portion of the multi-purpose terminal would be operational as part of Major Project, including the first multi-purpose berth. Visual impacts would include a hardstand area of approximately nine hectares, terminal lighting, and an increased number of ships and shipping movements. A range of plant and equipment, including cranes, forklifts, trucks, warehouse sheds and conveyor belts would be required for the operation of the multi-purpose terminal and movement of bulk material. The Port Kembla Gateway Jetty would remain operational during reclamation and dredging activities associated with the Major Project.

23.4.3 A summary of visual impacts based on viewing location

Immediate Area

Viewers located in an area adjacent to the Outer Harbour. This is because there is a general lack of foreground screening. However, viewers in the area immediately adjacent to the development would likely experience a low visual impact due to the potential screening of the proposed development by adjacent existing commercial and industrial buildings and structures.

Local Area

Views from residential areas to the south and west of the Outer Harbour, which is relatively undulating, would likely comprise glimpses of cranes and ships during the operational phases of Concept Plan and Major Project which would be viewed in the context of existing port and industrial development in the foreground and/or background. The low lying topography of the Wollongong Golf Course to the north would effectively limit the golf players' view of activities associated with the development.

Regional Area

The visual impact of the Concept Plan and Major Project would be low to moderate when viewed from the regional area depending on the location of the view. With the exception of Lions Park, Wollongong and Mt Kiera, most views of the Outer Harbour are effectively screened behind headlands or are of sufficient distance that the features of the proposed development would be indistinguishable from the surrounding landscape. The most prominent features of the Port area from the regional viewing locations are the Port Kembla Copper smoke stack, BlueScope Steel steelworks and GrainCorp grain silos.

23.5 Mitigation Measures

Key activities that would be undertaken for construction of the Concept Plan, such as dredging, reclamation, road construction, and rail infrastructure upgrades, are continual throughout the three stages of development. Similarly, the operational activities that would be undertaken in each stage of the Concept Plan, such as operation of berths, truck and train movements, stockpiling of dry bulk and containers, would be similar throughout each of the stages. Accordingly, the visual impacts associated with the construction and operation phases of the development are considered to be similar throughout each stage.

In light of this, the measures and controls proposed to mitigate potential visual impacts on the immediate, local and regional landscape for both Stage 1 (Major Project) and all stages of development (Concept Plan) have been presented together, as follows:

Construction

- Lighting used for evening and night time work should be projected downward and toward the work area to minimise light spill into surrounding areas.
- Construction areas would be designated and clearly defined to minimise disruption to the community and workers in the Outer Harbour area.
- Construction methodology should be designed to ensure efficiency of works and minimise the area and period of disturbance.
- Construction areas and plant/machinery and materials storage areas should be clearly delineated to ensure visual amenity of the site is maintained.

Operation

- Lighting for terminals and other operational areas, including the new road link, would be carefully selected to minimise light spill on surrounding areas outside the site boundaries and minimise visual impact when viewed from adjacent premises.
- Preparation of a Landscape Management Plan to guide any landscaping works proposed across the site.
- Suitable colours and materials would be selected for the buildings and other structures to minimise reflectivity and contrast.

23.6 Summary

During development of the Concept Plan, visual impacts on the immediate, local and regional landscape during construction phases would result from dredging and reclamation activities, construction of new road links, upgrade of existing rail infrastructure, and general construction activities including stockpiling and plant and equipment storage areas.

Once the Concept Plan is operational, visual impacts would include an additional 42 hectares of hard stand to accommodate multi-purpose terminals and container terminals, seven new berths, movement of plant and equipment, additional truck and train movements, container stacks and storage of dry bulk and bulk cargo. The additional Port activity would be located within an area dedicated to port and industrial activities and would be generally consistant with the surrounding environment.

Measures to mitigate visual impacts for the Concept Plan are also appropriate for Major Project (Stage 1) of the development.

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24.0 Heritage Assessment

24.1 Methodology

The overall aim of this assessment was to identify the Aboriginal and historic heritage values of the proposed area to be developed as part of Major Project and Concept Plan, identify potential impacts on those values and, if potential impacts are identified, provide suitable management recommendations to mitigate those impacts.

The DGRs do not specifically mention heritage, so a Preliminary Heritage Assessment was undertaken on a broad level to determine if heritage posed a constraint to the project. Following the assessment, a detailed Historic Heritage Assessment and Statement of Heritage Impact was also produced to outline the nature and effect of impacts on historic heritage items identified in the Preliminary Heritage Assessment.

The assessment of Aboriginal cultural heritage for the proposed development has been compiled in accordance with DECCW's *Guidelines for Aboriginal Cultural Heritage Impact Assessment and Community Consultation* (DEC, 2005) and the *Aboriginal Cultural Heritage Standards and Guidelines Kit* (NPWS, 1997).The European heritage component has been undertaken in compliance with various guidelines within the *Heritage Manual* (NSW Heritage Office,1997).

Detailed assessment methodology is outlined in the Preliminary Heritage Assessment in the Historic Heritage Assessment, prepared by AECOM and dated August 2009 and January 2010, respectively (refer **Appendix M**).

24.2 Existing Environment

The area of the Concept Plan is generally flat with little topographic relief. The lands along the north shore of Lake Illawarra are steeply undulating with a relief of up to 120 m at Flagstaff Hill to the west, becoming steadily lower towards Red Point. Lands in the Port Kembla township rise to 50 m.

Various creeks rising off the slopes of the Illawarra Escarpment around Mount Kembla, flow eastwards towards the coast with many converging into Allans Creek, and thence into Tom Thumbs Lagoon (Inner Harbour). The undulating lands along Lake Illawarra provide the guiding force for many small creeks that drain southwards into the lake or northwards towards Allans Creek. One creek system flows eastwards from around Cringila, flowing into Outer Harbour as a third-order creek (Salty Creek).

The study area lies completely within a soil landscape that has been extensively altered, disturbed or buried. Hazelton and Tille (1993) shows the study area as 'Disturbed terrain' soil landscape. This soil landscape occurs where soil disturbance has occurred to a depth of at least 100 cm.

The vegetation in the study area has been largely cleared for industrial purposes. A preliminary visual inspection indicated there were no mature trees suitable for Aboriginal scarred trees. The land has been used since the mid-19th century for industrial purposes and the land surface has been completely disturbed.

In its natural form, the bay is likely to have been used with relative intensity prior to European contact. Major land disturbance, however, has occurred over the majority of the study area, and the depth of disturbance is likely to have severely impacted and/or displaced evidence of Aboriginal occupation. The areas earmarked for dredging are unlikely to contain significant evidence of Aboriginal occupation due to the actions of the marine environment.

Port Kembla Outer Harbour began to take its current shape as early as the 1890s when the original Port Kembla jetty was approaching its limit of operating efficiency. The need for a deepwater port led to the construction of the two large breakwaters which form the Outer Harbour. The eastern breakwater was commenced in 1901 and completed in 1930. Work on the northern breakwater commenced in 1912 and was completed in 1925 (McDonald McPhee, 1991).

The Outer Harbour has accommodated a number of jetties over the years (some have now been demolished) to service the various developing industrial enterprises around the harbour and the broader Illawarra region. The jetties in the Outer Harbour were vital infrastructure for the transhipment of the Illawarra's natural resources to external markets and contributed to the development of lucrative industries in the region. Today there are four operational jetties in the Outer Harbour – the No.3 Jetty, the No. 4 Jetty (Berth 206), the No.6 Jetty (Port Kembla Gateway), and the liquid bulk Berth 201. With the exception of Berth 201, which is a modern structure, the jetties were constructed between 1908 and 1958 and represent the changing face of harbour operations within the Outer Harbour basin. The three historic jetties are no longer used for their initial purpose, with No. 3 Jetty used as a base for tug boat operations, No. 4 used for sulphuric acid imports and No. 6 used predominantly for the export of copper concentrate.

It is clear that the remaining existing facilities in the Outer Harbour are not suitable for future operations. The Outer Harbour needs redeveloping to facilitate flexibility in line with the change in demand for various cargoes and development of new cargo handling technologies.

None of the existing jetties are currently listed on the heritage schedules, and were not considered in the City of Wollongong Heritage Study (McDonald and McPhee *et. al.*, 1991). However, the Preliminary Heritage Assessment found that the jetties may have heritage significance and should be considered. The heritage significance of the three remaining jetties has now been established and a Statement of Heritage Impact prepared for each item.

24.3 Impact Assessment

24.3.1 Aboriginal Heritage

A search of the DECCW AHIMS database on Friday 13 February 2009 revealed that within a 5 x 5 km search area, centred on the mid-point of the study area, there are 18 known and registered Aboriginal sites predominantly located in the coastal strip between the eastern breakwater of Outer Harbour at MM Beach and Windang Park at Primbee. None of the registered Aboriginal sites are located within the footprint of the proposed Concept Plan.

The background searches undertaken uncovered no evidence that recorded or unrecorded Aboriginal sites would be impacted by the Concept Plan or Major Project (Stage 1). As such it is considered that no further Aboriginal heritage assessment is required for the study area prior to development of the Outer Harbour.

24.3.2 Historic Heritage

A total of 37 historic heritage items are listed in the Port Kembla area, the majority of which are not in the study area. However, an inspection was conducted to determine the exact location of each item, their landscape context and the chances of any direct or indirect (e.g. visual) impact the proposed development may have upon the heritage items.

The inspection identified seven heritage listed items that may potentially be impacted by the total development (refer **Table 24-1**). Of the seven heritage listed items, two are located within the proposed area of disturbance; three are located adjacent to the proposed area; and two shipwrecks (*Adele* and *Clio*) are listed as having been wrecked at Port Kembla, but their exact location is unknown.

There are also three remaining jetties in the Outer Harbour which will be impacted by the development. Although none of these jetties are heritage listed, they are considered to have some local level of heritage significance.

Table 24-1: Listed Heritage Items Within or in Close Proximity to the Proposed Development

Item No.	Item	Location	Register	Significance	Within Proposed Development Area?	Affected by Proposed Development?	Comment
9	Break Water Battery	Gloucester Boulevard, Port Kembla	WLEP, WHS	Local Criteria: a, c, e, g	No	Potential for indirect impact (visual)	Forms part of Precinct with Items 12 and 18. This item is listed for landmark, group and architectural values (aesthetic significance). Given its location in respect to the proposed development there is unlikely to be any detrimental visual impact.
11	Commonwealth Rolling Mills and Gardens	Old Port Road	WLEP, WHS	Local Criteria: c	No	Potential for indirect impact (visual)	Item listed for its architectural value only. Given its location in respect to the proposed development there is unlikely to be any detrimental visual impact.
12	Concrete Tank Barriers	Gloucester Boulevard, Port Kembla (northern end of beach)	WLEP, WHS	Local Criteria: a, c, e, g	No	Potential for indirect impact (visual)	Forms part of Precinct with Items 9 and 18. This item is listed for historical, group, technological and representative value. Given its location in respect to the proposed development there is unlikely to be any detrimental visual impact.
18	Historical Military Museum	Gloucester Boulevard, Port Kembla	WLEP, WHS	Local Criteria: c, e, g	Yes	Potential for direct impact by the proposed road construction work	Forms part of Precinct with Items 9 and 18. This item is listed for landmark and architectural values (aesthetic significance). The pill box is located adjacent to the Morgan's Cement Factory and may be affected by proposed road construction work.
21	Mobile Block Setting Steam Crane	Eastern Breakwater, Outer Harbour	WLEP, WHS	Local Criteria: a, e, f, g	Yes	Potential for direct impact by the proposed road construction work	This item is listed for its historic, technological and rarity values but not for its aesthetic values. It is likely to be impacted by the proposed road construction and may need to be relocated.
36	*Adele*	Port Kembla	NSD, MHD	National	No	Unlikely	Wrecked at Port Kembla 5/5/1943 exact location unknown, but is unlikely to be in the vicinity of the study area.
37	*Clio*	Port Kembla, northern breakwater	NSD, MHD	National	No	Unlikely	Ran aground off northern breakwater 15/11/1927; exact location unknown, but is unlikely to be in the vicinity of the study area.

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The following sections provide a brief description of each item that would potentially be affected by the Concept Plan and Major Project (Stage 1). A summary of the Statement of Significance and Heritage Impact is also provided for each item and the detailed significance assessment is presented in Section 6.0 of the Historic Heritage Assessment, **Appendix M**).

Break Water Battery, Tank Barriers and Historical Military Museum (Items 9, 12 and 18)

Three heritage-listed items situated in close proximity, and forming a remnant military precinct at the southern end of the eastern breakwater, are approximately 100m distance from an existing public carpark and boat ramp. These items are:

- Breakwater Battery (Item 9), which consists of two gun emplacements, formerly housing 6" ex-Naval guns, with related underground facilities. It is significant as evidence of coastal defence, especially during World War II.
- Concrete Tank Barriers (Item 12), which consists of a group of 900 – 1200 mm high concrete tetrahedron barriers that were originally located at Berkeley Harbour.
- Historical Military Museum (Item 18), which consists of a four storey brick and concrete structure, a gun pill box and an air raid shelter.

The Breakwater Battery, Concrete Tank Barriers and Historical Military Museum are located within the military heritage precinct to the south east of the proposed development. The only listed item impacted from activities associated with the Concept Plan would be the Historical Military Museum. Potential impact would result from the construction of an access road from Darcy Road to the car park at the end of Foreshore Road.

The Breakwater Battery is of local historic significance in the Wollongong area as a site of coastal defence during World War II. The Battery has local technical significance as it gives a general understanding of the spatial layout of a coastal fortification of the Second World War when viewed in conjunction with the items in the Historical Military museum. It is a representative example at the local level of a Second World War era coastal defence installation.

The concrete tank barriers are located at the end of Gloucester Boulevard and were originally placed on beaches at Berkeley Harbour to prevent tank movement. They are locally historic heritage items but are not located in their original context as they were relocated from Berkeley Harbour, in Lake Illawarra. Moreover the barriers are not located in an area demonstrative of their original use, as they are located behind a rocky foreshore which would have been avoided in preference for easier landing sites nearby.

The Historical Military Museum consists of a four storey brick and concrete structure, a gun pill box and air raid shelter. The museum structure initially served as a lookout post for the battery during the Second World War. A brick and concrete pillbox is associated with the museum and is located approximately 80 m to the south west of the museum building. The pillbox itself is in poor condition, and exhibits significant cracking and some signs of partial collapse, especially near the lookout windows on the northern side of the structure. Substantial reconstruction with modern fabric has occurred within the pillbox structure as well as around the pillbox.

A new access road connecting Darcy Road to the Outer Harbour is proposed as part of the Concept Plan in order to facilitate greater port security while still maintaining public access to the Boat Harbour, Eastern Breakwater as well as the Port Kembla Heritage Park, of which these heritage items are a part. The new road would have minimal impact on the Breakwater Battery and Tank Barriers as it is on the opposite side of a hill, and therefore views and curtilage of the heritage sites would not be affected. The most important aspects of the Breakwater Battery and Historical Military Museum are their views out to sea, as this is the prime need of a coastal defence installation, and the relationship these items share (the Historical Military Museum is the former battery control building). Both of these relationships would be maintained as part of the Concept Plan.

Overall, the new road proposed as part of the Concept Plan, extending between Darcy Road and the boat harbour car park, has minimal impact on the heritage items. The new road would be located in a cutting which removes it from view from the battery and tank barriers and which will still allow for continued access to the site. Views out to sea would not be affected. The new road construction is likely to impact the setting of the Historical Military Museum and associated pill box and air raid shelter, as it would bisect these heritage items. However the heritage significance of the pillbox is already affected by intrusive reconstruction using modern materials.

Extensive modern development, such as the new PKPC offices and car park, already surrounds all the historic items and the new road would not have any greater impact than the existing development. An opportunity exists as part of the detailed planning for construction of the new port access road to take steps to mitigate the heritage impact to the Historical Military Museum site. Specifically the road should be designed to produce the most limited intrusion possible to accessibility between the concrete pillbox and the museum structure. Landscaping should be considered to ensure that the visual impact from the pillbox to the museum is minimised.

Mobile Block Setting Steam Crane (Item 21)

The mobile block setting steam crane, located on disused rail tracks that once connected Darcy Road with the breakwater, is locally significant as a tangible link with construction and earlier phases of maintenance of the Outer Harbour Eastern Breakwater. The crane and associated items are rare at a state level as they are believed to be the only remaining type of a class of cranes in operation around NSW and throughout Australia. It is a representative example of a mid-sized mobile steam crane, and is a class of machinery which was widespread throughout the state at this time. The item is of state significance for its rare and representative qualities.

The item is likely to be affected by the proposed road construction as part of the Concept Plan which will link Darcy Road with the boat harbour carpark. The new road may require this heritage item to be relocated, but the crane is a moveable heritage item and its significance would not be impacted as long as it is retained and interpreted near to its present site and alignment, which is in keeping with its historical use.

Shipwrecks HMAS Adele (Item 36) and Ketch Clio (Item 37)

The 288 ton screw steamer *Adele*, built 1906 at Leith in the United Kingdom by Hawthorn & Co., was wrecked at Port Kembla on 7 May 1943 on the Northern breakwater. The wreck is protected under the NSW *Heritage Act 1977* and it is significant as a wreck over 50 years old. The exact location of the wreck is not known, however Hoogendorn (1999: 94) places the wreck somewhere on the breakwater. As the breakwater is dynamic and constantly shifting, the integrity of the shipwreck is likely to have been severely compromised.

The wooden ketch *Clio* ran aground off the northern breakwater at the Outer Harbour on 15 November 1927, whilst carrying a cargo of shell grit. The wreck is protected under the Commonwealth *Historic Shipwreck Act 1976,* it is significant as a wreck over 75 years old. The exact location of the wreck is not known but it is considered unlikely to be located within the Outer Harbour basin. The wreck is listed on Maritime Heritage Online as being off the northern breakwater, therefore outside the Outer Harbour and not affected by the Concept Plan.

It is considered that the likelihood of encountering either the *Adele* or the *Clio* within the Outer Harbour basin is extremely low. From the early 1980s until early 90s Port Kembla Port Corporation had surveyors on staff, with bathymetry surveys undertaken on a six monthly basis for the main channels while 12 monthly surveys were conducted on berthing basins and other parts of the port. Since the early 1990s all bathymetry surveys were contracted out and port surveys were conducted on a 12 monthly basis which at times included side scan sonar which provides harbour bed object identification. Over the last four years multibeam/swath technology has been available which has provided total bottom coverage and side scan sonar which has covered 100 per cent of the port bed below mean high water. In addition to these technologies, ongoing dredging has taken place within the Outer Harbour under regular maintenance activities.

If there were any wrecks located within the Outer Harbour, they are likely to have been identified by this technology. No objects have been identified therefore it is likely that, given the amount of bathymetry coverage over the last 30 years, there are no ship wrecks within the port enclosure (Port Kembla Port Corporation, pers. comm. 2009).

Commonwealth Rolling Mill and Gardens (Item 11)

The Commonwealth Rolling Mill, currently occupied by BHP Billiton and BlueScope Steel, lies over 100 metres to the south west of the proposed site on the western side of Old Port Road. It is significant as a rare and exceptional example of art deco factory architecture.

The item would not be directly impacted by the proposed construction, although, its aspect may be altered marginally. Given the item's distance separation from the site and the context of the surrounding port industrial development, there is not likely to be any indirect (visual) impact to its listed heritage values.

No. 3, 4 and 6 Jetties

These jetties were constructed in an era when Port Kembla maintained a strong coastal shipping and export presence, have local historical significance for their role in coastal trading and the import and export of cargo at Port Kembla. The Jetties are a tangible reminder of previous methods of trade and shipping in the area, and demonstrate superseded methods of jetty construction suited to smaller craft and less substantial loads.
No. 4 Jetty is the oldest of the remaining Outer Harbour jetties, but is also the most heavily modified over its lifespan, demonstrating how port facilities are dynamic and need to constantly evolve to meet changing demands. The substantial modifications that have been made to all of the jetties are intrusive to their heritage value.

No. 3 Jetty was constructed in 1940 to replace an older jetty and operated until 1983 as a general cargo jetty. Since this time the jetty has functioned as a tug boat mooring berth. The jetty is constructed with timber piles, cross braces and decking. The deck has undergone substantial modification including the addition of a concrete roadway for stability in more recent years as well as substantial steel grating and fencing. These modifications are functional and allow the jetty to continue operating in limited form. While the jetty is still functional for a third of its length, it is in relatively poor condition.

No. 4 Jetty constructed in 1908 and extended in 1929. It was originally 500 feet long however subsequent extension brought the total length of the wooden jetty to 800 feet. General cargo diminished in the 1970s and was transferred to the Inner Harbour and No. 6 Jetty. In 1999 the jetty underwent significant modification in the form of the addition of a concrete berth being constructed off the north western end to handle large bulk liquids ships. The original timber construction of the jetty has been heavily augmented with the use of metal piles and pile wrappings to allow for the continued service of the jetty. The decking has undergone much modification including the construction of a concrete roadway along its length to the bulk liquids berth. The original decking is in poor condition and is unable to be accessed, with most of the original deck fenced off and condemned.

No. 6 Jetty (Port Kembla Gateway), constructed in 1958, was the last jetty to be constructed in the Outer Harbour. Originally constructed as a general cargo and mini-bulk cargo jetty, it continued in this role into the 1980s when the general demise of this kind of cargo handling in favour of containerisation saw the jetty altered for the export of ore concentrates. The jetty has undergone considerable modification since this time including removal of all except one of the moving cranes, construction of a new mobile loader on the base of one of the 17 ton cranes and the addition of a large conveyor type loader for ore concentrates. The jetty retains its original concrete deck although the railway lines have been out of commission since 1990 as the jetty is not deemed capable of handling the additional weight of modern rail vehicles. The entire deck is still in commission and in frequent use although the jetty has been operated privately since 1991.

The historic value of No. 3, 4, and 6 Jetties is assessed as being of low local significance. The jetties have been intrusively modified over their life and they are in relatively poor condition. The retention of these items in their present condition would not be of great benefit to the Outer Harbour area. Removal of the jetties and their replacement with modern structures can be seen as a logical progression in the development of the Outer Harbour, consistent with previous practices of removing outdated wharf structures and upgrading and enhancing port facilities as need and technical ability allows. The historic use of the port as a location of import and export of cargo is not changed, and the redevelopment would allow the Outer Harbour to continue to be viable as a working port for years to come.

No. 3 and 4 Jetties are programmed to be demolished to accommodate Major Project (Stage 1) dredging and reclamation works and No. 6 Jetty (Port Kembla Gateway) to accommodate Concept Plan (Stage 3) dredging and reclamation works.

As the jetties are assessed as being of low local significance, heritage management options involving retention and preservation are inappropriate. Therefore, it is recommended that archival recording of No. 3, 4, and 6 Jetties is undertaken prior to their demolition.

24.4 Mitigation Measures

24.4.1 Concept Plan

To ensure impacts on historic heritage resulting from the Concept Plan are minimised, the following management and mitigation measures are proposed:

- Implement a Conservation Management Plan for the Mobile Block Setting Steam Crane prior to commencing construction activities within the proximity of the item as part of the Concept Plan (Stage 3), and produce a nomination for inclusion on the State Heritage Register. As part of the Conservation Management Plan, suitable prominent locations for temporary or permanent relocation and interpretation of the crane should be investigated.
- Should shipwreck material be retrieved during dredging or other activities associated with the Concept Plan (Stage 3), works in the immediate vicinity should cease and a suitably qualified heritage professional would be contacted to assess the discovery and provide advice of mitigation or other measures.
- Ensure design of port access road as part of the Concept Plan (Stage 3) limits intrusion on accessibility between the concrete pillbox and the Historical Military Museum and incorporate sympathetic landscaping to minimise visual impact between the pillbox and Museum.
- Undertake archival photographic recording prior to demolition No. 6 Jetty as part of Concept Plan (Stage 3) and document a comprehensive history of the jetty including description of the structure and operation in order to preserve knowledge of their function.

24.4.2 Major Project

To ensure impacts on historic heritage resulting from the Major Project (Stage 1) are minimised, the following management and mitigation measures are proposed:

- Undertake archival photographic recording prior to demolition of No. 3 and No. 4 Jetties as part of Major Project (Stage 1) and document a comprehensive history of the jetties including description of the structure and operation in order to preserve knowledge of their function.
- Should shipwreck material be retrieved during dredging or other activities for Major Project (Stage 1) works in the immediate vicinity should cease and a suitably qualified heritage professional would be contacted to assess the discovery and provide advice of mitigation or other measures.

24.5 Summary

The background searches undertaken in this preliminary assessment uncovered no evidence that recorded or unrecorded Aboriginal sites would be impacted by the proposed development as part of the Concept Plan or Major Project. All previously recorded Aboriginal sites are located well outside the impact area, and there is considered to be little or no likelihood that any intact or undisturbed subsurface Aboriginal heritage material remains *in situ* within the study area. It is considered that no further Aboriginal heritage assessment is required for the study area prior to development of the Outer Harbour.

There are likely to be some minimal impacts on listed heritage items in the Historical Military Museum during the construction of the access road from Darcy Road to the boat harbour car park at the end of Foreshore Road, however these impacts can be minimised with sympathetic road design and landscaping. Extensive modern development surrounds the historic items, which reduces their historic value, and the new development would not have any greater impact.

The state significant Mobile Block Setting Steam Crane would need to be relocated in order to ensure it is not affected by road construction, and a Conservation Management Plan would need to be created for this item.

The historic value of No. 3, 4 and 6 Jetties is limited to low local significance due to intrusive modifications and their relatively poor condition. The retention of these items in their present condition would not be of great benefit to the Outer Harbour area. However, archival recording of the jetties is recommended in respect of local significance prior to the demolition.

25.0 Sustainability

25.1 Introduction

Sustainable development is defined by the World Commission on Environment and Development as '*development that meets the needs of the present without compromising the ability of future generations to meet their own needs'* (UN, 1992: 2/1).

The *EP&A Act 1979* encourages ecologically sustainable development (ESD) in line with the four sustainability principles set out under the *EP&A Regulation 2000*:

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

25.2 Existing Environment

PKPC is committed to sustainability principles through *implementation and support of initiatives to prevent pollution, protect biodiversity, use resources effectively and minimise waste* (PKPC Environmental Policy Statement, 2006).

PKPC is also heavily involved in the social/community and economic aspects of sustainability. The Port is one of the Illawarra Region's key assets, supporting employment and contributing significantly to the local and state economy. The Port currently sustains over 3,500 jobs and contributes $418 million to the regional economy annually (PKPC, 2007). PKPC also recognises that the future of the Port and continued innovation must reflect community values.

PKPC works with the local community and not-for-profit organisations on a number of ongoing initiatives including:

- Community Communication Strategy.
- Stakeholder briefings.
- Sponsorship and Donations Program.
- Reporting to Port Kembla Pollution Committee Meetings.
- Providing articles for local newspaper and Port Kembla community newsletter.
- Providing accommodation and secretarial support for the Port Kembla Harbour Environment Group meetings.
- Establishment of the Port Kembla Heritage Park.
- NSW Marine Pests Working Group
- NSW Pollution Executive Committee

25.3 Methodology for Environmental Assessment

This sustainability assessment considers the proposed development in light of the four principles of ESD.

High-level opportunities are considered for the incorporation of energy savings (including alternative energy options), emissions reduction and the incorporation of innovative renewable energy generation technologies in the project.

Sustainability encompasses economic and social considerations as well as environmental considerations. The socio-economic assessment in **Section 20** provides further information on these aspects of the development.

As sustainability measures for the development could equally be applied to Stage 1 (Major Project) and all stages (Concept Plan), distinction between the two is not provided.

25.4 Impact Assessment

25.4.1 Principles of Sustainability

The following provides a summary of key issues for each of the ESD principles as they relate to the proposed development.

> ***The precautionary principle****, namely, that if 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.*

While a number of potential threats are outlined in the environmental risk assessment (**Section 30**) most of these are considered unlikely to cause serious or irreversible environmental damage. Potential threats which relate to the construction (dredging and reclamation) process would be managed as follows:

- Dredged sediments would be used for the reclamation and placed at a depth below the depth of wave action to maximise opportunities for future consolidation and reduce the potential for further disturbance.
- Reclamation and finished levels (with pavements) for all stages of the development are designed to ensure the newly created land is not vulnerable to sea level rise in the next 50 or 100 years.
- The surface of reclaimed areas would be treated appropriately to minimise the potential for fugitive dust emissions and ensuing risk from contaminated runoff to the surrounding receiving environment of the Outer Harbour.

In terms of operation, the proposed development is an expansion of the current Outer Harbour and the constructed terminals would be used for purposes not dissimilar to the current activities (i.e. Port activities). Measures to prevent environmental degradation of a serious or irreversible nature during operation would be addressed by a series of management plans and monitoring programs (refer **Section 29**) and by an extension of PKPC's existing policies and practices.

Key environmental issues associated with the development were identified during preparation of the Outer Harbour Master Plan and preparation of the PEA. The environmental assessment of the proposed development has been undertaken in parallel with consultation with Government agencies to ensure the key issues have been identified and addressed and lack of scientific certainty with respect to potential issues has been minimised.

> ***Inter-generational equity,*** *namely, that the present generation should ensure that the health, diversity and productivity of the environment are maintained or enhanced for the benefit of future generations.*

The greatest risk of the proposed development to intergenerational equity is the potential for long term degradation of harbour waters and ensuing impact on aquatic ecology during both construction (dredging and reclamation activities) and operation (increased shipping activity and potential for polluted stormwater runoff). Mitigation measures which form a fundamental part of the development would ensure that contaminated dredge material is contained in the reclamation area to minimise impacts of pollutants in the harbour. In addition, once operational the multi-purpose terminals, container terminals and access roads would incorporate stormwater management measures to capture and treat stormwater runoff and prevent polluted discharge to the receiving waters of the Outer Harbour.

Benefits to future generations would also be realised by:

- Provision of jobs during construction and operation, potentially reducing the number of people (currently 15.8% of the workforce) who commute outside the region for employment.
- Direct economic benefits for the regional and State economy.
- Attracting investment in the Illawarra Region and the Wollongong LGA.
- Improving the visual interest and appearance of the Outer Harbour.

Further discussion on the economic and social benefits of the proposed development is outlined in **Section 20**.

> ***Conservation of biological diversity and ecological integrity****, namely, that conservation of biological diversity and ecological integrity should be a fundamental consideration.*

The proposed development is able to be constructed without any significant impact on the biological diversity and ecological integrity of the locality.

The proposed design, construction and operation would incorporate a number of measures to maintain biological diversity and ecological integrity including:

- Dredging environmental management plan.
- Improved management of stormwater.
- Green and Golden Bell Frog Management Plan (threatened species).
- Incorporation in detailed design of marine habitat friendly structures for seawalls and other marine interface structures.
- Implementing compensatory habitat measures through continued support from PKPC of Coastal Saltmarsh community groups in more viable patches of saltmarsh community within the region.

Further discussion on ecology and water quality is outlined in **Sections 14, 16** and **17** respectively.

> ***Improved valuation, pricing and incentive mechanisms****, namely, that environmental factors should be included in the valuation of assets and services.*

The proposed development has considered a range of environmental factors in the valuation of assets and services such as:

- Vegetation management measures.
- Use of recycled spoil and slag and interburden rock (local where possible) for reclamation.
- Potential to incorporate on-site renewable energy generation.
- A transport modal split favouring rail.

These factors have been given due consideration in project valuation and where appropriate included in the project cost. In addition site specific safeguard measures have been identified to manage environmental impact and the costs of these measures have been included in the overall project cost.

25.4.2 Energy Savings and Emission Reduction

Energy saving and emission reduction represent direct environmental benefits by reducing the atmospheric emissions generated by construction and operational activities. Initiatives to save energy and reduce emissions also frequently result in design that saves money or is cost-neutral.

PKPC has developed a *Natural Resource Reduction Plan 2005-2010* which recommends investigation of a number of options to achieve energy savings and emission reduction. Some of these options may effectively be extended to operation of the proposed development, possibly including:

- Greenhouse gas monitoring system during construction and operation.
- Sustainable purchasing policy.
- Alternative energy sources such as gas boilers and photovoltaic cells.
- Purchase of green power.
- Alternative energy efficient lighting in outdoor open spaces.
- Lower emissions and alternative fuel vehicle fleets.
- Waste reduction and purchasing policy.
- Carbon offsets and participation in Green Hands, a native tree planting program.

During construction, energy savings and emission reduction may be achieved through:

- Procurement of green construction vehicle fleets.
- Favouring rail or barge transport modes above road to transport materials where possible.
- Procurement of reclamation spoil and other construction materials from local sources.
- Use of materials with high recycled content.
- Purchase of green energy for construction.
- Procurement of lower embodied carbon construction materials.
- Undertaking of energy efficiency management plans for construction and operation.
- Effective resource use and minimum-waste during construction.

25.5 Mitigation Measures

There are a range of mitigation options outlined in this section to mitigate identified environmental impacts. However, there are three potential areas of mitigation, (alternative energy, habitat enhancement and stormwater capture) that can provide positive environmental benefits over the life of the project. These are:

- Promotion of renewable energy generation.
- Design of marine habitat friendly structures.
- Use of Water Sensitive Urban Design initiatives.

25.5.1 Renewable Energy Technology and Innovation Potential

The Outer Harbour and adjacent coastal environment provides the potential to harvest wave, wind and solar energy in line with the Australian government's legislative initiative for 20% renewable energy by 2020.

Ports are windy environs, so there is potential for power generation from micro and large scale wind turbines as part of future design and construction works, for example along the breakwater. The potential for this opportunity would be considered during the detailed design phase.

Similarly, there is potential to generate power from the sun by encouraging future tenants to install panels on structures to take advantage of the solar potential. Solar photovoltaics could potentially provide enough energy to offset use for general administrative purposes and stevedoring accommodation on the central operational portion of the multi-purpose terminals. This is in line with PKPC's commitments to sustainability and commitments to adopting renewable energy. Initiatives would be confirmed during detailed design.

In addition to sustainability other benefits of installing renewable technologies to generate energy for Outer Harbour operations include:

- Enhanced public profile.
- Creation of a world-class port that showcases innovative technology.
- Attracting investment and clients with similar commitments.
- Reduced operational expenditure on energy.

25.5.2 Marine Habitat Friendly Structures

Over the past few years techniques have been developed to improve marine habitats in ports through design and construction of marine habitat friendly structures. During the detailed design phase investigation of research trials to achieve marine habitat enhancement would be considered. These techniques, which are low cost, include rock revetments, and pre-cast concrete cladding with habitat skirt.

25.5.3 Water Sensitive Urban Design

There are opportunities to investigate efficient use of water throughout construction and operation phases of the development. Due to the relatively large area of hardstand and roof areas that would be constructed as part of the Concept Plan, the majority of water sensitive urban design initiatives for the development would focus on water capture and reuse. For example there is potential to capture stormwater runoff from the roofs of cargo storage sheds. The captured water could be treated and stored in water tanks onsite, and reused for other onsite uses, such as:

- Dust suppression for dry bulk stockpiles and other bulk material handling activities.
- Toilet flushing within amenities.
- Irrigation for landscaping.
- Fire fighting.

These and other water sensitive urban design measures would be investigated and confirmed during detailed design for Stage 1.

25.6 Summary

There are no significant environmental impacts associated with the proposed development that affect the principles of sustainability mitigation measures are proposed to address the potential environmental impacts of the proposed development that have been identified. Habitat, energy enhancement and water management can provide positive environmental benefits over the life of the project, enhance public profile and attract investment.

26.0 Climate Change

26.1 Existing Environment

Port Kembla is situated on the Australian east coast, approximately 80 kilometres south of Sydney. The current climate of Port Kembla is cool temperate with an average rainfall of 1100mm, distributed relatively evenly throughout the year.

The Outer Harbour waters are protected from ocean currents and waves by the eastern and northern breakwaters. The Inner Harbour is naturally protected due to its location, the narrow channel of The Cut and the Outer Harbour structures.

The proposed development of the Outer Harbour would have a design life of 100 years. The coastal location and operational nature of the development mean that the Port is vulnerable to climate change impacts that affect coastal environments.

Although the precise effects of climate change are unknown, research indicates a demonstrated change in Australia's climate. There is significant evidence that this change will continue despite mitigation measures that may be adopted. Changes in Australia since the early 1900s include:

- average (mean) temperature increase by about 0.9°C[4];
- substantial rainfall declines (50mm lower average rainfall per decade);
- sea level rise of around 17cm and ocean warming.

Further discussion on observed climatic change in Australia is presented in **Appendix N.**

26.2 Methodology

This section provides a high-level desktop assessment of climate change scenarios and associated impacts likely to be experienced by the Concept Plan during its design life. This assessment is based on the latest available information from the Fourth Assessment Report from the Intergovernmental Panel on Climate Change (IPCC 2007) and supplemented by local research including the *Climate Change in Australia: Technical Report* (CSIRO, BOM 2007), the *Illawarra Region Summary of Climate Change Impacts* (DECC NSW, UNSW 2008) and the *Infrastructure and Climate Change Risk Assessment for Victoria* (CSIRO, Phillips Fox, Maunsell Australia, 2008). The sea level rise projects adopted for this project are in line with NSW Government policy (DECCW, 2009).

Climate change is a global phenomenon, the precise effects of which are unknown. The time-lag between cause (atmospheric emission concentration) and effect (climatic change) mean that climate change would be experienced during the design life of the Concept Plan as a result of current emission concentration in the atmosphere. Global mitigation measures may reduce the long-term (2070 and beyond) effects of climate change. However, effects for 2030 and 2050 projections have high potential to occur. The effects of climate change increase over time and it is important that the design of the development takes projected changes into account to ensure the design life of the infrastructure.

Given the proximity and similarity in climate and conditions between Sydney and Port Kembla, Sydney and Sydney Harbour projections are provided as the closest approximation for the Concept Plan where regional data is not available.

Due to the long term nature of climate change, impacts for the Major Project are not significant as Stage 1 would be completed by 2018. Therefore, climate change impacts for the total development (Concept Plan) have been presented only.

[4] (Nicholls and Collins, 2005)

26.2.1 Climate Change Projections

The climatic changes that are likely to be experienced during the design life of the Concept Plan are presented in **Table 26-1** Global warming projections indicate that climate changes would affect both average conditions and the frequency and intensity of extreme events. More detail for each of these scenarios is included in **Appendix N**.

Table 26-1: Climate change variables and scenarios

Climate change variable	Climate change scenario
Storm Surge	• Data from the Manly Hydraulics Laboratory indicate that the 100 year (ARI) storm surge is 0.6 m (AWACS 1991). • Storm surge height could increase by 1% by 2030 and 4% by 2070 (McInnes et al 2007), which is insignificant.
Sea level rise	NSW Government Sea Level Rise Policy Statement (DECCW 2009) states that the best projections of sea level rise for the NSW coast are: • 0.40 metres by 2050. • 0.90 metres by 2100.
Temperature	CSIRO and BOM (2007) best estimate (50th percentile) projected changes for eastern Australia (relative to a baseline period 1980-1999) include: • An increase of annual mean temperatures of around 1°C by 2030;. • An increase in annual mean temperatures of between 1.8°C and 3.5°C by 2070.
	DECCW and UNSW (2008) projection for the Illawarra region is: • An increase of between 1.5°C and 3°C (over all seasons) by 2050.
Extremely hot days (over 35°C)	CSIRO and BOM (2007) predict an increase in the number of days per year over 35°C from 3.5 (currently) to: • 4.4 days per year over 35°C by 2030. • 8.2 days per year over 35°C by 2070.
Rainfall	CSIRO and BOM (2007) predict an overall decrease in annual precipitation for NSW including • A decrease of 2% by 2030. • A decrease of 5% to 10% by 2070. However, DECCW and UNSW projections for the Illawarra region project an increase of rainfall including: • An increase of 50% rainfall in summer by 2050. • An increase of 20% to 50% rainfall in autumn and spring.
Extreme rainfall	An increase in rainfall intensity and the amount of rain per rain-day is expected. This is punctuated by longer dry spells between rain-days and characterised by more flash flooding.
Evaporation	The CSIRO and BOM (2007) best estimate (50th percentile) projected changes for eastern Australia include: • An increase in annual potential evapotranspiration of 2% by 2030. • An increase in annual potential evapotranspiration of between 6% and 10% by 2070. The evaporation rates would mean drier conditions in autumn and spring despite increased rainfall (DECCW and UNSW, 2008).
Wind speed	All sources project increases in average wind speed and more frequent extreme winds. This would have exponential effects on infrastructure such as buildings and power lines.

26.3 Impact Assessment

26.3.1 Construction

Climate change is unlikely to significantly affect the Port during construction in Stage 1 and 2 of Concept Plan development as they are programmed to be completed by 2025, prior to, or in the early phases of the predicted climatic changes around 2030. During Stage 3, construction works may be influenced by climatic changes predicted to occur around 2030. A decreased return period for storm surges (1 in 8 years at 0.5m) could impact on timing of construction works and result in program delays. In addition, an increase in annual mean temperature of 1°C and number of days per year over 35°C could impact on working conditions for construction workers.

Managing construction in extreme weather would be considered in a construction risk assessment based on current climatic conditions for Stage 1 and 2 but would incorporate predicted climatic changes for Stage 3 construction works.

In relation to sea level rise, final design for the Concept Plan would allow for a 100 year design life. However, as an adaption strategy, the reclamation would be designed to accommodate both 2050 and 2100 Sea Level Rise projections. Design finished reclamation surface levels for this project, therefore, for a 100 year planning period would need to be above:

2.4 m PKHD (1,000 year ARI) + 0.9 Sea Level Rise (2100) + 0.2 m long wave activity + 0.4 m (half of H_s significant wave height) = 3.9 m PKHD

The Concept Plan development provides for a reclamation level of 4.0 m and pavement thickness of 1.2 m. The final hardstand level would be 5.2 m, comfortably above the Sea Level Rise predictions for both 2050 and 2100.

26.3.2 Operation

The projections indicate that climate change would affect the Concept Plan during its design life. Effects of climate change on port infrastructure were investigated in the *Infrastructure and Climate Change Risk Assessment for Victoria* (CSIRO, Phillips Fox, Maunsell Australia, 2008). The report noted risk scenarios and climate change variables, and risk ratings for various infrastructure types based on the 'low' and 'high' emission projection scenarios from the IPCC and CSIRO. Climate projections are currently tracking at the 'high' emissions scenario and will continue to do so if significant global action is not taken to reduce greenhouse gas emissions.

Information from the *Infrastructure and Climate Change Risk Assessment for Victoria* (2008) report as it applies to infrastructure on Australia's east coast has been extrapolated and presented in **Table 26-2** below. The report states that the main risks relate to extreme events, sea level rise and accelerated degradation of materials and structures. Of relevance to the Concept Plan is data on ports, roads and rail. Changed climatic conditions would have different impacts on these infrastructure items depending on their location, materials, structures and use.

Port infrastructure in 2030 is assessed as being of high risk from sea level rise and intensity of storms and wind events. The road and rail infrastructure to be constructed and upgraded as part of the Concept Plan would be at moderate risk from increased average temperatures, changes in rainfall patterns and extreme events such as rainfall. It is noted that these risk factors have been considered for the timeframe of the Concept Plan.

Table 26-2: Infrastructure Risk Summary – East Coast Australia (CSIRO, Maunsell | AECOM and Phillips Fox, 2008)

Transport	Risk Scenario	Climate Variable	Indicative ratings for infrastructure on Australia's east coast			
			2030		2070	
			Low	High	Low	High
Ports	Storm impacts on ports and coastal infrastructure	• Increase in intensity of extreme wind • Sea level rise • Increase in frequency and intensity of storms • Increase in extreme daily rainfall	Low	High	High	Extreme
	Sea level rise impacts on port infrastructure materials	• Sea level rise	Low	Moderate	Low	High
Roads	Asphalt degradation	• Increased solar radiation • Increased temperature and heatwaves	Moderate	Moderate	Moderate	Moderate
	Road foundations degradation	• Increased variation in wet/dry spells • Decrease in available moisture	Moderate	Moderate	Moderate	High
	Flood damage to roads	• Increase in extreme daily rainfall • Increase in frequency and intensity of storms	Moderate	Moderate	Moderate	Moderate
Rail	Rail track movement	• Increased temperature and heatwaves	Low	Moderate	Moderate	High
	Storm damage to rail	• Increase in extreme daily rainfall • Increase in frequency and intensity of storms • Increased electrical storm activity	Moderate	Moderate	Moderate	Moderate

26.4 Mitigation Measures

Through acknowledging that climate change would impact the Concept Plan, appropriate mitigation measures can be achieved through adaptation. Adaptation strategies decrease the risk of asset damage from projected events which would represent an economic and social cost. Adaptation strategies may include suitable material selection, using design standards that respond to future changes rather than historical data, an increase in maintenance regimes, using technology that meets new performance and service standards, planning for future conditions and cultural change (Holper *et al,* 2007).

Some of the strategies within each of these categories are currently used by PKPC to manage the impacts of a variable climate and extreme weather conditions. Many risk treatment and climate change adaptation strategies that could be applied to the Concept Plan would be an extension or intensification of these current practices.

Mitigation strategies for different types of infrastructure for the Concept Plan are outlined in **Table 26-3**.

Table 26-3: Climate Change Mitigation Strategies by Infrastructure Type

Infrastructure	Climate Variable	Mitigation Strategy
Ports	Ports and rail are more prone to extreme wind events whilst port and coastal infrastructure are particularly at risk when storm surges combine with sea level rise. With emissions tracking at the higher end of current projection models, it is likely that the port would be exposed to high risk from storm impacts by 2030 and high or extreme risk by 2070, depending on the success of global mitigation strategies. Increased frequency and intensity of extreme rainfall events could cause significant flood damage to port infrastructure. Increased temperature would cause additional expansion of concrete joints, protective cladding, coatings and sealants. Reduced life expectancy, increased maintenance costs and potential structural failure during extreme events. Deterioration of concrete.	• Monitor latest research • The proposed reclamation levels have been set above predicted extreme sea level rises (i.e. including storm surges and extreme events) for the 100 year design life of the facility, with a freeboard suitable to cater for extreme sea level rise predictions to 2100. • Bunding and pavements would be designed to withstand stronger and more frequent storm surges. • Surfaces would be designed to withstand hotter temperatures. • Maintenance regimes would take into account accelerated degradation of infrastructure. • Structures and surfaces would be designed for saline conditions.
Roads	Increased frequency and intensity of extreme rainfall events may result in significant flood damage to road infrastructure. Increased temperature and solar radiation may result in reductions in the life of asphalt on road surfaces and hardstand.	• Detailed design would ensure levels and drainage systems for the new roads have sufficient capacity to accommodate increased flood volumes and higher intensity storm events. • Maintenance regimes would take into account accelerated degradation of bituminous surfaces.
Rail	Increased frequency and intensity of extreme rainfall events my result in significant flood damage to rail infrastructure . An increase in the number of lightning strikes could affect rail	• Above-ground structures would be designed to withstand stronger wind conditions, more frequent storm events and saline conditions.

Infrastructure	Climate Variable	Mitigation Strategy
	operations. Increased storm activity may increase the cost of transport infrastructure maintenance and replacement, and the disruption of transport services which could have significant economic impacts. Increased temperature may stress the steel in rail tracks through expansion and increased movement.	• Risk management strategies would be in place for extremely hot days to manage potential rail buckling. • Maintenance regimes would take into account accelerated degradation of infrastructure.

26.5 Summary

The Concept Plan is likely to be affected by changed climatic conditions during its design life. The most significant impact would be from sea level rise and storm surges during extreme events. Proposed reclamation levels and finished terminal surface levels have taken these impacts into account and provide for sea level rise beyond the 50 year design horizon and could accommodate extreme sea level rise predictions to beyond 2100.

Increased rainfall, winds, storm activity, solar radiation and temperatures would result in accelerated degradation of materials and structures. Management of these impacts would occur through maintenance regimes that would be detailed in OEMP(s) prepared for the operation of the terminals.

Impacts from extreme events such as intense rainfall and storms would be managed through PKPC risk management and emergency regimes. Drainage capacity would be designed for projected intense rainfall events and consideration would be given to standards for overhead structures used for rail. Alternative power sources would also be considered to ensure power supply during extreme events is maintained.

Information on emissions reduction opportunities in relation to climate change mitigation, including potential for carbon reduction, energy efficiency and renewable energy generation is discussed in **Section 25.**

27.0 Waste Management

27.1 Existing Environment

The operating environment within the Outer Harbour is currently comprised of three jetties and a bulk liquid berth. Current port activity, which includes the storage and transportation of dry bulk and bulk liquids, does not generate a substantial amount of waste.

27.2 Methodology

The NSW Waste and Resource Recovery Strategy 2007 (NSW WARR) was considered to assess the waste generated by the proposed development. The strategy aims to maximise the conservation of natural resources and to minimise environmental harm from waste management and disposal of waste. This need is exacerbated by the growing population in NSW and a healthy economy that is producing more goods and services. The broad targets for the NSW WARR are highlighted in **Table 27-1**.

Table 27-1: NSW WARR Strategy 2007

Key Result Area	Target
Preventing and avoiding waste	To hold level of total waste generated for five years from the release of *Waste Strategy 2003*.
Increased recovery and use of secondary materials	By 2014, to: • Increase recovery and use of materials from the municipal waste stream, from 26% (in 2000) to 66%, • Increase recovery and use of materials from the commercial and industrial waste stream, from 28% (in 2000) to 63%, and • Increase recovery and use of materials from the construction and demolition sector, from 65% (in 2000) to 76%.
Reducing toxic substances in products and materials	By 2014 or earlier to: • Phase out priority substances in identified products as a first choice or, if not possible, to achieve maximum recovery for re-use.
Reduce litter and illegal dumping	• Reduce total amount of litter reported annually. • Reduction in total tonnages of illegally dumped material reported by regulatory agencies and Regional Illegal Dumping (RID) squads annually.

Source: DECC, NSW Waste Avoidance and Resource Recovery Strategy 2007

27.3 Impact Assessment

27.3.1 Concept Plan

Construction Phase

The various types of waste that would be generated for the Concept Plan would occur during the demolition, dredging, reclamation, and construction activities including the road and rail infrastructure works. At this point, it is difficult to quantify the amount of waste that would be generated for the Concept Plan. Solid wastes likely to be generated during the construction of components covered under the Concept Plan are listed below:

- Vegetation.
- Excavated spoil material.
- Concrete.
- Wooden piles and other structural timbers from jetties.

- Steel.
- Rock.
- Soft sediments.
- Scrap metal.
- Office wastes – cardboard, paper, used cartridges, food waste.

Excavated spoil material, rock and soft sediments are likely to be reused for the reclamation components during Stages 1, 2 and 3. Approximately 5,300,000 m3 of fill would be required for the Concept Plan. The majority of fill for the Concept Plan would be required for Stage 1 (4,628,049 m3). Part of the fill would include the reuse of dredging material from within the Outer Harbour (383,575m3 rock, and 833,675 m3 soft sediments) while the balance (3,410,799 m3) would include the reuse of fill imported from external sources. Priority would be given to the reuse of dredged sediments within the footprint of the Concept Plan. Any additional fill would be sourced from quarries or major infrastructure projects. Concept Plan construction waste generated would be similar to the Major Project Construction waste as presented in **Table 27-2**.

Detailed assessments, mitigation measures and monitoring protocols concerning construction and waste associated with Stages 2 and 3 of the Concept Plan would be assessed and detailed as part of subsequent separate applications for approval made at a later date.

Operation Phase

Occupancy details for the Concept Plan have not yet been confirmed, thus detailed estimation of waste generated during the operation phase of the development cannot be carried out at this stage. Concept Plan operation waste generated would be similar to the Major Project Construction waste as presented in Table 3.Trade waste licenses would be obtained by the occupants for disposal of liquid wastes. Incoming vessels to the Port would be subjected to assessment in accordance with the Quarantine Act 1908. Australian Quarantine Inspection Service (AQIS) manages quarantine controls at our borders to minimise the risk of exotic pests and diseases entering the country.

A licensed waste contractor would be made responsible for collection and appropriate disposal of waste. Licensed quarantine waste contractors would be used to dispose quarantine waste from ships in accordance with the requirements of AQIS.

Detailed OEMP(s) would be prepared prior to the commencement of operation of each of the leases on the terminal. Handling, storage and disposal of waste would be addressed in each OEMP.

27.3.2 Major Project

Construction Phase

The majority of waste would be generated during the demolition, reclamation, dredging and construction activities of the Major Project. Construction activities to be undertaken as part of the Major Project would involve the generation of solid waste as detailed in **Table 27-2** including waste generated by employees, and building materials.

Sources of fill would comprise waste materials from other industries (including blast furnace slag and coal wash) and Virgin Excavated Natural Materials (VENMs) from other civil construction projects, depending on the availability of material. PKPC has applied for a resource recovery (land application) exemption from DECCW to use blast furnace slag and coal wash in the reclamation, and is currently awaiting approval.

Waste generated during the construction of the Major Project is classified in accordance with the NSW DECCW Waste Classification Guidelines (July 2008) and presented in **Table 27-2** below.

Table 27-2: Waste Generated During Construction of Major Project

Waste	Composition	Classification per DECCW Waste Classification Guidelines	Potential Recovery/Reuse	Disposal
Site clearing and ground preparation	Excess fill materials and/or excavated material	General Solid Waste (Non Putrescible)	Concrete can be used as road base and fill for new internal port roads.	General waste (putrescibles and non-putrescibles) would be stored in separate bins depending on the waste disposal method and waste collection contractor requirements. Bins/skips would be emptied on a regular basis such to prevent overflow of materials.
Demolition wastes from : No. 3 Jetty (Tug Berth) No.4 Jetty (Berth 206)	No 3 Jetty: Concrete, wooden piles, steel. Berth 206: Sulphuric Acid Pipes, concrete, wooden piles, steel	General Solid Waste (Non Putrescible)	Concrete can be used as road base, breakwater fodder, and fill for new internal port roads. Steel and wood, depending on their condition, can be used for erection of temporary or permanent structures. Berth 206: pipes would be decommissioned and taken offsite to a recycling facility.	General waste (putrescibles) would be stored in separate bins depending on the waste disposal method and waste collection contractor requirements.
Construction of facilities, access road and rail upgrade and General Waste	Scrap wood and metals and concrete spills Packaging from materials received at a facility, such as foam, strapping and lumber. Office paper, cardboard, plastic, metal and glass food and beverage containers. Food waste. Office equipment and	General Solid Waste (Non Putrescible)	Collected in bins and recycled. Materials such as plastic, metal and concrete may be suitable for reuse or sent for reprocessing off-site. Material supplier would be responsible for waste and excess material removal of items brought to site. Segregate recyclable material such as paper and cardboard	General waste (putrescibles and non-putrescibles) would be stored in separate bins depending on the waste disposal method and waste collection contractor requirements. Bins/skips would be emptied on a regular basis such to prevent overflow of materials. General waste disposal would be the responsibility of lessee's. PKPC would encourage the following methods of disposal (putrescibles and non-putrescibles) would be stored in separate bins

Waste	Composition	Classification per DECCW Waste Classification Guidelines	Potential Recovery/Reuse	Disposal
	appliances. Wastes associated with heating and air conditioning systems and building maintenance.		boxes from organic waste and send to recycling facilities; and Arrange for collection of computers, florescent bulbs and similar waste to be taken to the nearest recycling or reprocessing facility. Organic material may be suitable for compost feedstock off-site.	depending on the waste disposal method and waste collection contractor requirements. Bins/skips would be emptied on a regular basis such to prevent overflow of materials. Check nature of waste to ensure hazardous materials are kept separated.
Dredging	Rock	General Solid Waste (Non Putrescible)	Reused in Reclamation	Rock would be reused as fill in reclamation areas.
Dredging	Soft sediments	The management of sediments would be outlined in a CEMP(s) prepared for the construction activities.	Reused in Reclamation	Sediments would be reused as fill for the reclamation areas.
Small Quantities of Waste from construction equipment.	Spent solvents and oily rags; Empty paint cans, chemical containers; Used lubricating oil; Used batteries (such as nickel-cadmium or lead acid); and Lighting equipment. Used engine oil, antifreeze, batteries and similar waste generated from fork lifts, cars and trucks.	Hazardous	Oil, batteries may be suitable for recycling off-site. Specialist advice required.	Hazardous wastes would be kept separate as required by collection contractors.

Waste	Composition	Classification per DECCW Waste Classification Guidelines	Potential Recovery/Reuse	Disposal
Human Waste	Sewage, wastewater, etc.	Liquid Waste Group C	Treated in waste treatment plants	Appropriately collected, stored and disposed offsite in accordance with the Council and NSW EPA requirements.

Operation Phase

The central portion of the multi-purpose terminals would be a common user area that would house stevedore accommodation, offices and amenities. Typical wastes generated during operation of the central portion of the multi-purpose terminals would comprise waste from maintenance activities and domestic waste (refer **Table 27 3**).

In addition to the common user area, parts of the multi-purpose terminals would be leased. The occupancy of the central portion of the multi-purpose terminals has not yet been confirmed, thus detailed estimation of waste generated during the operation phase of the development cannot be carried out at this stage. Quantities of waste anticipated to be generated by lessees would be assessed as part of separate applications for approval made by lessees prior to operation. Detailed OEMPs would be prepared prior to the commencement of operation of each of the leases. The OEMPs would address handling, storage and disposal of waste.

Load based licenses would be obtained by the occupants for disposal of wastewater (tradewaste) from maintenance, washdown and quarantine areas (as deemed appropriate by the Sydney Water Corporation or the local sewer authority, whichever applicable) and disposal of sewer into the sewerage system.

Australian Quarantine Inspection Service (AQIS) manages quarantine controls at our borders to minimise the risk of exotic pests and diseases entering the country. Waste that is transported to the Port through ships arriving from outside Australia would be subject to assessment in accordance with the Quarantine Act 1908. Incoming vessels would apply to the AQIS: form s20AA Permission to Enter an Australian Non-Proclaimed First Port of Entry and/or Application for s33 Permission to Enter Subsequent Ports of Call. The environmental management procedures currently in place for the Inner Harbour would be incorporated into OEMPs for the Outer Harbour as appropriate.

The seagoing cargo vessels that use the Port may generate oily waste water, garbage, quarantine waste and also hazardous waste. These waste materials would be managed once the vessel arrives in port and processes would be in place to prevent pollution during the transfer of the waste to land. Recycling of these wastes may be possible, and where not possible, waste would be disposed in accordance with the relevant statutory procedures.

A licensed waste contractor would be made responsible for collection and appropriate disposal of waste. Licensed quarantine waste contractors would be used to dispose quarantine waste from ships in accordance with the requirements of AQIS.

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Table 27-3: Waste Generated During Operation of Major Project

Waste	Composition	Classification per DECCW Waste Classification Guidelines	Potential Recovery/Reuse	Disposal
Domestic Waste	Glass, aluminium cans, paper and cardboard, bottles and food waste.	General Solid Waste (Non Putrescible)	Segregate recyclable material such as paper and cardboard boxes from organic waste and send to recycling facilities; and Arrange for collection of computers, florescent bulbs and similar waste to be taken to the nearest recycling or reprocessing facility. Organic material may be suitable for compost feedstock off-site.	General waste (putrescibles and non-putrescibles) would be stored in separate bins depending on the waste disposal method and waste collection contractor requirements. Bins/skips would be emptied on a regular basis such to prevent overflow of materials. General waste disposal would be the responsibility of lessee's. PKPC would encourage the following methods of disposal (putrescibles and non-putrescibles) would be stored in separate bins depending on the waste disposal method and waste collection contractor requirements. Bins/skips would be emptied on a regular basis such to prevent overflow of materials. Check nature of waste to ensure hazardous materials are kept separated.

Waste	Composition	Classification per DECCW Waste Classification Guidelines	Potential Recovery/Reuse	Disposal
Maintenance waste	Machinery and metal scraps, used rags,	General Solid Waste (Non Putrescible)	Collected in bins and recycled. Materials such as plastic, metal and concrete may be suitable for reuse or sent for reprocessing off-site. Material supplier would be responsible for waste and excess material removal of items brought to site.	General waste (putrescibles and non-putrescibles) would be stored in separate bins depending on the waste disposal method and waste collection contractor requirements.
Small Quantities of waste from operation of equipment.	Spent solvents and oily rags; Empty paint cans, chemical containers; Used lubricating oil; Used batteries (such as nickel-cadmium or lead acid); and Lighting equipment. Used engine oil, antifreeze, batteries and similar waste generated from fork lifts, cars and trucks.		Oil, batteries may be suitable for recycling off-site. Specialist advice required.	Hazardous wastes would be kept separate as required by collection contractors.
Sewage	Sewage	Liquid Waste Group C	Treated in waste treatment plants	Disposed into the Sydney Water sewerage system.

27.4 Mitigation Measures

Key activities that would be undertaken for construction of the Concept Plan, such as dredging, reclamation, road construction, and rail infrastructure upgrades, are continual throughout the three stages of development. Similarly, the operational activities that would be undertaken in each stage of the Concept Plan, such as operation of berths, would be similar throughout each of the stages. Accordingly, waste streams associated with the construction and operation phases of the development are considered to be similar throughout each stage. In light of this, waste management measures and controls for both Stage 1 (Major Project) and all stages of development (Concept Plan) have been presented together, as follows:

Construction Waste Management

CEMPs would be prepared for packages of construction work prior to commencement of construction activities. These plans would include Waste Management Plans that would identify the different waste streams, detail waste storage requirements, waste handling measures and disposal methods. It is envisaged that the different waste streams would be stored separately, collected and disposed by licensed waste contractors.

Operational Waste Management

Waste Management Plans (WMPs) would be prepared as part of OEMPs prepared for each leesee and activities operated and managed by PKPC. The WMPs would address handling, storage and disposal of waste. Waste that is transported to the Port through ships arriving from outside Australia would be subject to Quarantine regulations. The environmental management procedures currently in place for the Inner Harbour would be incorporated into WMPs for the Outer Harbour as appropriate.

The seagoing cargo vessels that visit the Port may generate oily waste water, garbage, quarantine waste and may also generate hazardous waste. These waste materials would be managed once the vessel arrives in the Port and processes would be in place to prevent pollution during the transfer of the waste to land. Recycling of these wastes may be possible, and where not possible, waste would be disposed in accordance with the relevant statutory procedures.

Licensed waste contractors would be made responsible for collection and appropriate disposal of waste.

The following measures would be included as a minimum in Waste Management Plans which would be part of the OEMP(s).

- Incoming vessels to the Port would be subjected to assessment in accordance with the *Quarantine Act 1908*. Incoming vessels would apply to the AQIS: form s20AA Permission to Enter an Australian Non-Proclaimed First Port of Entry and/or Application for s33 Permission to Enter Subsequent Ports of Call.
- Requirements outlined in the National Ballast Water Management Arrangements. The Ballast Water Management Arrangements aim to ensure Australia has consistent international and domestic ballast water management controls in place to reduce the risk of introducing a marine invasive species into Australia's unique marine environment.

Solid Waste Storage – General Waste

General waste (putrescibles and non-putrescibles) would be stored in a variety of receptacles of differing styles and sizes depending on the waste collection requirements and the management or disposal method to be used for each material.

All bins and/or skips would be emptied on a regular basis to prevent overflow of materials.

Solid Waste Storage – Industrial and Hazardous Waste

Small quantities of industrial and hazardous waste would be generated from equipment, vehicle and building maintenance activities. Hazardous waste would be stored so as to prevent or control accidental releases to air, soil, and water resources in the area. Storage provisions would include:

- Sufficient space between incompatibles or physical separation such as walls or containment bunds.
- Store in closed containers away from direct sunlight, wind and rain.
- Secondary containment systems would be constructed with materials appropriate for the wastes being contained and adequate to prevent loss to the environment.
- The available volume of secondary containment would be at least 110% of the largest storage container, or 25% of the total storage capacity (whichever is greater), in that specific location for liquid hazardous waste.
- Provide adequate ventilation where volatile wastes are stored.

Hazardous waste storage activities would be subject to special management actions, conducted by employees who have received specific training in handling and storage of hazardous wastes. Management actions would include:

- Provision of readily available information on chemical compatibility to employees, including labelling each container to identify its contents.
- Limiting access to hazardous waste storage areas to employees who have received proper training.
- Clearly identifying (label) and demarcating the area, including documentation of its location on a facility map or site plan.
- Conducting periodic inspections of waste storage areas and documenting the findings.
- Preparing and implementing spill response and emergency plans to address their accidental release.

Transportation

- On-site and off-site transportation of waste would be conducted so as to prevent or minimize spills, releases, and exposures to employees and the public.
- All waste containers designated for off-site shipment would be secured and labelled with the contents and associated hazards, be properly loaded on the transport vehicles before leaving the site, and be accompanied by a shipping paper (i.e. manifest) that describes the load and its associated hazards.
- Hazardous materials to be transported and disposed by a licensed contractor.

Monitoring

Monitoring activities associated with the management of hazardous and non-hazardous waste would include:

- Regular visual inspection of all waste storage collection and storage areas for evidence of accidental releases and to verify that wastes are properly labelled and stored. Monitoring activities would include:
    - Inspection of vessels for leaks, drips or other indications of loss
    - Identification of cracks, corrosion, or damage to tanks, protective equipment, or floors
    - Verification of locks, emergency valves, and other safety devices for easy operation (lubricating if required and employing the practice of keeping locks and safety equipment in standby position when the area is not occupied)
    - Checking the operability of emergency systems
    - Documenting results of testing for integrity, emissions, or monitoring stations (air, soil vapour, or groundwater)
    - Documenting any changes to the storage facility, and any significant changes in the quantity of materials in storage
    - Regular audits of waste segregation and collection practices
    - Characterising waste at the beginning of generation of a new waste stream, and periodically documenting the characteristics and proper management of the waste, especially hazardous wastes
    - Keeping manifests or other records that document the amount of waste generated and its destination

- Monitoring records for hazardous waste collected, stored, or shipped would include:
  - Name and identification number of the material(s) composing the hazardous waste
  - Physical state (i.e. solid, liquid, gaseous or a combination of one, or more, of these)
  - Quantity (e.g. kilograms or litres, number of containers)
  - Waste shipment tracking documentation including, quantity and type, date dispatched, date transported and date received, record of the originator, the receiver and the transporter
  - Method and date of storing, repacking, treating, or disposing at the facility, cross-referenced to specific manifest document numbers applicable to the hazardous waste
  - Location of each hazardous waste within the facility, and the quantity at each location

27.5 Summary

The proposed development would generate various waste types. General solid waste would be collected and disposed of via a licensed contractor. Hazardous waste storage would be subject to specialised management procedures and would be disposed of via an authorised contractor to an approved site.

Waste Management Plans would be prepared prior to commencement of construction and operation activities and would emphasise potential for recovery and reuse of waste; minimise waste generation, and include specific requirements for each of the waste types identified. Mitigation measures and monitoring programs would be implemented to minimise the environmental impact of the development.

Waste types, impacts, mitigation measures and monitoring procedures would be reassessed for Stage 2 and 3 as part of the project applications for Stage 2 and 3 made at a later date.

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28.0 Cumulative Impacts

28.1 Introduction

An assessment of the potential cumulative impacts of the Port Kembla Outer Harbour development in the context of the existing and known major proposed developments in the area, has been undertaken.

The Concept Plan development is anticipated to be completed by 2037. The overall design and construction of the Outer Harbour terminals and ancillary infrastructure would take approximately 27 years based on current programming projections.

Stage 1 activities, including dredging, reclamation, terminal and berth construction, rail infrastructure upgrade and jetty demolition, would commence in 2010 and be completed by 2018. Stage 2 activities, including reclamation, road and rail infrastructure construction and terminal and berth construction would commence in parallel with completion of Stage 1 and would be constructed between 2014 and 2025. Stage 3 activities which include jetty demolition, dredging, reclamation and terminal and berth construction would commence at the completion of Stage 2 and would be constructed between 2026 and 2037.

During the progressive completion of the Concept Plan there would be a number of other project proposals and approvals that could have cumulative impacts in combination with the Outer Harbour development. Due to the long timeframe of the Concept Plan and uncertainty as to future projects which may be approved, it is not possible to assess in detail the potential cumulative impacts that may occur in Stages 2 and 3 of the Concept Plan. Detailed assessment of cumulative impacts of Stages 2 and 3 would be undertaken as part of separate project applications based on proposals at that time. This summary, therefore, focuses on the cumulative impacts of the Major Project Stage 1) in the context of projects recently approved or seeking approval for development.

28.2 Existing Development

Significant existing development exists within and around Port Kembla including:

- BlueScope Steel steelworks.
- Orica sulphuric acid works.
- Incitec Limited fertiliser manufacturing.
- GrainCorp Operations Limited.
- Port Kembla Coal Terminal.
- Port Kembla Copper redevelopment.
- Various light industrial sources (steel workshops, equipment hire etc).
- Recreational boat harbour.
- Inner Harbour.
- Road and rail networks serving the area.

The cumulative impacts of these existing developments form baseline environmental conditions against which the environmental impacts of the project have been assessed.

Assessment of the cumulative impacts of the Outer Harbour development with existing development has inherently been undertaken as part of the impact assessment for the Concept Plan and Major Project.

28.3 Future regional development

28.3.1 Port Kembla Coal Terminal Increased Road Receival Hours

The Port Kembla Coal Terminal (PKCT), located in the Inner Harbour (refer to **Figure 28-1**), is responsible for receiving, assembling and loading coal from the southern and western NSW coal fields. Permission has previously been granted to allow the terminal to receive coal deliveries on a specific section of public road between 7am and 6pm on Monday to Saturday, which has resulted in a restricted maximum capacity to receive coal by public road to 5.2 million tonnes per year. Port Kembla Coal Terminal gained approval under Part 3A of the *EP&A Act* in June 2009 (Reference No. 08_0009), to increase the road receivals to 24 hours a day, 7 days a week which would result in a maximum of 10 million tonnes of coal per year being able to be received by public road.

The *Existing Operations & Increased Road Receival Hours for Port Kembla Coal Terminal Traffic Study* (Cardno Eppell Olson, 2008) suggested that the increase in road receival hours and the additional amount of coal able to be received by the Port would result in an average increase of 28 trucks (in both directions) per hour when the receivals are allowed to 24 hours a day, 7 days a week. However, before 24 hours a day, 7 days a week operation is in place, it is estimated that there would be an average increase of 70 trucks per hour (in both directions) as a result of the increase to 10 million tonnes per year (mtpa) being received but with the road receival hours remaining at 11 hours a day, 6 days a week. PKCT forecast 10 mtpa of coal may be delivered by road as early as 2013 and at the latest by 2018 (PKCT, 2008). Springhill Road, Bellambi Lane and Mount Ousley Road were identified as key locations that would be subjected to significant changes but the impact assessment concluded that increases in coal truck volumes would have minimal effects on road traffic performance and would not exacerbate the road network capacity issues.

The Port Kembla Coal Terminal Environmental Assessment concluded that there would be little change to noise levels and no significant impacts on air quality, dust emissions or traffic and transport as a result of the project.

28.3.2 Soybean Processing and Biodiesel Production Facility

Construction and operation of a Soybean Processing and Biodiesel Production Facility (SPBP) within the Port Kembla Inner Harbour (refer to **Figure 28-1**) has been approved by the DoP (Reference No. MP 08_0083, May 2009). The SPBP facility will process soybeans for the production of biodiesel as well as the co-products of consumable soy protein meal (animal feedstock), glycerine and bleaching earth. These products will be distributed from the SPBP facility to domestic, regional, national and international (such as New Zealand) markets.

The project has an estimated construction period of 70 weeks, commencing late 2009, and may therefore be operational by mid 2011.

The SPBP facility will utilise approximately 1.4 million tonnes of soybean per annum as raw material from which soybean meal, biodiesel and the nominated co-products will be produced. Annually, the SPBP facility will produce approximately 288 million litres of biodiesel, 1.1 million tonnes of soy protein meal, 25,450 tonnes of glycerine and 3,000 tonnes of used bleaching earth. The proposed hours of operation are 24 hours per day, seven (7) days per week.

National Biodiesel have committed to, where practically possible and feasible, maximising the use of sea and rail in order to ensure that the impact on the local road network is minimised. The following transport movements represent the likely normal operational scenario for the movement of raw materials, outgoing product and soybean meal:

- Transport by sea/rail accounts for 99% of incoming raw materials and 77% of outgoing products.
- The bulk (70%) of the soybean meal will be transported by sea with a further 25% of the soybean meal to be distributed via rail.
- Road transport would account for 1% of incoming raw materials; 23% of outgoing product; and 5% of soybean meal transport.

Figure 28-1: Indicative Locations of Future Developments in the Vicinity of the Outer Harbour

These estimates indicate an increase in ship movements of 8-12% to and from the Inner Harbour for the operational phase of the Soybean Processing and Biodiesel Facility. PKPC is confident that Port Kembla has suitable infrastructure and service providers to manage this additional shipping. All heavy vehicle movements will be via Spring Hill Road and Masters Road to access the Southern Freeway and the assessment concluded that the additional (heavy and light) vehicle movements generated by the facility will not have an adverse impact on the intersections of Tom Thumb Road/Springhill Road and Springhill Road/Masters Road.

28.3.3 BlueScope Steel Injection Station Port Kembla Steelworks

BlueScope Steel currently operate a number of steel refining stations within the Basic Oxygen Steelmaking (BOS) building. Approval under Part 3A of the *EP&A Act* was granted in December 2008 (Reference No. MP 08-0132) to replace the prototype Steel Laden Injection Station with a new Steel Injection Station capable of producing 125,000 tonnes of high quality specialised steel a year.

The Steel Injection Station (refer to **Figure 28-1**) operates 24 hours a day, 7 days a week, generating 1-2 tonnes of steel, 2-3 tonnes of slag and 0.6 tonnes of dust per week during operation. The proponent proposes to recycle the slag and dust. Environmental benefits include increased capture of fugitive emissions resulting from the new ladle cover and increased capture of particulates as a result of the new booster fan and cyclone.

Construction works are planned to be complete by early 2011. The proposal will generate an additional 13 heavy vehicle movements per day during demolition works and four heavy vehicle movements a day during operation, using predominantly Springhill Road and Five Island Road. The local road network has the capacity to accept these increases and the proposal will satisfy DECCW's operational noise criteria.

28.3.4 Port Kembla Copper Site Demolition Project: Redevelopment for Future Use

Port Kembla Copper, off Military Road Port Kembla (refer to **Figure 28-1**), formally ceased smelting operations in August 2003 placing the site under a care and maintenance program. Feasible options to recommission the smelting operations have not evolved due to a downturn in market demand. As such, Port Kembla Copper intends to prepare the copper smelter for divestment. As part of this process useful plant and equipment would be sold, demolition of site structures would occur, and material removed and disposed of.

The Proponent lodged an EA with the DoP, which went on Public Exhibition in 2009 (30 April – 01 June). The Proponent is currently preparing a response to public submissions. Demolition and site clearance is programmed to occur in 2010, subject to Part 3A approval. Likely environmental impacts include vibrations produced from felling structures, dust from demolitions and increases in heavy vehicle traffic on industrial roads (Darcy Road, Five Islands Road, Flinders Road and Old Port Road) during construction/demolition.

Prior to, or on completion of these works, Port Kembla Copper intend to sell the site. It is anticipated that the site would be redeveloped for general industrial port related activities.

28.4 Future Infrastructure Upgrades

28.4.1 Maldon – Dombarton Proposed Rail Line

The Maldon – Dombarton rail corridor is a partially built rail link between Picton and Maldon. There is currently significant government interest in completing the construction of this line in order to provide a more direct connection between Port Kembla and Western Sydney, compared with the Moss Vale line. The line has been viewed as a potential infrastructure solution to supporting increased economic activity within the Illawarra.

The justification for developing the Maldon – Dombarton line was based on catering for anticipated increases in coal volumes from the Western Coalfields. Construction of the line commenced in 1983 and 25 kilometres of formation between Maldon and Dombarton was constructed including the approaches for a bridge across the Nepean River and two portals of the Avon tunnel. However, as forecasts of higher coal volumes failed to materialise, construction on the line was halted in 1988. Subsequent planning studies to implement the remainder of the route indicated that the project was not economically justifiable in light of a lack of demand based on current rail traffic volumes. However, potential increases in future rail volumes, for example resulting from the Outer Harbour development, and congestion on the Sydney metropolitan freight network could improve the business case for the line.

At the time of writing, a pre-feasibility study of the route has been completed and the Federal government had allocated $3,000,000 for a feasibility study to be carried out (refer Connell-Hatch et al Maldon – Dombarton Pre-Feasibility Study for Port Kembla Port Corporation *July 2009).*

Given its likely timing the Maldon – Dombarton rail link would potentially offer significant advantages for the container freight operations during Stages 2 and 3 of the Concept Plan.

28.4.2 Princes Highway Upgrade

The Princes Highway is the main link from Sydney and the Illawarra region to the Shoalhaven region and the south coast and far south coast of NSW and north eastern Victoria. The existing Princes Highway between South Kiama and Nowra is primarily one lane in each direction and has a number of winding sections with limited overtaking opportunities. The NSW government is therefore committed to upgrading the section of the Princes Highway between Gerringong and Bomaderry to four lanes.

In addition to improving road safety, some of the main objectives of the upgrade are to improve efficiency between Gerringong and Bomaderry, to support regional and local economic development and to enhance potential beneficial environmental effects and manage potential adverse environmental impacts. The upgrade of this road would improve the connectivity of the heavy vehicles generated by the Concept Plan travelling south towards the Southern Highlands, Canberra and Melbourne.

28.5 Cumulative Impact Assessment

There are four Major Projects approved and under construction or in operational phases, and one project seeking approval under Part 3A at the time of writing. Construction activities associated with these developments would occur prior to, or overlap for a period of time with, the proposed construction activities and operational phases of the Concept Plan, in particular with the Major Project (Stage 1).

There is potential for major developments, in combination with the Outer Harbour development, to result in cumulative impacts on the environment. The construction and operation of these major projects, including the Outer Harbour development, would occur within an area characterised by existing heavy industry and port-related activities. Within this context and based on a review of the environmental assessments presented for these major developments, potential cumulative impacts arising from the combined effects of the Outer Harbour development and other major developments, for receptors including flora and fauna, water quality, soils and geology, heritage and landscape and visual amenity, would be minimal.

Potential cumulative impacts would primarily be associated with socio-economic, traffic and transport, noise and air quality.

Socio-Economic

There would be beneficial socio-economic impacts, associated with increased employment opportunities and stimulation of local and regional economies, resulting from the Outer Harbour development. Other major projects would also provide significant socio-economic benefits to the region through continued and new employment, improved containment of employment, considerable investment in the Illawarra Region and by promoting efficient use of existing infrastructure. Therefore there would be cumulative beneficial impacts resulting from the Outer Harbour development in combination with the other major developments considered.

Traffic and Transport

There would be increased road, rail and shipping movements during construction and operation of the developments, with the potential for cumulative impacts on road, rail and port capacity. The additional road movements associated with the Major Project (Stage 1) would have some impact on traffic and transport, however the existing road network has sufficient capacity to accommodate for this, and no change would occur to the Level of Service provided by the road network.

The environmental impact assessments for the other major projects have concluded that although there would be impacts on traffic and transport, these would be negligible and the capacity of the existing road network would be sufficient. In combination with other major projects, the Outer Harbour development is unlikely to significantly contribute to a cumulative impact on traffic movements in the vicinity of the Outer Harbour.

Noise

There is a potential for noise impacts resulting from construction activities and operations associated with the major developments planned in the vicinity of the Outer Harbour. Noise generated during construction and operation of all the developments would generally be within allowable guideline levels and likely to have minor impacts, with the exception of certain elements of the Port Kembla Coal Terminal and Port Kembla Copper Demolition projects.

The Environmental Assessment for the Port Kembla Coal Terminal project predicted that there would be noise impacts along Bellambi Lane resulting from the project, however the Outer Harbour development does not contribute to noise levels in that area and therefore the cumulative impact would be negligible.

The Port Kembla Copper Site Demolition project would produce significant, albeit short term, noise and vibration impacts as a result of the demolition of the 200m stack. If the demolition was to be undertaken at the same time as the Outer Harbour dredging, there would be the potential for cumulative noise and vibration impacts. As the stack demolition would be a single event, the construction program for the Outer Harbour rock dredging (and more particularly, any rock blasting associated with the dredging) could account for the event and avoid cumulative noise and vibration impacts by avoiding blasting on the same day as the stack demolition.

With noise mitigation measures in place as part of each of the projects, there would be minimal cumulative noise impacts associated with the Outer Harbour development and other major developments.

Air Quality

There would be increased dust and pollutant emissions resulting from construction and operation of the Outer Harbour development, however impacts on air quality would generally be minor, short term and manageable through appropriate dust and pollutant mitigation measures that would be implemented.

Impact assessments for the other major projects have concluded that impacts on air quality would generally be minor, within regulatory limits and manageable with appropriate mitigation. In combination with other major projects, the Outer Harbour development is unlikely to significantly contribute to a cumulative impact on air quality in the vicinity of the Outer Harbour.

28.6 Summary

Potential cumulative impacts of Stage 1 of the Port Kembla Outer Harbour development, in the context of the existing and known major proposed developments in the area, have been assessed.

Construction impacts associated with the developments would occur over a limited timeframe, while operational impacts would occur over a longer timeframe. While there are likely to be cumulative impacts primarily in relation to environmental issues such as traffic and transport, noise and air quality resulting from the construction and operation of the major projects in the area around Port Kembla, the impacts would generally be minor and manageable, assuming the appropriate mitigation measures are implemented. Mitigation measures proposed in this EA and other environmental impact assessments have been designed to control impacts of individual projects and cumulative impacts.

All planned major developments to be undertaken in the vicinity of the Outer Harbour, including the Outer Harbour development, are in line with the existing land use and activities within the area. Cumulative positive socio-economic benefits would be expected as a result of the projects, by promoting increased employment opportunities, improved self-containment of employment, significant investment in the Illawarra Region and more efficient use of existing infrastructure.

Detailed assessments of cumulative impacts for Stages 2 and 3 of the Concept Plan would be undertaken as part of separate project applications and based on proposals at that time.

29.0 Statement of Commitments

29.1 Introduction

This section provides the Draft Statement of Commitments (SoCs) for the proposed Port Kembla Outer Harbour development in accordance with section 75F(6) of the *EP&A Act*. The commitments for Concept Plan and Major Project have been presented in separate tables.

The inclusion of appropriate environmental assessment and management measures into the planning, construction and operation of the proposed development will minimise adverse impacts on the environment. Adoption of the relevant measures identified in the draft SoCs into environmental assessments for future project applications during Stage 2 and 3 of the Concept Plan and Environmental Management Plans will be an important component of the proposal and will reiterate the commitment of the proponent and any contractors to the mitigation of environmental impacts identified in this assessment.

The focus of the SoC for the Concept Plan is on what should be undertaken as part of future project applications for Stages 2 and 3 to ensure the environmental assessments for these stages are comprehensive and robust. In addition, the SoC for Concept Plan incorporates broad measures to avoid, minimise, manage, mitigate, offset and/or monitor impacts associated with the total development.

The draft SoC for Major Project (Stage 1) incorporates measures to avoid, minimise, manage, mitigate, offset and/or monitor impacts identified in this Environmental Assessment but to a level of detail suitable for implementation during the construction and operation of Stage 1.

29.2 Environmental Management Plan Framework

The proposed development will be delivered in a series of discrete and sequential stages. Preliminary programs propose Stage 1 activities, subject to achieving Major Project Approval, would commence in 2010 and be completed by 2018. Stage 2 would commence in parallel with the completion of Stage 1 and be constructed between 2014 and 2025 while Stage 3 would commence in 2026 (at the completion of Stage 2) and be completed by 2037. Activities proposed in Stages 2 and 3 of the development will be generally consistent with the Concept Plan and subject to separate project applications.

Environmental Management Plan (EMP) Framework documents will be developed for each project within the Concept Plan to guide environmental management in accordance with the conditions of approval and Statement of Commitments for the Concept Plan. Separate EMP Framework for construction (including dredging and reclamation) and operational activities. The EMP Framework will identify the activities to be undertaken, the likely staging of these works and the relevant environmental issues and specific management plans that will apply to each activity. The EMP Framework will comprise administrative tools outlining environmental management practices, safeguard measures to be implemented, timing of their implementation and management as well as monitoring of the process and procedures for the life of the project.

Each discrete phase of construction activity will have its own Construction Environmental Management Plan (CEMP). Similarly, discrete operating units (e.g. terminals) will each have their own Operations Environmental Management Plan (OEMP). All CEMPs and OEMPs will include appropriate strategies and management measures to control and manage environmental risks, assess environmental performance and comply with relevant statutory requirements that are applicable to that part of the project.

The key principles for the suite of EMP's comprise:

- Ensuring that works are carried out in accordance with appropriate environmental statutory requirements, the conditions of approval for the Major Project and Concept Plan and relevant guidelines.
- Ensuring that works are carried out in accordance with the goals and commitments presented in this Environmental Assessment and any future assessments.
- Ensuring that works are carried out in such a way as to minimise the likelihood of environmental degradation occurring.
- Ensuring that works are carried out in such a way as to manage the impact of the works on neighbouring land uses.
- Ensuring that all employees engaged in the works comply with the terms and conditions of the EMP's.
- Providing clear procedures for management of environmental impact, including corrective actions.
- Identifying management responsibilities and reporting requirements to demonstrate compliance with the EMP's.
- Ensuring the EMPs are reviewed periodically and amendments made as required.

29.3 Draft Statement of Commitments

This section describes the general commitments made as part of this Environmental Assessment for both Concept Plan and Major Project. The Statement of Commitments (SoC) identify a combination of matters that will be dealt with in the next stage of the Major Project (detailed design) and implemented during both construction and operation phases. The SoC for Concept Plan also includes matters that require further assessment and/or that must be dealt with during subsequent stages of the development, based on current knowledge and design resolution.

Tables 29-1 and **29-2** describe the commitments identified by this Environmental Assessment to avoid or minimise adverse impacts on the environment during the Concept Plan and Major Project, respectively.

The draft SoCs for Concept Plan and Major Project will be finalised following consideration of the feedback received during public exhibition of the EA.

Table 29-1: Statement of Commitments for Concept Plan

Concept Plan	
Issue	**Environmental Commitment**
Environmental Management	The proposed Outer Harbour development will be constructed and operated generally as described in the *Port Kembla Outer Harbour Development, Environmental Assessment*, prepared by AECOM and dated February 2010 and portrayed in **Figure 5-3** (Concept Plan) and in **Figure 5-5** (Major Project). The proponent will prepare and implement a suite of Environmental Management Plan (EMP) Framework documents that will be developed for construction (including dredging and reclamation) and operation for Stages 1, 2 and 3 of the Concept Plan. Each discrete phase of construction activity will have its own CEMP. Similarly, discrete operating units (e.g. terminals) will each have their own OEMP. All CEMPs and OEMPs will include appropriate strategies and management measures to control and manage environmental risks, assess environmental performance and comply with relevant statutory requirements that are applicable to activities to be undertaken within that stage of the Concept Plan. Sub-plans will be included in the CEMP and OEMP Framework and will be included in each relevant stage of the project as appropriate. Sub-plans that will be required to be prepared for either construction or operation of at least one of the stages of the project will include the following: • Soils and Water Management Plan (SWMP) • Stormwater Management Plan (STMP) • Acid Sulfate Soil Management Plan (ASSMP)

Concept Plan	
Issue	**Environmental Commitment**
	• Spoil Management Plan (SPMP) • Dredging Environment Management Plan (DEMP) • Site Management Plan (SMP) • Hazardous Substance Management Plan (HSMP) • Emergency Response Plan (ERP) • Green and Golden Bell Frog Management Plan (GGBFMP) • Traffic Management Plan (TMP) • Noise Management Plan (NMP) • Air Quality Management Plan (AQMP) • Safety Management Plan (SFMP) • Landscape Management Plan (LMP) • Conservation Management Plan (CMP) • Waste Management Plan (WMP) • Demolition Management Plan (DMP) • Refuelling Management Plan (RMP)
Soil Erosion and Sedimentation	Controls and measures to mitigate soil erosion and sedimentation construction and operation impacts as a result of Stage 1 of the Concept Plan are detailed within the Major Project SoC (**Table 29-2**). A *Soils and Water Management Plan* (SWMP) would be prepared prior to the commencement of construction activities and will be included as a sub-plan in the relevant CEMP for that stage. The SWMP will be prepared in accordance with Landcom's *Managing Urban Stormwater; Soils and Construction Manual 2004* and will be maintained for the duration of the construction process and operational period. A *Stormwater Management Plan* (STMP) would be prepared prior to the commencement of operation of activities. Potential impacts to soil erosion and sedimentation as a result of Stages 2 and 3 of the Concept Plan will be identified during environmental assessments undertaken to support project applications for those stages. Controls and measures to mitigate impacts will be incorporated into SWMPs and STMPs to be implemented during construction and operation phases for Stages 2 and 3, respectively.
Hydrology and Water Quality	A SWMP would be prepared prior to the commencement of key project components and will outline specific measures to ensure impacts to water quality and hydrology during construction of each stage of the Concept Plan are minimised. Monitoring programs for water quality and biology will be developed, in consultation with DECCW and the Port Kembla Harbour Environment Group, and implemented for each stage of the Concept Plan. These monitoring programs will outline monitoring frequencies and testing procedures and results will be used to identify emerging trends or problems, provide data for measuring the impact of operational activities, determine whether pollution controls are working and provide a basis for efficient response to emergencies such as spills. PKPC will ensure that hydrological and ecological considerations are taken into account in the stormwater design for terminals for all stages of terminal construction. Water sensitive urban design (WSUD) will be utilised where ever practicable to reduce the volume, velocity and contaminants associated with stormwater runoff.
Contaminated Sediments	Mitigation measures proposed to manage contaminated sediment impacts associated with Stage 1 will be included within a DEMP and are presented in the Major Projects SoC (**Table 29-2**). A DEMP will also be prepared prior to dredging activities for Stage 3 and will broadly

Concept Plan	
Issue	**Environmental Commitment**
	include the following: • Description of extraction methodology and machinery to be employed. • Identification of dredge areas. • Identification of disposal (reclamation) areas. • Turbidity control devices (floating booms, silt curtains). • Erosion and sediment control measures. • Water and air quality monitoring locations. Additional Contaminated Sediment Investigations will be undertaken as part of subsequent project applications for Stage 3. The additional investigations will assess potential contaminated sediment impacts associated with the following: • Area to be dredged north of Port Kembla Gateway to accommodate the third multi-purpose berth. • Dredging for expansion of the existing ship turning circle located south of the northern breakwater. • Reclamation for northern portion of the multi-purpose terminals. Mitigation measures that are proposed to manage contaminated sediments that are located in these areas will be included in the SMPs for those stages.
Contaminated Soils and Groundwater	Mitigation measures proposed to manage contaminated soil and groundwater impacts associated with Stage 1 will be included within a SMP and are presented in the Major Projects SoC (**Table 29-2**). Additional Contaminated Land Investigations will be undertaken as part of subsequent project applications for Stages 2 and 3. The additional investigations will assess potential contaminated soil and groundwater impacts associated with the following: • An extension of the road link from Christy Drive to connect with the container terminals, • Reconfiguration of rail in the South Yard to enable efficient operation of the western and eastern container facilities (this is in addition to the rail infrastructure upgrade required as part of Stage 1). • An extension of an existing rail siding into and along the length of the container terminals. • New road link from Darcy Road to boat harbour. • Hard stand of landward extent of development west to existing rail lines and south to Foreshore Road. Any contamination 'hot spots' that are identified during subsequent investigations for Stages 2 and 3 will be included within SMPs for those stages.
Human Health and Ecological Risk	Measures proposed to mitigate potential risks for Stage 1 are presented in the Major Project SoC. Where applicable, these measures will also be applied to Stages 2 and 3 of the Concept Plan. *Site Management Plan* PKPC will prepare a SMP for each stage of the Concept Plan which will set our procedures to manage potential risks identified to human receptors and ecological receptors during land based construction works. *Dredging Environment Management Plan* PKPC will prepare a DEMP prior to dredging activities for Stage 3. *Hazardous Substance Management Plan*

Concept Plan	
Issue	**Environmental Commitment**
	An HSMP will be prepared for each Stage of the Concept Plan and will contain the following information where it is relevant to the proposed activities: • Work methods to safeguard against hazards such as spills. Any fuel spillage will be reported, documented and immediately remediated. • Appropriate methyl bromide management procedures for the container terminals. • Separation of the flammable solids and flammable liquids storage areas. • Ammonium Nitrate (AN) storages at the container terminal will be sited and designed to comply with the relevant Australian Standard (AS) in respect to both storage quantities and siting (distance separation). • Transport risk assessment studies which will be conducted for future development at each facility will include an assessment of the transport requirements and risks associated with the transport of Dangerous Goods; • Appropriate training and qualifications for staff involved in the handling of chemicals and in emergency spill response procedures. • Diagrams and descriptions of access and unloading locations will be developed as well as procedures for drivers of vehicles delivering chemicals. • A program of regular monitoring and maintenance of equipment used in the transportation and handling of chemicals. • A register of equipment, responsibilities and procedures for responding to spills. • A program of monitoring of the condition of bunding. • *Emergency Response Plan* An Emergency Response Plan (ERP) will be prepared as part of the OEMP for each of the general cargo terminals and container terminals. The ERP will be prepared in accordance with the HIPAP No.1 Emergency Planning Guidelines. *Additional Assessments* A further qualitative risk assessment will be undertaken once dredging methodology has been confirmed, prior to the commencement of dredging tasks in Stage 1 and Stage 3, and will include: • A further qualitative risk assessment of contaminated sediment dispersal to assess potential risks to ecological receptors. • Recommendations and mitigation measures that arise from these additional assessments will be incorporated into the DEMP.
Potential Hazard	*Hazardous Substance Management Plan* PKPC will ensure that the risks that may be associated with potential hazards will be maintained within the permissible levels via mitigation measures included in a HSMP. Measures will include: • The container terminal will be designed with appropriate Methyl Bromide dosing and capture systems and operated in a manner that minimises the risk of release of potentially harmful gas. • The flammable solids storage area will be separated from the flammable liquids storage area by a minimum of 35m.

Concept Plan	
Issue	**Environmental Commitment**
	• The risks associated with the potential storage of toxic gases will be specifically addressed in the individual environmental impact assessments conducted for the various terminal operators. Appropriate risk reduction measures that may be determined as a result of this assessment will be included in the terminal design and operational procedures, where applicable.
Flora and Fauna	*Compensatory Measures* Compensatory measures to offset the loss of soft substrate habitat in the Outer Harbour and the sandy beach area of Red Beach are proposed for Stage 1 of the Concept Plan. A summary of these measures is presented in the Major Project SoC. The need for additional compensatory measures for Stages 2 and 3 will be considered during environmental assessments prepared as part of project applications for those stages. *Green and Golden Bell Frog Management Plan* The GGBFMP framework prepared as part of this EA will be developed into a comprehensive GGBFMP in consultation with a suitably qualified ecologist and DECCW prior to the commencement of construction works for Stage 1. The GGBFMP developed for Stage 1 construction works will be reviewed and updated for environmental assessments that will be undertaken as part of project applications for Stages 2 and 3. Each GGBFMP will include the following as a minimum: • Program of works and timeline for all key components of the project • Undertake a conservation assessment ranking for any known or likely GGBF habitats in the study area, including but not limited to, identification and assessment of breeding, shelter, foraging, and movement habitat components. • Identify any actual or potential threats from construction and operations • Identify appropriate actions to prevent or minimise actual or potential threats • Include details of how the proponent will monitor and report on the ongoing effectiveness of the GGBFMP • A program of works and timeline for planting and landscaping in appropriate areas with vegetation suitable for GGBF foraging and shelter as well as installing structures (such as logs and concrete pieces) to facilitate movement and over wintering habitat. • A feasibility assessment of retaining and/or enhancing shelter, foraging and movement habitat or potential breeding habitat along the proposed road corridor off Darcy Road. Mitigation measures proposed to manage impacts on GGBFs for Stage 1 construction works are detailed in the Major Project SoC. The need for additional breeding ponds to be constructed to offset impacts to potential foraging habitat for populations of GGBF (particularly adjacent to Site 8) will be assessed as part of project applications for Stage 2 and Stage 3 of the Concept Plan. Ecological impacts of the Concept Plan will be reviewed as part of project applications for Stages 2 and 3 including impacts on threatened species, populations and ecological communities, and riparian and stream ecology (Salty Creek).

Concept Plan	
Issue	**Environmental Commitment**
Rail	Recommendations for rail infrastructure upgrade and arrangements for Stage 1 are presented in the Major Project SoC. Adequacy of the existing rail infrastructure and capacity of the regional network will need to be reassessed prior to the construction and operation of Stages 2 and 3. The following commitments are proposed to assess rail infrastructure and network capacity for Stages 2 and 3: • PKPC will participate in the *Maldon Dombarton Study*, ensuring that the Outer Harbour is included as a main destination for goods in the Maldon Dombarton Study. • PKPC will liaise with RailCorp regarding access from the Outer Harbour to the Unanderra Line (a distance of 4km).
Traffic	A Traffic Management Plan (TMP) will be prepared by PKPC in accordance with Traffic Control at Worksites (RTA, 2003), prior to construction of Stage 1 in order to minimise impact on pedestrian and vehicle movements. The proposed content of the TMP is detailed in the Major Project SoC. Future traffic and transport assessments will be undertaken as part of project applications for Stages 2 and 3. This will include an assessment of the traffic impacts associated with the changes to the road network and to separate port related traffic and public traffic accessing the boat harbour.
Noise	*Noise Management Plans* A Construction Noise Management Plan (CNMP) will be prepared by PKPC prior to the commencement of construction of Stage 1 in line with DECCW "Draft Construction Noise Guidelines". The content of the CNMP is detailed in the Major Project SoC. PKPC will prepare an Operational Noise Management Plan (ONMP) prior to the commencement of operation of each stage of the Concept Plan. It is understood that a rail infrastructure planning study for Port Kembla Outer Harbour will be undertaken in 2010. An assessment of the acoustic impact arising from changes to the rail infrastructure associated with Stages 2 and 3 of the Concept Plan will be undertaken to complement this planning study. Sleep disturbance arising from increased rail movements associated with Stages 2 and 3 of the Concept Plan will be investigated at this stage. Noise and vibration assessments will be undertaken as part of applications for project applications for Stages 2 and 3 to assess both construction and operation impacts.
Air Quality	An AQMP will be prepared for inclusion in the CEMP and OEMP for each stage of the Concept Plan. Site specific mitigation measures for the management of particulate emissions during construction and operation of each of the stages of the Concept Plan will be included in AQMPs. Mitigation measures to be included in the AQMP for Stage 1 are detailed in the Major Project SoC (**Table 29-2**). PKPC will assess future operations at the development site on a case by case basis, for potential impacts on the local air shed, with consideration of the regional and local pollution findings of the Air Quality Impact Assessment (AQIA Report, AECOM 2009). Further analysis and atmospheric dispersion modelling will be undertaken for Stages 2 and 3 of Concept Plan. The reporting of this modelling will be included in separate project applications for Stage 2 and 3 of the Concept Plan.

Concept Plan	
Issue	**Environmental Commitment**
Socio-Economic	Throughout the progressive development of the Concept Plan PKPC will ensure that access to the existing small boat harbour and associated facilities is not affected during either the construction of operational activities of each stage. In addition, PKPC will include appropriate measures in a SFMP to ensure that safe access is provided for recreational boaters entering and exiting the small boat harbour. PKPC will continue to liaise with community groups to inform them about project status throughout the development of the Concept Plan.
Landscape and Visual Amenity	PKPC will prepare a *Landscape Management Plan* to ensure visual impacts associated with Stage 1 are minimised. The content of the LMP is detailed in the Major Project SoC. LMPs will be prepared for CEMPs and OEMPs for each stage of the Concept Plan and will include the following: • Lighting used for evening and night time work will be projected downward and onto the proposed works. • Construction timing should be programmed to ensure efficiency of works and minimise period of disturbance. • Construction areas and plant/machinery and materials storage areas will be clearly designated and clearly defined. • Lighting for terminals and other operational areas, including the new road link, will be carefully selected to minimise light spill • A Landscape Management Plan (LMP) will be prepared to guide any landscaping works that are proposed across the area of development. Suitable colours and materials will be selected for the terminal pavement, buildings and other structures to minimise reflectivity and contrast. Landscape and Visual Amenity assessments will be undertaken as part of project applications for Stages 2 and 3.
Heritage	An archival photographic recording will be prepared prior to demolition of No. 3 and No. 4 Jetties (part of Stage 1) and a comprehensive history of the jetty prepared. An archival photographic recording will be prepared prior to demolition of No. 6 Jetty during Stage 3 and a comprehensive history of the jetty prepared. Should shipwreck material be retrieved during dredging or other activities during Stages 1 and 3, works in the immediate vicinity should cease and a suitably qualified heritage professional will be contacted to assess the discovery and provide advice of mitigation or other measures. The environmental assessment to be undertaken as part of a project application for Stage 2 will consider the intrusion of the new road link connecting Darcy Road with the boat harbour on accessibility between the concrete pillbox and the Historic Military Museum and incorporate sympathetic landscaping. PKPC will ensure the design of the new road limits intrusion on the listed heritage items. A Conservation Management Plan (CMP) will be prepared for the Mobile Block Setting Crane prior to commencing construction activities within the proximity of the item during Stage 2, and include nomination for inclusion on the State Heritage Register. If required to be relocated, suitable prominent locations for relocation and interpretation of the crane will be investigated.

Concept Plan	
Issue	**Environmental Commitment**
Waste	*Waste Management Plan* WMPs will be prepared for inclusion in relevant CEMPs and OEMPs for all stages of the Concept Plan and will emphasise potential for recovery and reuse of waste, minimise waste generation, and include specific requirements for each of the waste types identified. *Demolition Management Plan* A Demolition Management Plan (DMP) will be prepared to include appropriate management measures for the dismantling, removal and disposal of structures and materials during Stages 1 and 3. Waste assessments will be undertaken for Stages 2 and 3 as part of project applications for these stages. Waste generated as part of Stages 2 and 3 (that cannot be reused in the reclamation) are likely to include material from demolition activities such as wooden piles, concrete, steel, and scrap metal as well as materials during general construction activities, including plant and equipment maintenance waste (chemical containers and batteries), and office and amenity wastes (paper, ink cartridges, food waste).
Sustainability	Throughout all stages of the Concept Plan PKPC is committed to the following: • Consider the potential for incorporating local renewable power generation (e.g. from micro and large scale wind turbines) as part of future design and construction works. • Consider the potential for power generation from the sun by encouraging future tenants and lessees to install panels on structures to take advantage of the solar potential. • Investigate the potential for water capture and reuse during the detailed design of terminals. Recommendations and mitigation measures to manage sustainability issues identified during this environmental assessment will be reviewed as part of environmental assessments for Stages 2 and 3, and revised to incorporate new technological innovations that could be considered and implemented as part of the total development.
Climate Change	Throughout all stages of the Concept Plan PKPC is committed to the management of the impacts of a variable climate and extreme weather conditions as follows: • The proposed reclamation and pavement levels will be set above predicted extreme sea level rises (i.e. including storm surges and extreme events) for the 100 year design life, with a freeboard suitable to cater for further sea level rise beyond that time. • Risk management strategies will be in place for extremely hot days to manage potential rail buckling. • Maintenance regimes will take accelerated degradation of infrastructure into account. Assessments for Stages 2 and 3 will review the findings of this assessment in light of the latest climate change projections and statistics.

Table 29-2: Statement of Commitments – Major Project

Major Project	
Issue	**Environmental Commitment**
Construction Phase	
Major Project - General	The proposed Outer Harbour development will be constructed and operated generally as described in the *Port Kembla Outer Harbour Development, Environmental Assessment*, prepared by AECOM and dated February 2010 and portrayed in **Figure 5-3** (Concept Plan) and in **Figure 5-5** (Major Project). The proponent will prepare and implement a suite of Environmental Management Plan (EMP) Framework documents that will be developed for construction (including dredging and reclamation) and operation for Stage 1. Each discrete phase of construction activity will have its own CEMP. Similarly, discrete operating units (e.g. terminals) will each have their own OEMP. All CEMPs and OEMPs will include appropriate strategies and management measures to control and manage environmental risks, assess environmental performance and comply with relevant statutory requirements that are applicable to that part of Stage 1. A number of sub-plans will be included in relevant CEMPs and OEMPs and will include the following, where relevant: • Soils and Water Management Plan (SWMP) • Stormwater Management Plan (STMP) • Acid Sulfate Soil Management Plan (ASSMP) • Spoil Management Plan (SPMP) • Dredging Environment Management Plan (DEMP) • Site Management Plan (SMP) • Hazardous Substance Management Plan (HSMP) • Emergency Response Plan (EMP) • Green and Golden Frog Management Plan (GGFMP) • Traffic Management Plan (TMP) • Noise Management Plan (NMP) • Construction Noise Management Plan (CNMP) • Operational Noise Management Plan (ONMP) • Air Quality Management Plan (AQMP) • Safety Management Plan (SFMP) • Landscape Management Plan (LMP) • Conservation Management Plan (CMP) • Waste Management Plan (WMP) • Demolition Management Plan (DMP) • Refuelling Management Plan (RMP)

Major Project	
Issue	**Environmental Commitment**
Soil Erosion and Sedimentation	*Soils and Water Management Plan* SWMPs will be prepared by PKPC prior to commencement of construction of Stage 1 and will be included where relevant in the CEMPs for that stage. The SWMPs will be prepared in accordance with Landcom's *Managing Urban Stormwater; Soils and Construction Manual 2004*. *Erosion and Sedimentation Controls* Management controls aimed at containing, redirecting, and stabilising soils that are unavoidably disturbed by construction activities will include: • Installing water diversion structures to ensure surface water runoff does not enter zones of exposed soils during construction, particularly in the vicinity of the new road link from Christy Drive, and rail infrastructure upgrade in the South Yard. • Installation of erosion and sedimentation control devices prior to excavation at the site, that will remain in place until the bare soils and surfaces are stabilised temporarily or permanently (by suitable surface materials, revegetation or other means) and removed when redundant. • Installing sediment traps around areas of soils that will be exposed as a result of construction activities to protect downstream water quality. Sediment traps will be maintained and will remain in place until all works are finalised and surfaces are stabilised. • Installing buffers to the riparian zone, for example sediment fences, to prevent sediment laden water from entering Salty Creek, Darcy Road Drain, and the Outer Harbour. • Installing filter rolls at stormwater drain locations to minimise potential for sedimentation of drains and subsequent flooding during heavy rainfall. • Implementation of site management procedures including watering or covering of unsecured stockpiles of reclamation material (if stockpiles contain fines) anticipated to be exposed and unused for a period longer than two continuous weeks. • Limiting the area of disturbance to those locations necessary to construct the new roads, reclamation area and rail infrastructure upgrade. • Disturbed areas will be restored (sealed or covered with pebbles/gravel or vegetated, as appropriate) upon the completion of the works in that area to ensure that soils are exposed for as short a time as possible. • Daily visual inspections of erosion and sediment control devices to determine the condition and effectiveness of control measures. Immediate action will be taken to repair any control devices that have failed to work adequately. Emergency procedures will be detailed for high rainfall events that could increase soil erosion during construction. *Fill materials, dredging and reclamation* • Environmentally suitable fill materials will be used for reclamation only. • Appropriate soil enhancement procedures and treatments will be implemented, as required, to facilitate consolidation of soft material and minimise slumping. • Soils confirmed to be Actual ASS will be handled in accordance with the Acid Sulfate Soil Management Plan (ASSMP).

Major Project	
Issue	**Environmental Commitment**
	• PKPC will carefully consider the disposal/placement of potential ASS and preference will be given to disposal/placement of Potential ASS in locations beneath the water to avoid exposure to oxygen. • Where feasible, reclamation will be undertaken with a material which will allow for a similar groundwater flow to the current flow regime into the Outer Harbour. *Terminal hardstand and temporary unpaved surfaces* • The surface material of reclaimed areas that are to remain unpaved until Stage 2 will be selected and prepared to minimise potential erosion. If surface fill material is susceptible to erosion a suitable surface layer with low erosive qualities will be laid.
Hydrology and Stormwater Design	*Soil and Water Management Plan* A SWMP will be prepared to document mitigation measures to manage hydrology and water quality impacts associated with construction of Stage 1. The SWMP will include the following measures: • A control system to ensure that bulk material stockpiles and materials within handling areas are contained onsite, through the use of containment walls, bunding, stormwater and dust controls. Any excess sediment laden runoff will either be contained within the bunded storage areas or directed to a land based treatment area. A program of regular monitoring and maintenance of the storage and handling of bulk materials will be implemented. • Measures to minimise excess materials being deposited offsite during loading and transportation of bulk materials from the material handling area. Controls such as vehicle shaker pad, use of vacuum road sweepers, covering loads during transport and dust suppression. • Emergency spill response procedures will also be included in the Emergency Response Plan (ERP). *Dredging Environment Management Plan* A DEMP will be prepared and implemented for all stages of Stage 1, incorporating: • Description of extraction methodology and machinery to be employed. • Identification of dredge areas. • Identification of disposal areas. • Turbidity control devices (floating booms, silt curtains). • Erosion and sediment control measures. • Water and air quality monitoring locations. *Salty Creek and Darcy Road Drain* PKPC will design and size channel structures or culverts to convey flows from Salty Creek and Darcy Road Drain through the reclamation area for flood events up to the 100 year ARI design storm event. The design of these structures will consider: • Potential climate change impacts due to increasing sea levels and rainfall intensities. • Possible hydraulic impacts due to flows greater than the 100 year ARI storm and up to the Probable Maximum Flood and/or due to blockage of the structure. • Fish passage. Consideration should be given for the incorporation of a V-shaped recess in the floor of the culverts to facilitate movement of fish and other mobile

Major Project	
Issue	**Environmental Commitment**
	aquatic species during periods of low flow. • Water sensitive urban design (WSUD) will be utilised where ever practicable to reduce the volume, velocity and contaminants associated with stormwater runoff.
	Potential Pollutants Handling The handling of oils and fuels, washing of all equipment, (including all concreting equipment) will be undertaken within bunded areas or containers and pollutants trapped in bunded areas will be disposed of in accordance with the waste management section of the CEMP. Any fuel spillage will be reported, documented and immediately remediated. Collected contaminated material will be disposed of as per the management section of the CEMP and in accordance with the NSW Waste Classification Guidelines 2008. *Water Quality and Biological Monitoring programs* PKPC will develop water quality and biological monitoring programs, in consultation with the Port Kembla Harbour Environmental Group and DECCW, during construction and operation. The water quality and biological monitoring programs will form part of the CEMP and will: • Identify monitoring parameters. • Identify representative monitoring locations and frequency of monitoring. • Identify testing procedures (ensuring chemical testing is undertaken by NATA accredited laboratory). • Outline the framework and format for reporting monitoring results.
Contaminated Sediments	*Acid Sulfate Soils* An ASSMP will be prepared prior to the dredging and reclamation works. Measures for the appropriate management of Acid Sulfate Soils, in line with the ASSMAC. These measures will either ensure that future works avoid exposing Potential Acid Sulfate Soils (PASS) to air or provide for appropriate management of the PASS. *Dredging Environmental Management Plan* A DEMP will be prepared based on the measures recommended by the AECOM Sediment Investigation, 2010 and will include: • Procedures for sediments to be dredged and emplaced in the reclamation area at essentially the same time (to avoid the need for land storage and wastewater management, and avoid the exposure of PASS.) • Dredged sediments deposited as part of the proposed reclamation will be contained and effectively encapsulated and confined in an engineered containment structure which will be constructed of clean imported fill. • Dredged sediments will be placed at depth, below the depth of wave action at the base of the reclamation fill. • Dredging and reclamation will be undertaken within the protection of parallel silt curtains encompassing the dredging and placement areas. • Dredging technologies will be selected in consideration of their ability to minimise the generation of turbidity. • Turbidity monitoring will be employed in conjunction with twice daily observations by personnel undertaking the dredging and reclamation activities to assist in early identification of problems and proactive implementation of mitigation measures.

Major Project	
Issue	**Environmental Commitment**
	• Regular monthly flyovers will be undertaken to assess the presence of potential sediment plumes and algal blooms from the dredging or placement areas. • Contingency measures will be implemented immediately in the event visible turbidity and harbour water quality impacts are identified during routine monitoring. The DEMP will refer to the ASSMP and will include appropriate management measures for: • Handling and transportation of PASS below water. • Any PASS dredged material will be encapsulated and confined within an engineered containment structure (bunded area) at a lower harbour depth within the reclamation. • The removal of PASS from dredged material to land (if encapsulating and confining the material underwater is not possible). • Any mobilisation of disturbed soils that are confirmed to be AASS. Twice-daily manual measurements of turbidity will be carried out in conjunction with observations by personnel undertaking the dredging and reclamation activities to assist in early identification of problems and proactive implementation of mitigation measures. *Human Health Risk Assessment* The risk to human health and the environment associated with the contaminated sediment (in particular the identified sediment contamination hotspots) should be evaluated by a further qualitative risk assessment. If the risk assessment concludes that the contamination hotspots present an unacceptable risk to the environment, a Remedial Action Plan will be prepared to appropriately manage the identified materials of concern. *Ground Water Considerations* The reclamation will be designed to ensure that the existing groundwater flow regimes are not significantly altered and that there is no increased risk of harm associated with groundwater contamination.
Contaminated Soils and Groundwater	*Site Management Plan* PKPC will prepare a SMP prior to the commencement of construction to manage excavation works and to address the following: • Contamination 'hotspots' based on visual observations and through detailed soil sample analysis if required. • Appropriate management of contamination including selective excavation (to minimise quantities), stockpiling, characterisation and disposal (likely to an off-site soil remediation facility) assuming that the material is not suitable for inclusion within the reclamation area. • Develop a groundwater monitoring program to be conducted at the site prior to the commencement of the works and annually thereafter. This program will be designed and undertaken so as not to impede construction or operation of the development. *Pacific National South Yard* A Limited Phase Two Environmental Site Investigation will be undertaken prior to the commencement of works at the proposed site for the extension of the railway siding at the Pacific National South Yard, to assess potential contamination issues in this area.

Major Project	
Issue	**Environmental Commitment**
Human Health and Ecological Risk	*Dredging Environment Management Plan* Prior to commencing dredging a further qualitative assessment will be undertaken to address potential risks to ecological receptors associated with contaminated sediment dispersal. The assessment will consider the following: • Potential indirect effects or risks to marine ecosystem or communities outside the heavily impacted PKOH area. • Potential indirect risks to human health due to toxic dinoflagellate blooms or bioaccumulation of contaminants into edible fish or shellfish. • The extent to which protected or recreationally important species are present within the PKOH. This assessment should be based on detailed design of the dredging works and specific environmental management safeguards aimed at minimising and containing contaminated sediment dispersal. Recommendations and mitigation measures that arise from the additional assessment will be incorporated into the DEMP. PKPC will prepare a HSMP for construction of Stage 1 that will address the following: • Handling of oils and fuels and the washing of all equipment, including all concreting equipment, in accordance with the DECCW Bunding and Spill Management Guidelines: Storing and Handling Liquids: Environmental Protection - Participants Manual and Environmental Compliance Report: Liquid Chemical Storage, Handling and Spill Management - Part B Review of Best Practice and Regulation. • Disposal of any pollutants trapped in bunded areas in accordance with the waste management section of the CEMP and DECCW waste guidelines. • Any fuel spillage will be reported, documented and immediately remediated. *Refuelling Management Plan* PKPC will prepare a Refuelling Management Plan (RMP) which will address on site refuelling if required and which will identify appropriate refuelling locations, proximity to infrastructure, bunding required, location, use of spill kits and monitoring.
Flora and Fauna	*Compensatory Measures* Compensatory measures to offset the loss of soft substrate habitat in the Outer Harbour and the sandy beach area of Red Beach are proposed for Stage 1. A summary of these measures is presented below: • Hard substrate habitat in the form of new berth faces, pile-supported desk areas and rock revetments will be increased as a result of the development. Habitat features that will be incorporated into the design of the hard structures will include: - Boulder-sized rocks placed without cement to offer crevices in the inter-tidal and sub-tidal zones for the use of fish and invertebrates - Artificial rock pools in revetments to provide habitat for species such as sea-hares, sea urchins and octopus - Objects such as concrete knobs, or similar, attached to vertical wall structures to add texture and form for the benefit of colonising organisms.

Major Project	
Issue	**Environmental Commitment**
	• Soft substrate habitat measures will be implemented as part of habitat improvement projects proposed for Tom Thumb Lagoon and Garungaty Waterway (refer **Section 16** and **Appendix G** for additional detail). The measures proposed are intended to complement the existing restoration programs in these areas by increasing fish passage, tidal exchange and promoting estuarine communities such as saltmarsh, mangroves and seagrass. The measures are consistent with Wollongong Council's *Estuary Management Plan* (2007) and the *Plan of Management* prepared for Conservation Volunteers Australia in 2006. The habitat improvement projects will be undertaken over the next 10 years and will include ongoing monitoring and maintenance to ensure that effective habitat outcomes are achieved and sustained on the site. *Dredging Environment Management Plan* The DEMP will address the following: • Ways in which the generation of shockwaves through the water column associated with underwater rock blasting can be reduced as far as it is practicably achievable. • Measures to reduce or minimise negative impacts on marine mammals will be included in the DEMP and will be based on available and relevant guidelines. • To protect migratory marine mammals which are the most sensitive receptor (and important from a conservation point of view), specific mitigation measures may include a marine mammal observer program to be implemented and stop blasting provisions if whales are sighted within specified distances from the development area. *Green and Golden Bell Frog Management Plan* Prior to any works which involve the clearing of vegetation and debris within the development area of Stage 1, a suitable and targeted survey will be undertaken by an ecologist in order to allow for the detection of any GGBF. If GGBF are detected, no clearing works will commence until the GGBF response provisions in the GGBFMP have been implemented. A comprehensive GGBFMP will be prepared prior to the commencement of construction works for Stage 1. The GGBFMP will be prepared by a suitably qualified ecologist and in consultation with DECCW and will be in accordance with the following plans and previous studies: - *Draft Recovery Plan: Green and Golden Bell Frog* (Lesson 1829) *Recovery Plan* (DECCW, 2005) - *Best Practice Guidelines: Green and Golden Bell Frog Habitat* (DECCW, 2008) - *The Green and Golden Bell Frog Key Population at Port Kembla Management Plan* (DECCW, 2007) - *Assessment of Habitat, Dispersal Corridors and Management Actions to Conserve the Port Kembla Key Population of Green and Golden Bell Frog 2007-2008* (Gaia Research, 2008). The GGBFMP will include the following as a minimum: • Program of works and timeline for all key components of Stage 1 • Undertake a conservation assessment ranking for any known or likely GGBF habitats in the study area, including but not limited to, identification and assessment of breeding, shelter, foraging, and movement habitat components.

Major Project	
Issue	**Environmental Commitment**
	• Identify any actual or potential threats from construction and operations, including but not limited to, - habitat loss, modification and disturbance - fragmentation and isolation of habitat - water quality and pollutant issues - road mortality - exotic weed control and application of herbicides containing glyphosate - slashing and mowing - invasion by *Chrysanthemoides monilifera* - predation and disease (refer detailed mitigation measures below). • Identify appropriate actions to present or minimise these actual or potential threats, including, but not necessarily limited to: - Scheduling works to coincide with activity cycles where practicable - Construction of any compensatory habitat prior to proposed habitat loss - Frog fencing - Engaging a suitably qualified ecological consultant to be onsite during construction - Development of response protocols in the event that frogs are found in the active construction areas - Signage - Measures outlined in the frog hygiene protocol. • Include details of how the proponent will monitor and report on the ongoing effectiveness of the GGBFMP including, but not necessarily limited to: - Including the objectives of the monitoring program - Method of monitoring - Data return to DECCW - Licensing - Reporting framework - Duration - Frequency. • A program of works and timeline for planting and landscaping in appropriate areas with vegetation suitable for GGBF foraging and shelter as well as installing structures (such as logs and concrete pieces) to facilitate movement and over wintering habitat. Mitigation measures to minimise the spread of deadly pathogens and disease to the GGBF include the following: • Frog exclusion fencing will be installed around construction sites in close proximity to known or potential GGBF breeding habitats • The construction works site and any open trenches within the development area should be checked each morning during construction for the presence of any Frogs which should be released into nearby ground cover. Handling the species should be minimised. Frog Hygiene Protocol (NPWS, 2001) should be followed to avoid the spread of chytrid spores or other pathogens between aquatic habitats and frog sites. • If necessary, earth-working equipment and vehicles will be cleaned of excess soil by brushing or hosing when they enter and exit the site in order to minimise the likelihood of the spread of weed seeds and plant pathogens.

Major Project	
Issue	**Environmental Commitment**
	• If it is likely that vehicle tyres will result in mud and water being transferred to other bodies of water or frog sites, they should be sprayed with a disinfecting solution as per the Frog Hygiene Protocol (NPWS, 2001). This should be carried out at a safe distance from water bodies, so the disinfecting solution can infiltrate the soil instead. • The importation of water should avoid known areas of breeding habitat in close proximity to construction activities (such as Site 18). • The use of imported mulch or compost should be avoided in any rehabilitation works in the vicinity of known breeding areas and associated dispersal avenues.
Rail	Recommendations for rail infrastructure upgrade and arrangements for network paths for construction and operation of Stage 1 are as follows: • During reclamation activities, PKPC will review the need to install a material handling system to unload fill from trains at the area dedicated to stockpiling imported fill material.
Traffic	*Traffic Management Plan* PKPC will prepare a TMP in accordance with Traffic Control at Worksites (RTA, 2003), prior to construction and operation of Stage 1 in order to minimise impact on pedestrian and vehicle movements. The TMP will outline and manage the transportation routes to the site for heavy vehicles during construction of Stages 1a, 1b and 1c of the Major Project. The TMP will also include: • Access arrangements for heavy vehicle to the site. • Procedures for the delivery and dispatch of products. • Preference for the use of larger trucks in order to minimise vehicular movements. • Haulage routes to and from the site. • Driver protocols. • Use of truck turnaround areas. • Financial penalties. • Truck movement hour restrictions.
Noise	*Construction Noise Management Plan* A Construction Noise Management Plan (CNMP) will be prepared by PKPC prior to the commencement of construction of Stage 1 in line with DECCW "Interim Construction Noise Guidelines'" in order to minimise the noise impact at sensitive receivers. The CNMP will include: • Notification of and maintaining regular contact with noise-affected neighbours. • Maintaining a complaints register and complaints handling. • Operating plant in a quiet and efficient manner. • Adoption where practicable of alternative work practices which generate less noise. For example, the use of hydraulic rock splitters instead of rockbreakers, or electric equipment instead of diesel or petrol powered equipment, amongst other management measures. PKPC is committed to the selection of acoustically considerate plant where possible and the use of noise reducing measures such as silencers, multi-frequency reversing alarms, visual system reversing warnings, enclosures and shrouds.

Major Project	
Issue	**Environmental Commitment**
	The construction noise level emission and the potential annoyance to sensitive receptors will depend on the final selection of equipment, type of operation, activity duration and the time of day at which works are conducted. Additional noise impact assessment will be carried out if the construction plant to be used on site differs significantly from that assumed for modelling purposes in the Acoustic Assessment Report (AECOM, February 2010). *Rock Blasting* PKPC will ensure that site specific data gathered during trial blasts (to refine and determine methods for the blasting of bedrock) is used to refine and calibrate the calculations prior to any blasting taking place. *South Yard* The construction schedule, including working hours and types of plant working simultaneously, for the South Yard works will be carefully considered at the construction planning stage, to reduce the predicted impact of construction noise associated with the South Yard upgrade.
Air Quality	*Air Quality Management Plan* PKPC will prepare an AQMP and mitigation measures will include but not be limited to: • Transport loads and materials will be covered to avoid generating wind-blown dust. • Site surfaces will be wetted down during dry weather including excavation sites, haul roads, spoil stockpiles and other exposed areas. • Vehicular access will be confined to designated access roads. • Shaker pad facilities will be provided for construction trucks and machinery leaving site. • Instantaneous dust monitoring will be undertaken at the site boundary. Regular checks on exhaust emissions from construction equipment, trucks, plant and machinery will be undertaken. • Construction site speed limits will be implemented.
Landscape and Visual Amenity	*Landscape Management Plan* PKPC will prepare a LMP for construction of Stage 1 which includes site specific measures and controls including: • Projection of lighting used for evening and night time work will be downward and toward site works to minimise light spill on adjacent areas. • Clear definition of materials storage areas, compounds and construction areas and boundaries. • Construction timing will be programmed to minimise period of disturbance.
Heritage	*Archival photographic recording* An archival photographic recording will be prepared prior to demolition of No. 3 and No. 4 Jetties (part of Stage 1) and a comprehensive history of the jetty prepared including a description of their structure and operation. *Historical shipwrecks* Should shipwreck material be retrieved during dredging or other activities during Stage 1, works will cease and a suitably qualified heritage professional will be contacted to assess the discovery and provide advise on mitigation or other measures.

Major Project	
Issue	**Environmental Commitment**
Waste	*Waste Management Plan* PKPC will ensure that appropriate general and hazardous waste identification, handling, storage, transportation, disposal and monitoring measures, to be followed on-site during construction for Stage 1 are included in a WMP which is to form part of all relevant CEMPs. PKPC will ensure these management measures as well as on site waste management activities are undertaken in accordance with the relevant NSW and Commonwealth Regulations and Guidelines. *Demolition Management Plan* The DMP for Stage 1 will include appropriate management measures for the dismantling, removal and disposal of structures and materials from No. 3 and No. 4 Jetties.
Operation Phase	
Hydrology and Water Quality	*Operation Environment Management Plan* The OEMP will include the following measures to ensure the appropriate management of materials handled at the first multi-purpose berth: • A control system to ensure that bulk material stockpiles and materials within handling areas are contained onsite, through the use of containment walls, bunding, stormwater and dust controls. • Any excess sediment laden runoff will either be contained within the bunded storage areas or directed to a land based treatment area. • Implementation of a program of regular monitoring and maintenance of the storage and handling of bulk materials will be implemented. • Measures to minimise excess materials being deposited offsite during loading and transportation of bulk materials from the material handling area. • Implementation of controls such as vehicle shaker pads, use of vacuum road sweepers, covering loads during transport and dust suppression. • Inclusion of emergency spill response procedures in the ERP. *Water sensitive urban design* WSUD will be utilised where ever possible to reduce the volume, velocity and contaminants associated with stormwater runoff. *Stormwater Management Plan* A STMP will be prepared to appropriately manage the accumulation of surface water from rainfall, storm events and stockpile watering. The STMP will outline the management of surface water for operation of Stage 1 (central portion of the multi-purpose terminals) and measures for treatment such as a first flush stormwater capture system. Management of surface water will be considered and confirmed during detailed design but is likely to include harvesting of water from roofs of buildings and other roofed structures.
Potential Hazards	*Emergency Response Plan* PKPC will prepare an ERP in accordance with the HIPAP No.1 Emergency Planning Guidelines as part of the OEMP of the multi-purpose terminal. *Hazardous Substance Management Plan* PKPC will prepare a HSMP as part of the OEMP that will be implemented during the operation of the first berth including as a minimum, the following measures to prevent and respond to spills: • A system to ensure that all staff involved in the handling of chemicals are suitably qualified and trained in emergency spill response procedures.

Major Project	
Issue	**Environmental Commitment**
	• Diagrams and descriptions of access and unloading locations and procedures for drivers of vehicles delivering chemicals. • A program of regular monitoring and maintenance of equipment used in the transportation and handling of chemicals. • A register of equipment, responsibilities and procedures for responding to spills. • A program of monitoring of the condition of bunding. • Procedures for maintenance activities for the Sulphuric acid pipeline that will be relocated from Berth 206.
Traffic	*Traffic Management Plan* A TMP will be included in the site OEMP. The Plan will address work practices on site, haulage routes to and from the site, driver protocols, financial penalties and hours of operation amongst other measures.
Rail	Recommendations for rail infrastructure upgrade and arrangements for network paths for construction and operation of Stage 1 are as follows: • Rail infrastructure upgrade in the South Yard required for operation of Stage 1 will comprise extension of siding No. 13 by 120m to 780m and turnout installation and removal. • Agreement will be sought from ARTC to allow the use of five train paths per day, in each direction on the Unanderra Line.
Noise	*Operational Noise Management Plan* PKPC will prepare an ONMP as part of the OEMP, prior to the commencement of operation of the proposed development. PKPC will consider the use of a visual signalling system, or other suitable options, as an alternative to sounding train horns in the South Yard during night time rail operations. PKPC will carry out an additional noise impact assessment, if it is found, after detailed design and operations planning, that the finalised operational scenario differs significantly from that used for modelling purposes in the Acoustic Assessment (AECOM, February 2010).
Air Quality	*Air Quality Management Plan* PKPC will ensure that the AQMP includes appropriate site specific mitigation measures for the management of particulate emissions during the operation of the proposed development such as: • Sealing roads and areas susceptible to windblown dust impacts. • Covering of transport loads. • Watering and/or using surfactants on stockpiles. • Covering of bulk cargo stockpiles (where necessary practicable). • Instantaneous dust monitoring at the boundary of the site most affected by dust impacts. • Reclaimed areas for future terminal development to be covered with suitable compacted materials to ensure fugitive dust emissions are minimised. • Site specific mitigation measures for the management of particulate emissions during the operation of the proposed development's night time operation.

Major Project	
Issue	**Environmental Commitment**
Landscape and Visual Amenity	*Landscape Management Plan* PKPC will ensure that the LMP includes appropriate site specific measures and controls to mitigate potential visual impacts on the immediate, local, and regional landscape including: PKPC will prepare a LMP which includes: • Lighting for the portion of the dry bulk/multi-purpose terminal that will be operational as part of Stage 1 and other operational areas, including the new road link, will be carefully selected to minimise light spill on surrounding areas outside the terminal boundaries and minimise visual impact when viewed from adjacent premises. • Selection of suitable colours and materials for the terminal pavement, buildings and other structures to minimise reflectivity and contrast.
Sustainability	As per Concept Plan
Climate Change	As per Concept Plan
Waste	*Waste Management Plan* PKPC will ensure that appropriate general and hazardous waste identification, handling, storage, transportation, disposal and monitoring measures, to be followed on-site during operation of the proposed development, are included in a WMP which is to form part of the OEMP. PKPC will ensure these management measures as well as on site waste management activities are undertaken in accordance with the relevant NSW and Commonwealth Regulations and Guidelines. The following measures will be included as a minimum in the WMP: • Incoming vessels to the Port will be subjected to assessment in accordance with the Quarantine Act 1908. Australian Quarantine Inspection Service (AQIS) manages quarantine controls at our borders to minimise the risk of exotic pests and diseases entering the country. Incoming vessels will have to apply to the AQIS: form s20AA Permission to Enter an Australian Non-Proclaimed First Port of Entry and/or Application for s33 Permission to Enter Subsequent Ports of Call. • The OEMP should incorporate requirements as in the National Ballast Water Management Arrangements under the Australian National System for the Prevention and Management of Marine Pest Incursions.
Socio-Economic	• PKPC will ensure that access to the existing small boat harbour and associated facilities is not affected during either the construction or operational phase of Stage 1. • PKPC will include appropriate measures in a SFMP for Stage 1 to ensure that safe access is provided for recreational boaters entering and exiting the small boat harbour, particularly during reclamation and dredging activities. • PKPC will continue to liaise with community groups during Stage 1 to inform them about project status and timing for construction key project components.

30.0 Environmental Risk Analysis

The Environmental Risk Analysis (ERA) addresses all potential environmental risks associated with the proposed Outer Harbour Development (refer **Table 30-1**). The ERA is based on the risk assessment undertaken for the PEA, which was a preliminary assessment of the potential environmental risks associated with the Outer Harbour development. The preliminary ERA has been revised in light of the detailed environmental assessment and the mitigation measures, outlined in the Statement of Commitments (SoC; **Section 29**) and relevant sections of the EA that will minimise impacts on the environment.

The ERA makes reference to the appropriate Environmental Management Plans (EMPs), within which these mitigation measures will be included. The ERA also identifies potential residual impacts and allocates a residual risk associated with the post-mitigation environmental impacts.

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Table 30-1: Environmental Risk Analysis

Environmental Issue	Allocation of Risk Pre- Mitigation	Assessment and Mitigation Measure	Residual Impact	Allocation of Risk Post-Mitigation
Contamination (including Geology and Soils)				
Mobilisation of potentially contaminated fill during land based excavation activities i.e. road/rail construction.	**High**	Disturbance of fill materials would be controlled by a CEMP that will be prepared to manage excavations, identify hotspots; and manage contamination, stockpiles and disposal of spoil. Preparation of a Soils and Water Management Plan with reference to the *Managing Urban Stormwater: Soils and Construction Guidelines* (Landcom, 2004) to minimise soil erosion, sedimentation, and mobilisation of contaminated sediments resulting from construction and operation. Preparation of a Site Management Plan. Refer to **Sections 10** and **11**.	Negligible	**Low**
Disturbance of areas within the Outer Harbour where contaminated sediments have been placed from Inner Harbour dredging campaigns.	**High**	Dredging, placement and encapsulation of sediments to be managed by a Dredging Environmental Management Plan, Spoil Management Plan and Soil and Water Management Plan, to minimise mobilisation of sediments and turbidity resulting from dredging. Refer to **Sections 10, 11** and **14**.	Short term residual impact during particle settling post-blasting and dredging activities	**Medium**
Demolition of jetties and berths.	**Medium**	Preparation of a Demolition Management Plan, which would outline environmental control devices to reduce the impacts of demolition e.g. on water quality. Refer to **Sections 14** and **27**.	Negligible	**Low**

Environmental Issue	Allocation of Risk Pre- Mitigation	Assessment and Mitigation Measure	Residual Impact	Allocation of Risk Post-Mitigation
Erosion and sedimentation and spread of contaminants off-site and/or into the harbour as a result of land based excavation works.	**Medium**	Management of erosion, sedimentation and identified 'hotspots' would be controlled by a CEMP. Implementation of a Contamination Site Management Plan and Soils and Water Management Plan, with reference to the *Managing Urban Stormwater: Soils and Construction Guidelines* (Landcom, 2004), to minimise soil erosion, sedimentation, and mobilisation of contaminated sediments resulting from excavation and construction. Refer to **Sections 10, 11** and **14**.	Negligible	**Low**
Creation of preferential pathways between contaminated fill materials and aquifer beneath Port Kembla Harbour as a result of excavation activities associated with road/rail construction.	**Medium**	Groundwater contamination in the vicinity of the site is a regional issue that is not specific to the development. Notwithstanding, groundwater was not encountered during the investigation and, based on the Douglas Partners (2009) investigation, is not expected to be encountered during excavation works associated with construction of the proposed road/rail infrastructure given the recorded depth of the groundwater and the limited depth of the excavation works. Therefore, specific groundwater management measures are not likely to be required as part of the land based redevelopment works. Refer to **Section 11**.	Negligible	**Low**

Environmental Issue	Allocation of Risk Pre- Mitigation	Assessment and Mitigation Measure	Residual Impact	Allocation of Risk Post-Mitigation
Migration of contaminated groundwater to the Outer Harbour.	**Medium**	Groundwater contamination in the vicinity of the site is a regional issue that is not specific to the development. Impact on groundwater flow regime by the reclamation area is not likely to be significant in terms of groundwater flow or quality. It is recommended the reclamation area be designed to ensure that the existing groundwater flow regimes are not significantly altered and that there is no increased risk of harm associated with groundwater contamination. Groundwater monitoring to assess potential exposure pathways and migration of regional groundwater contamination. Preparation of a Soils and Water Management Plan. Refer to **Section 11**.	Negligible	**Low**
The release of sulphuric acid from disturbed land based ASS, which may drain into the harbour/stormwater system.	**Medium**	Land-based excavation activities will be of limited depth and are unlikely to extend beyond imported fill depth. As such, it is highly unlikely that excavation activities will expose potential land-based ASS. Preparation of an Acid Sulfate Soil Management Plan to minimise the risk of disturbance of potential acid sulfate soils during land based construction. Refer to **Section 11**.	Negligible	**Low**
Importation of potentially contaminated soils to be used as reclamation fill.	**High**	Determination of the suitability of imported fill sources for reclamation activities will be conducted prior to use as reclamation fill. Refer to **Section 11**.	Negligible	**Low**

Environmental Issue	Allocation of Risk Pre- Mitigation	Assessment and Mitigation Measure	Residual Impact	Allocation of Risk Post-Mitigation
Erosion and sedimentation resulting from movement of construction machinery and excavation activities associated with road/rail construction and reclamation activities. Mobilisation of soils may result in the release of sediment laden surface water off-site and/or into the harbour.	**High**	A surface water management system, including pollution control devices, to control sedimentation and runoff, is proposed for the reclamation areas during construction and for the terminals during operation. Preparation of a Soils and Water Management Plan to outline measures to minimise the volume of sediment and polluted water entering the Outer Harbour. Water quality and biological monitoring programs will ensure Water Quality Objectives of the Outer Harbour are not compromised. Refer to **Section 14**.	Negligible	**Low**
Exposure and/or mobilisation of soils creating dust which may extend beyond the boundaries of the development.	**Medium**	Preparation of a Soils and Water Management Plan and Air Quality Management Plan to manage dust generated by construction and operation activities. Refer to **Section 22**.	Negligible	**Low**
Sediment accumulation in stormwater drains, drainage lines and natural surface depressions.	**Medium**	A surface water management system, including pollution control devices, to control sedimentation and runoff, is proposed for the reclamation areas during construction and for the terminals during operation. Preparation of a Soils and Water Management Plan to control sedimentation and runoff. Refer to **Section 14**.	Negligible	**Low**

Environmental Issue	Allocation of Risk Pre- Mitigation	Assessment and Mitigation Measure	Residual Impact	Allocation of Risk Post-Mitigation
Sedimentation and increased turbidity of water bodies including Salty Creek, Darcy Road Drain, and the Outer Harbour.	**High**	All dredging and placement of sediments to occur within the water column to avoid exposure of sediments to oxygen. A surface water management system, including pollution control devices, to control sedimentation and runoff, is proposed for the reclamation areas during construction and for the terminals during operation. Preparation of a Soils and Water Management Plan to control sedimentation and runoff. Refer to **Section 14**.	Short-term turbidity resulting from blasting and dredging activities would be confined to area within silt curtains in Outer Harbour.	**Low**
Potential exposure of dredged ASS to oxygen during movement and/or disposal of sediments.	**High**	Preparation of an Acid Sulfate Soils Management Plan, in accordance with ASSMAC, to be incorporated into a Dredging Environmental Management Plan to minimise exposure of, and manage, potential ASS. Refer to **Section 10**.	Negligible where sediments remain below water level, as proposed.	**Low**
Hydrology and Water Quality (including Hydrodynamics and Coastal Processes)				
Alteration to flow regime, geomorphology and discharge of Salty Creek as a result of reclamation area.	**Medium**	Installation of energy dissipater to reduce the potential for localised impacts on bed morphology. Design of a box culvert will ensure tidal and flood discharge conveyances would be maintained and could provide a benefit through the introduction of regular tidal flushing of Salty Creek. Refer to **Sections 14** and **16**.	Negligible	**Low**

Environmental Issue	Allocation of Risk Pre- Mitigation	Assessment and Mitigation Measure	Residual Impact	Allocation of Risk Post-Mitigation
Disturbance to bed of Salty Creek from rail construction activities.	**Medium**	Salty Creek is a highly disturbed waterbody and rail construction works in the vicinity of the area will be limited and likely to have limited impacts. Preparation of a Soils and Water Management Plan. Refer to **Section 14**.	Negligible	**Low**
Change to harbour hydrodynamics as a result of the creation of new multi-purpose and container terminals.	**High**	Reclamation levels have been designed to accommodate future sea level rise. Freeboard and finished pavement level will result in the final level of the terminals being suitable to cater for predicted future sea level rise. Long wave processes and tidal discharge of the Inner Harbour would not be significantly affected. The project would have no significant impact on tidal velocities and predicted ship movements at berth would be well within guideline standards. Reclamation design would ameliorate adverse impacts of harbour seiching. Refer to **Section 15**.	Negligible	**Low**
Degradation of water quality during construction through re-suspension of contaminated sediments and increased turbidity.	**High**	Preparation of a Soils and Water Management Plan and Dredging Environmental Management Plan to minimise mobilisation of sediments and turbidity resulting from dredging. Preparation of an Acid Sulfate Soils Management Plan, in accordance with ASSMAC, to be incorporated into a Dredging Environmental Management Plan to minimise exposure of, and manage, potential ASS. Refer to **Sections 10** and **14**.	Short term impact on water quality due to suspended sediments and turbidity during dredging. Impact likely to be localised and managed by the use of silt curtains.	**Low**

Environmental Issue	Allocation of Risk Pre- Mitigation	Assessment and Mitigation Measure	Residual Impact	Allocation of Risk Post-Mitigation
Impacts on natural drainage processes associated with sedimentation.	**Medium**	The drainage function of Salty Creek and Darcy Road Drain would be maintained. Preparation of a Soils and Water Management Plan, including pollution control devices, to control sedimentation and runoff. Design of a surface water management system is proposed for the reclamation areas during construction and for the terminals during operation. Refer to **Section 14**.	Negligible	**Low**
Traffic and Transport				
Increase in traffic on local road network during construction due to volume of material to be transported to and from site. Impact would be subject to mode of transport available for spoil movement (e.g. barge and rail availability).	**Medium**	Use of barge and/or rail to transport spoil to and from site would be a preferred option. The local road network has sufficient capacity to accommodate increased traffic movements associated with construction. Preparation of a Traffic Management Plan to minimise impacts on pedestrian and vehicle movements during construction. The TMP would include, as a minimum, haulage routes, driver protocols and hours of construction. Refer to **Section 18**.	Negligible	**Low**
Impact on local and regional rail network during construction.	**Low**	Obtain agreements for use of road and/or train paths on various networks with Pacific National, RailCorp, and ARTC. Refer to **Section 19**.	Negligible	**Low**

Environmental Issue	Allocation of Risk Pre- Mitigation	Assessment and Mitigation Measure	Residual Impact	Allocation of Risk Post-Mitigation
Increase in traffic on local and regional road network during operation from increased trade and associated transport of containers, dry bulk, break bulk and general cargo.	**High**	The preferred mode of operational transport is by rail, although the local road network has sufficient capacity to accommodate increased traffic movements during operation. Construction of a new road link to Christy Drive to provide access to terminals. Upgrades to local roads recommended. Preparation of a Traffic Management Plan to include, as a minimum, haulage routes, driver protocols and hours of operation. Refer to **Section 18**.		**Low**
Impact on local and regional rail network during operation for the transport of containers, dry bulk, break bulk and general cargo.	**Medium**	Upgrade of the rail network and local rail infrastructure upgrades would be undertaken to ensure sufficient capacity and to minimise impacts on the rail network. Federal government is funding a feasibility study to be carried out in 2010 for the completion of the Maldon – Dombarton rail link. Refer to **Section 19**.	Impact on local and regional rail network during operation would depend on the type of activities and provision of support infrastructure (e.g. Maldon to Dombarton rail link)	**Low**
Impact on state transport infrastructure provision during construction and operation.	**Medium**	No grades required to state road network as a result of the project. Federal government is funding a feasibility study to be carried out in 2010 for the completion of the Maldon – Dombarton rail link. Preparation of a Traffic Management Plan. Refer to **Section 19**.	Impact on local and regional rail network during operation would depend on provision of support infrastructure (e.g. Maldon to Dombarton rail link)	**Low**

Environmental Issue	Allocation of Risk Pre- Mitigation	Assessment and Mitigation Measure	Residual Impact	Allocation of Risk Post-Mitigation
Aquatic and Terrestrial Ecology				
Loss of habitat (marine and shoreline) due to dredging and reclamation.	**Medium**	Preparation of a Dredging Environmental Management Plan to manage potential impacts on aquatic habitats and fauna. New hard substrate habitat, in the form of wharf face, pile supported decks and rock revetments would be designed with enhanced features to provide expanded aquatic habitat values to those that already exist in the Outer Harbour. Biological monitoring would be undertaken to monitor the effects of dredging on larval settlement on the existing and newly created hard substrate. PKPC will seek a long term partnership arrangement with Council and Conservation Volunteers Australia to fund habitat improvement works and ongoing monitoring and maintenance, to ensure that effective habitat outcomes are achieved and sustained on the site. Compensatory measures proposed for loss of soft substrate habitat. Refer to **Section 16**.	Loss of existing soft substrate habitat Creation of new hard substrate habitat (refer to **Section 16**)	**Medium**
Impacts on macroalgae and other marine vegetation during construction.	**Medium**	Limited marine vegetation in footprint of dredging and reclamation. Preparation of a Dredging Environmental Management Plan. Refer to **Section 16**.	Negligible	**Medium**

Environmental Issue	Allocation of Risk Pre- Mitigation	Assessment and Mitigation Measure	Residual Impact	Allocation of Risk Post-Mitigation
Impact on fish and marine species during construction.	**Medium**	Preparation of a Dredging Environmental Management Plan. Preparation of a Marine Mammal Management Plan for Construction by Blasting to limit the impact on fish and marine mammals. Refer to **Section 16**.	Negligible	**Medium**
Potential for a toxic bloom from disturbance of dinoflagellate cysts in sediment.	**High**	Preparation of a Dredging Environmental Management Plan, including measures such as installation of a silt curtain. Water quality monitoring during dredging works. No toxic blooms have been created by other dredging campaigns in the Inner and Outer Harbours. Preparation of an Algal Bloom Contingency Plan for the construction phase of the project. Refer to **Section 16**.	Negligible	**Low**
Impact on Green and Golden Bell Frog community due to destruction of habitat, degradation of water quality and increased mortality during construction.	**High**	Proposal will have limited impact on Green and Golden Bell Frog habitat. Preparation of a Green and Golden Bell Frog Management Plan. Preparation of a Soils and Water Management Plan, including pollution control devices, to control sedimentation and runoff. Refer to **Section 17**.	Negligible	**Low**
Impacts on threatened terrestrial species other than the Green and Golden Bell Frog.	**Low**	The site does not provide shelter, breeding areas or habitat for most of the threatened flora and fauna species that would potentially occur on the site. Refer to **Section 17**.	Negligible	**Low**

Environmental Issue	Allocation of Risk Pre- Mitigation	Assessment and Mitigation Measure	Residual Impact	Allocation of Risk Post-Mitigation
Removal of Coastal Saltmarsh (listed as an endangered ecological community under the TSC Act).	**Medium**	The medium to long-term viability of this community within this particular location is severely limited irrespective of development activities, as the existing saltmarsh is highly fragmented and degraded. PKPC would continue to support off-site compensatory habitat programs in more viable patches of saltmarsh community within the region. Refer to **Section 17**.	Negligible	**Low**
Socio-economic				
Impacts on landscape and visual amenity.	**Low**	Preparation of a Landscape Management Plan to control visual impacts from lighting, machinery, plant and stockpiles. Refer to **Section 23**.	Limited visual impact in the context of existing Port and industrial development in Port Kembla.	**Low**
Job creation during construction.	**Low**	This is a significant opportunity for the project as discussed in **Section 20**.	Positive	**Low**
Job creation during operation.	**Medium**	This is a significant opportunity for the project as discussed in **Section 20**.	Positive	**Low**
Community concern regarding degradation of air quality, increased noise and traffic movements associated with both the construction and operation phases.	**Medium**	Refer to community and stakeholder consultation discussed in **Section 8**. Air quality, noise and traffic impacts and mitigation measures are discussed in **Sections 22, 21** and **18** respectively.	Negligible	**Low**
Investment in local and regional economy.	**Medium**	This is a significant opportunity for the project as discussed in **Section 20**.	Positive	**Low**

Environmental Issue	Allocation of Risk Pre- Mitigation	Assessment and Mitigation Measure	Residual Impact	Allocation of Risk Post-Mitigation
Noise and Vibration				
Noise and vibration disturbance to sensitive receivers in surrounding area during construction, including blasting, reclamation and dredging activities.	**Medium**	Predicted exceedences from South Yard construction works. Delayed detonation of charges to minimise excessive vibration. PKPC is committed to acoustically sensitive plant where possible and the use of noise reducing measures. Careful planning of construction schedule, working hours and plant to be used. Preparation of a Construction Noise Management Plan to minimise noise impacts at sensitive receivers. Refer to **Section 21**.	Negligible	**Low**
Noise disturbance to sensitive receivers in surrounding area during operation of the first multi-purpose berth.	**Medium**	There are no predicted exceedences of noise environmental criteria for sensitive catchments. The sounding of train horns is predicted to result in exceedence of the sleep disturbance criteria and mitigation measures are proposed. Preparation of an Operational Noise Management Plan. Refer to **Section 21**.	Negligible	**Low**

Environmental Issue	Allocation of Risk Pre- Mitigation	Assessment and Mitigation Measure	Residual Impact	Allocation of Risk Post-Mitigation
Noise disturbance along transport routes during operation.	**Medium**	Stabling yard activities are predicted to comply with night-time intrusiveness criteria at all noise sensitive receivers. Predicted increases in noise levels from road and rail traffic are within relevant noise criteria eg. for road traffic (ECRTN+2dB(A)). Preparation of an Operational Noise Management Plan and Traffic Management Plan to minimise impacts of noise on sensitive receivers. Refer to **Section 21**.		**Low**
Air Quality				
Construction related impacts on air quality.	**Medium**	Preparation of an Air Quality Management Plan and Soils and Water Management Plan to minimise impacts of fugitive dust emissions during excavation and reclamation activities. Refer to **Section 16** and **22**.	Negligible	**Low**
Concurrent construction and operational air emissions impacting on air quality, i.e. truck, rail, and shipping emissions.	**Medium**	Short term localised increases in pollutant emissions during construction. Site specific 'best practice' dust mitigation measures would be incorporated into the Air Quality Management Plan for both construction and operation phases. CEMP to include specific measures such as sealing of roads, wetting down of site surfaces, covering of loads and sealing of exposed surfaces of the reclamation area. Refer to **Section 22**.	Short term localised particulate and NO_2 impacts from construction and operational activities.	**Medium**

Environmental Issue	Allocation of Risk Pre- Mitigation	Assessment and Mitigation Measure	Residual Impact	Allocation of Risk Post-Mitigation
Atmospheric pollution once the terminals are operational with the potential to result in degradation of air quality.	**Medium**	Operations predicted to cause short term localised increases in fine particulates. Site specific 'best practice' dust mitigation measures would be incorporated into the Air Quality Management Plan for operation phase. Berth design to include allowance for alternative marine power. Possible adoption of Green Award program to offer incentives for less polluting vessels to call at Port Kembla. Refer to **Section 22**.	Permanent but localised and short term increases in particulate matter and NO_x.	**Low**
Landscape and Visual Amenity				
Construction and operation impacts on immediate, local and regional landscape.	**Low**	Preparation of a Landscape Management Plan to control visual impacts from lighting, machinery, plant and stockpiles. Refer to **Section 23**.	Limited visual impact in the context of existing Port and industrial development in Port Kembla.	**Low**
Visual amenity impact on residents with a view of the Port (e.g. lighting and surface cover).	**Low**	Preparation of a Landscape Management Plan to control visual impacts from lighting, machinery, plant and stockpiles. Suitable colours and materials to be selected for terminal pavement, buildings and structures to minimise reflectivity and contrast. Refer to **Section 23**.	Limited visual impact in the context of existing Port and industrial development in Port Kembla.	**Low**
Heritage				

Environmental Issue	Allocation of Risk Pre- Mitigation	Assessment and Mitigation Measure	Residual Impact	Allocation of Risk Post-Mitigation
Damage or removal of Aboriginal artefacts or places as a result of reclamation and land based infrastructure (e.g. road/rail).	**Low**	No evidence of recorded or unrecorded Aboriginal sites within the footprint of the development. There is considered to be little or no likelihood of intact or undisturbed subsurface Aboriginal heritage material within the study area. Refer to **Section 24**.	Negligible	**Low**
Detrimental physical or visual impact upon items of non-indigenous heritage significance as a result of reclamation and land based infrastructure (e.g. road/rail).	**Medium**	Limited impacts during construction on listed heritage items such as the Historical Military Museum and associated pill box. To be managed by sympathetic road design and landscaping. Impacts are in the context of surrounding extensive modern development and low significance of heritage items. Demolition of jetties which are not listed heritage items but have been assessed as having local heritage significance. Archival recording of jetty structures recommended. Prepare Conservation Management Plan for the Mobile Block Setting Steam Crane. Very low likelihood of encountering shipwrecks during dredging works but mitigation measures recommended. Refer to **Section 24**.	Negligible	**Low**

Environmental Issue	Allocation of Risk Pre- Mitigation	Assessment and Mitigation Measure	Residual Impact	Allocation of Risk Post-Mitigation
Sustainability				
Use of resources (energy, materials, spoil, fuel).	**Medium**	Refer to Natural Resource Reduction Plan 2005-2010 (PKPC). Investigations of options to achieve energy savings will be carried out. Re-use of dredged and fill materials in reclamation area. Positive environmental benefits to be provided through the promotion of renewable energy generation, design of marine habitat friendly structures and use of Water Sensitive Urban Design initiatives where feasible. Refer to **Section 25**.	Negligible	**Low**
Increased CO_2 emissions during construction and operation.	**Medium**	Refer to Natural Resource Reduction Plan 2005-2010 (PKPC). Investigations of options to achieve energy savings and emission reduction will be carried out. Preparation of a Sustainability Management Plan. Refer to **Section 25**.	CO_2 emissions will be generated during construction and increased for ongoing operations	**Medium**
Climate Change				
Impact of changed average climatic conditions on materials, structures and infrastructure of Port (i.e. increased average temperatures and changes in runoff).	**Medium**	Extension or intensification of current climate change mitigation and adaptation strategies currently implemented by PKPC to manage the impacts of a variable climate and extreme weather conditions. Refer to **Section 26**.	Implementation of mitigation measures and adaptations would reduce impacts on infrastructure from climate change	**Low**

Environmental Issue	Allocation of Risk Pre- Mitigation	Assessment and Mitigation Measure	Residual Impact	Allocation of Risk Post-Mitigation
Impact of extreme climatic events infrastructure of Port (i.e. extreme and more frequent storm events, sea level rise).	**High**	Management of impacts would occur through maintenance regimes that would be detailed in OEMP(s) prepared for the operation of the terminals. Proposed reclamation levels and finished terminal levels have taken climate change impacts into account and provide for sea level rise beyond the 100 year design life. Refer to **Section 26**.	Implementation of mitigation measures would reduce impacts on infrastructure from climate change. Consequences from extreme events will be less frequent with adaptation measures implemented.	**Low**
Waste Management				
Handling of solid waste generated during the project e.g. waste generated by employees, port maintenance waste, dredging waste and hazardous waste.	**Medium**	Preparation of a Waste Management Plan and Hazardous Substance Management Plan which would set out waste identification, handling, storage, transportation, disposal and monitoring measures to be implemented during operation. Refer to **Section 27**.	Negligible	**Low**
Waste management during construction.	**Medium**	Preparation of a Waste Management Plan which would set out waste identification, handling, storage, transportation, disposal and monitoring measures to be implemented during construction. Refer to **Section 27**.	Negligible	**Low**
Potential contamination of land and water as a result of inappropriate handling of waste.	**Medium**	Preparation of a Waste Management Plan which would set out waste identification, handling, storage, transportation, disposal and monitoring measures to be implemented during operation. Refer to **Section 27**.	Negligible	**Low**

Environmental Issue	Allocation of Risk Pre- Mitigation	Assessment and Mitigation Measure	Residual Impact	Allocation of Risk Post-Mitigation
Hazard and Risk				
Exposure of employees to risks and hazards associated with construction activities (e.g. handling of contaminated soils) and future operations (e.g. increased handling of dangerous goods).	**Medium**	Preparation of the following environmental management plans as part of the CEMP and OEMP, to minimise construction hazards and risks: • Site Management Plan • Hazardous Substance Management Plan • Emergency Response Management Plan • Fire Management Plan • Safety Management Plan • Refuelling Management Plan Further assessments to be conducted as part of future project applications. Refer to **Section 13**.	Negligible	**Low**
Exposure of surrounding land uses/population to risks and hazards associated with construction activities and future operations (e.g. increased handling of dangerous goods).	**Medium**	Preparation of the following environmental management plans as part of the CEMP and OEMP, to minimise construction hazards and risks: • Site Management Plan • Hazardous Substance Management Plan • Emergency Response Management Plan • Fire Management Plan • Safety Management Plan • Refuelling Management Plan Further assessments to be conducted as part of future project applications. Refer to **Section 13**.	Negligible	**Low**

31.0 Conclusion and Justification

31.1 Needs and Benefits

Port Kembla Port Corporation (PKPC) proposes to develop additional port side and landside facilities in the Outer Harbour of the Port of Port Kembla (the Port) to attract new trades as well as increasing the capacity to handle increasing volumes of existing cargoes.

The Port has been operating for in excess of one hundred years. In 2007/08 the Port had a record throughput of 27 million tonnes of exports and imports. Total trade was up by 6% on the previous period and coal exports increased by nearly 14%. In 2008/09 total trade through the Port reached 26.4 million tonnes. The major cargoes handled comprised 13 million tonnes of export coal and 8 million tonnes of steel related products (iron ore imports and steel product exports).

Under the State Government's *NSW Ports Growth Plan,* a proportion of shipping and cargo previously handled through Port Jackson has been transferred to the Port. Recent development in the Inner Harbour has occurred to accommodate the transfer of some cargo from Sydney and the general growth in freight. This represents up to an additional 400 ship visits, 240,000 motor vehicles and 120,000 tonnes of break bulk cargo (timber, machinery, steel, paper etc) and a small volume of containers each year.

This growth combined with existing activities, including the BlueScope steel precinct and the grain and coal exporting facilities, means that there is very little available land in the Inner Harbour to accommodate future growth. Consequently, if the Port is to continue to attract new trades as well as increasing the volume of existing cargoes, additional portside and landside facilities would need to be provided. This is the primary driver for the proposed Outer Harbour development.

The *Port Kembla Outer Harbour Master Plan* (the Master Plan), a guide to the future development in the Outer Harbour of the Port, has recently been completed (Maunsell │ AECOM, 2008). The applications for concurrent Concept Plan and Major Project approval have been based on the Master Plan. Land within the Inner Harbour is almost fully occupied and growth in trade is constrained by lack of suitable port facilities. To develop the potential of the existing port, PKPC needs to create new port facilities through dredging, reclamation and the construction of new berths. The Outer Harbour is the only remaining area within the Port where this can be accommodated.

The proposed development would allow the Port to build on its competitive strength by enabling it to complete more effectively on the wider market but also better service the needs of wide range of businesses in the local and wider region. The Port expansion, through the development of the Outer Harbour, would act as both a short term and long term stimulus to the local and regional economy.

In the short and long term, the proposed development would generate job creation during both construction and operation phases. It is estimated that over 180 full-time equivalent jobs in the Illawarra region and over 297 would be generated per year throughout the state, predominantly in the building and construction, trade, manufacturing and finance and business sectors.

In a strategic context, the proposed development of the Outer Harbour is consistent with all relevant Government policies and strategies and addresses future trade projections for the Port.

31.2 Concept Plan and Major Project

Concept Plan Approval for the total development would allow PKPC a level of certainty in defining the key components of the full development, while allowing flexibility to refine discrete stages in parallel with port growth.

The Concept Plan provides a framework for the progressive completion of the Outer Harbour development and comprises creation of land dedicated to port activity. The reclaimed land would be divided into two main areas, one devoted to the import and export of dry bulk, break bulk and bulk liquid cargoes (multi-purpose terminals) and one devoted to container trade (container terminals).

A total of seven new berths would be accommodated within the total development, three berths for the multi-purpose terminals and four new berths for the container terminals. The existing oil and flammable liquids berth located on the northern breakwater would be retained as part of the Concept Plan. Development associated with the Concept Plan outside the reclamation footprint would comprise a rail infrastructure upgrade in the South Yard, a new road link connecting Darcy Road to the existing boat harbour, and an extension of existing rail sidings onto the container terminals. The existing boat harbour would be retained as part of the total development and access to and from the boat harbour would not be affected during construction and operation of each of the three stages of development.

The Concept Plan is anticipated to be completed by 2037. Once completed the reclamation footprint of the development would extend from the existing Port Kembla Gateway Jetty in the north to Foreshore Road in the south, the boat harbour to the east and existing rail sidings to the west.

Major Project Approval is being sought to construct and operate Stage 1 of the Concept Plan. The Major Project application sits within, and is part of, the overarching Concept Plan.

Construction elements of Stage 1 comprise demolition of No.3 and No.4 Jetties (including Berth 206), and reclamation and dredging for the footprint of the total development, with the exception of an area in the vicinity of the Port Kembla Gateway and expansion of the current swing basin area (ship turning circle). At the conclusion of Stage 1 construction activities, anticipated to be completed by 2018, the central portion of the multi-purpose terminals would be operational. Road and rail infrastructure to support the first berth would also be constructed.

Planning approval to construct and operate Stages 2 and 3 of the Concept Plan would be subject to separate Major Project applications made at a later date.

31.3 Overview of Environmental Impacts

This Environmental Assessment provided a description of the proposed project (including staging), described the existing environment and outlined the methodologies undertaken for assessment. It presented specialist studies that assessed the various environmental impacts associated with the activities to be undertaken as part of Stage 1 of the Concept Plan (Major Project) and more broadly the cumulative impacts associated with the total development (Concept Plan).

Potential environmental impacts resulting from the construction and operation of the Concept Plan and Major Project have been identified.

Potential environmental impacts associated with the total development include:

- Increase in road and rail traffic during construction and operation of all stages of development.
- Increase in noise and air quality impacts during construction and operation of all stages of development.
- Impacts on terrestrial and aquatic ecology, including extension of Salty Creek and Darcy Road Drain.
- Disturbance of existing contaminated sediments in the Outer Harbour during dredging campaigns and disturbance of existing contaminated soils on land during construction of new road and rail infrastructure.
- Impacts to the local hydrology and water quality in the Outer Harbour associated with dredging and reclamation.
- Impacts on both listed and unlisted local heritage items.

Appropriate mitigation measures to avoid or ameliorate these impacts have been recommended to reduce the impacts to an acceptable level of environmental risk. Whilst the project would have some residual impacts, the EA demonstrates that the proposed project, in conjunction with relevant management strategies and mitigation measures, would not result in significant impacts on the environment and would generate significant social and economic benefits to the Illawarra region and the State of NSW.

A draft Statement of Commitments has been prepared as part of this Environmental Assessment. The draft Statement of Commitments will be finalised following consideration of the feedback received during public exhibition of the EA.

The findings of the environmental assessment presented in this report and accompanying specialist studies confirm that the Port Kembla Outer Harbour development has a strong justification for proceeding, particularly in light of the economic and social benefits it would produce for the Illawarra region as well as NSW, and is considered to be suitable for approval under Part 3A of the *EP&A Act*.

32.0 References

ABS, 2009, National Regional Profile: Wollongong Local Government Area, LGA18450, Canberra, accessed 25 August, 2009, www.abs.gov.au

AECOM, 2008, Port Kembla Outer Harbour Master Plan - Road and Rail Access Issues, Sydney

AECOM, 2009, Sediment Investigation Report : Port Kembla Outer Harbour Sediment Investigation, Port Kembla, ENSR Australia Pty Ltd., Sydney

Alcorn, R., Hunter, S., Signorelli, C., Obeyesekera, R., Finnigan, T., Denniss. T., 2005, 'Results of the Testing of the Energetech Wave Energy Plant at Port Kembla on October 26, 2005', Energetech Australia, Botany, accessible: <http://www.energetech.com.au/attachments/Results_PK_Wave_Energy_Trial.pdf>

ANZECC, 1990, *Technical Basis for Guidelines to Minimise Annoyance due to Blasting Overpressure and Ground Vibration*, Australian and New Zealand Environment and Conservation Council

ANZECC, 2000, The Australian and New Zealand Guidelines for Fresh and Marine Water Quality. Australian and New Zealand Environment and Conservation Council

ANZECC/ARMCANZ, 2000, Interim Sediment Quality Guidelines, Australian and New Zealand Environment and Conservation Council and Agriculture and Resource Management Council of Australia and New Zealand

ASSMAC, 1998, Acid Sulfate Soil Manual, Wollongbar, NSW

AWACS, 1991, Design Guidelines for Water Level and Wave Climate at Pittwater. Australian Water and Coastal Studies Report 89/23, March 1991, Sydney

AWT, 1999, Aquatic Studies for the Port Kembla Outer Harbour Development Project: Report prepared for Port Kembla Port Corporation, Sydney

British Standards, 2009, British Standard 6472-1992 Evaluation of Human Exposure to Vibration in Buildings (1 Hz to 80 Hz), North Ryde

Brown, T., 2009, Letter to Fisheries regarding Aquatic Habitat Offsets for the Proposed Outer Harbour Development, Port Kembla, 18 December, 2009

Cardno, Eppell, Olson, 2008, Existing Operations & Increased Road Receival Hours for Port Kembla Coal Terminal Traffic Study, Sydney

CH2MHill, 1999, Port Kembla Port Corporation Environmental Impact Statement – Outer Harbour Development Project Draft – For Discussion Purposes Only, Port Kembla

CMPS&F Environmental, 1994, MSB – Illawarra Ports Authority, Contamination Assessment of Port Kembla Outer Harbour Vacant Land Parcels, Sydney

Commonwealth of Australia (Commonwealth), 2008a, National Pollution Inventory Emission Estimation Technique Manual for Railway Yard Operations Version 2, June 2008

Commonwealth Government of Australia (Commonwealth), 2008b, National Pollution Inventory Emission Estimation Technique Manual for Maritime Operations Version 2, July 2008

Connell Hatch, 2009, Maldon – Dombarton Pre-Feasibility Study for Port Kembla Port Corporation, Neutral Bay

CSIRO and BOM, 2007, Climate change in Australia, Technical Report, CSIRO and Australian Bureau of Meteorology, Canberra

CSIRO, Maunsell Australia Pty Ltd and Phillips Fox, 2008, Infrastructure and Climate Change Risk Assessment for Victoria, Holper, P., Lucy, S., Nolan, M., Senese, C., Hennessy, K. (eds), Report prepared for Victorian Government (referenced in text as Holper *et al*, 2008)

DEC NSW, 1999, NSW Industrial Noise Policy, Sydney

DEC NSW, 2005, Approved Methods for the Modelling and Assessment of Air Pollutants in New South Wales, Sydney

DEC NSW, 2005, Draft Recovery Plan for the Green and Golden Bell Frog (Litoria aurea). DECC NSW, Hurstville, NSW

DEC NSW, 2005, Guidelines for Aboriginal Cultural Heritage Impact Assessment and Community Consultation, Sydney

DECC NSW, 2006, Assessing Vibration – A Technical Guideline, Sydney

DECC NSW, 2006. Guidelines for the NSW Site Auditor Scheme (2nd Edition), Sydney

DECC NSW, 2007, Interim Guideline for the Assessment of Noise from Rail Infrastructure Projects, Sydney

DECC NSW, 2007, NSW Waste Avoidance and Resource Recovery Strategy, Sydney

DECC NSW, 2008, Interim Construction Noise Guideline, Sydney

DECC NSW, 2008, NSW Environmental Criteria for Road Traffic Noise, Sydney

DECC NSW, 2008, Waste Classification Guidelines, Sydney South

DECCW NSW, 2009, Wildlife Atlas, accessible: http://wildlifeatlas.nationalparks.nsw.gov.au/wildlifeatlas/watlas.jsp

DECC NSW and DPI, 2005, Draft Guidelines for Threatened Species Assessment, Sydney

DECC NSW and DoP NSW, 2005, Draft Guidelines for Threatened Species Assessment, DECC and DPI, Sydney

DECC NSW and DoP, 2007, Interim Guideline for the Assessment of Noise from Rail Infrastructure Projects.

Available: http://www.environment.nsw.gov.au/resources/noise/07187rninfra.pdf.

DECC NSW and UNSW, 2008, Report: Summary of Climate Change Impacts – Illawarra Region, Sydney

DECCW NSW and Sydney Catchment Management Authority, 2009, Environmentally Friendly Seawalls: A Guide to Improving the Environmental Values of Seawalls and Seawall-lined Foreshores in Estuaries, DECC and SCMA, Sydney

Denley E.J and Dayton P.K., 1985, Competition among macroalgae. In M.M. Littler and D.S Littler (Eds) Handbook of Phycological Methods. Ecological Field Methods: Macroalgae. Cambridge University Press

DoH WA, 2009, Guidelines for the Assessment, Remediation and Management of Asbestos-Contaminated Sites in Western Australia, Department of Health Western Australia, Perth

Department of Natural Resources. 2002, NSW Acid Sulfate Soil Risk Maps for Wollongong DPI, 2007. NSW DPI Primefacts 189, accessed August 2009, http://www.dpi.nsw.gov.au/__data/assets/pdf_file/0019/144154/black-cod.pdf

DoP NSW, 1992, Hazardous Industry Planning Advisory Paper No.6., Guidelines for Hazard Analysis, Sydney

DoP NSW, 2005, City of Cities: A Plan for Sydney's Future, Sydney

DoP NSW, 2006, Illawarra Regional Strategy 2006-31, Wollongong

DoP, 2008, Applying SEPP 33 – Consultation Draft July 2008, Hazardous and Offensive Development Application Guidelines, Sydney

DoP, 2008, Major Project Register: Bluescope Steel Injection Station Facility Port Kembla Steelworks, Application No. MP 08-0132, accessed February 1, 2009, http://majorprojects.planning.nsw.gov.au/index.pl?action=view_job&job_id=2700

DoP, 2009, Major Project Register: Port Kembla Copper Demolition Project, Application No. MP 08_0191, accessed February 1, 2009, http://majorprojects.planning.nsw.gov.au/index.pl?action=view_job&job_id=2702

DoP, 2009, Major Project Register: Wollongong City Council Soybean Processing and Biodisel Facility, Application No. MP 08_0083, accessed February 1, 2009, http://majorprojects.planning.nsw.gov.au/index.pl?action=search&page_id=&search=&authority_id=572&x=58&y=16

DoT and RTA, 2006, Draft Interim Guidelines on Transport Management and Accessibility Plans, Sydney

Douglas Partners, 2002, Report on Harbour Sediment Sampling and Analysis, Port Kembla Port, NSW

DNR, 2002, Acid Sulfate Soil Risk, map, Edition 2, Department of Natural Resources

DSRD, 2008, Regional Business Growth Plan – Illawarra, Sydney

EconSearch, 2009, Port of Port Kembla Economic Impact Study, Maryatville, SA

EPA NSW, 1999, Environmental Criteria for Road Traffic Noise, Chatswood

EPA NSW, 1994, Guidelines for Assessing Service Station Sites, Sydney

EPA NSW, 1997, Metropolitan Air Quality Study: Air Emissions Inventory, Sydney

EPA NSW, 2002, Ambient Air Quality Research Report (1996-2001); Dioxins, Organics, Polycyclic Aromatic Hydrocarbons and Heavy Metals, Sydney South

EPA VIC, 2001, Best Practice Environmental Management: Guidelines for Dredging, Melbourne

Environment Protection and Heritage Council,(EPHC) 2003, NEPM Ambient Air Quality, Adelaide, accessible: http://www.ephc.gov.au/sites/default/files/AAQ_NEPM__Ambient_Air_Quality_NEPM_Varied_scaleplus_Final_20 0305_1.pdf

Environment Protection and Heritage Council,(EPHC) 2004, NEPM Air Toxics, Adelaide, accessible: http://www.environment.nsw.gov.au/resources/noise/vibrationguide0643.pdf

Forbes Rigby, 2000, Flood Study and Preliminary Culvert Design, Salty Creek, Old Port Road, Port Kembla,

Forbes Rigby Pty Ltd, Wollongong

Gaia Research Pty Ltd, 2008, Assessment of Habitat, Dispersal Corridors and Management Actions to Conserve the Port Kembla Key Population of Green And Golden Bell Frog 2007-2008. Report prepared for the Department of Environment and Climate and Change, Sydney South

Hazelton, P.A. & Tille, P.J. 1993, Soil Landscapes of the Wollongong-Port Hacking 1:100 000 Sheets (Map and Report), Soil Conservation Service of NSW, Sydney

He, Z. and R. J. Morrison, 2001, 'Changes in the Marine Environment of Port Kembla Harbour, NSW, Australia, 1975-1995: A Review', Marine Pollution Bulletin, 42:193-201

Hedge, L.H., Knott, N.A., Johnston, E.L., 2008, Dredging increases the accumulation of metals by oysters in the water column: a multi-scale approach, Evolution and Ecology Research Centre, School of Biological Earth and Environmental Sciences, The University of New South Wales, Sydney.

Heritage Office NSW, 1997, *Heritage Manual*, Parramatta

IPCC, 2007, Summary for Policymakers. In: Climate Change 2007: Impacts, Adaptation and Vulnerability, Contribution of Working Group II to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change, Parry, M.L., Canziani, O.F., Palutikof,J.P., van der Linden, P.J. and Hanson C.E., (eds.), Cambridge University Press, Cambridge, UK, pp.7-22

International Chamber of Shipping, 1978, International Safety Guide for Oil Tankers and Terminals, London

International Maritime Organisation, 2000, International Maritime Dangerous Goods, London

International Maritime Organisation, 2002, 'Prevention of Air Pollution from Ships', accessed 28 January, 2010, http://www.imo.org/environment/mainframe.asp?topic_id=233

IRIS Research, 2008, Regional Profiles: The Illawarra Region, accessed 25 August 2009, <http:www.iris.org.au/index.pl?page=220>

Johnson G.J., 1995, A study of spatial and temporal variability in the infaunal macroinvertebrate assemblages of Port Kembla Outer Harbour. B.Env. Sc. (Hons) thesis. University of Wollongong

JNCC, 2009, JNCC Guidelines for minimising the risk of disturbance and injury to marine mammals whilst using explosives, JNCC Marine Advice, UK

Keevin, T.M. and Hamden, G.L., 1997, The Environmental Effects of Underwater Explosions with Methods to Mitigate Impcts, US Army Corp of Engineers

Knott, N. A., J. Aulbury, T. Brown, and E. L. Johnston, 2009, 'Contemporary ecological threats from historical pollution sources: impacts of large-scale resuspension of contaminated sediments on sessile invertebrate recruitment', Journal of Applied Ecology Vol. 46: 770-781

Landcom, 2004, Soils and Construction: Managing Urban Stormwater, NSW

Maunsell AECOM, 2008, Port Kembla Outer Harbour Master Plan Environmental Considerations, Report to Port Kembla Port Corporation, 7 July 2008, Sydney

McDonald and McPhee Pty Ltd., 1991, City of Wollongong Heritage Study, Volumes 1-5. Report for Wollongong City Council.

Morrisey, D.J., Howitt, L., Underwood, A.J. and Stark, J.S., 1992, Spatial variation in soft bottom benthos. Mar. Ecol. Prog Ser., Vol. 81: 197-204

Morrisey, D.J, Underwood, A. J., Howitt, L. and Stark, J.S., 1992, Temporal variation in soft bottom benthos. J. Exp. Mar. Biol. Ecol., Vol. 164: 233-245

National Transport Commission, 2007, Australian Dangerous Goods Code, Melbourne

NEPC, 1999, (Assessment of Site Contamination) Measure, Adelaide

Newell, R.C., Seiderer, L.J. and Hitchcock, D.R., 1998, Impact of Dredging Works in Coastal Waters: A review of sensitivity to disturbance and subsequent recovery of biological resources on the seabed. In Ansell, A.N., Gibson,

E.N. and Barnes, M. (Eds), Oceanography and Marine Biology: An Annual Review, Vol. 36: 127-178.

Nicholls, N., and Collins, D., 2006, 'Observed climate change in Australia over the past century', *Energy & Environment*, Vol. 17: 1-12

Nieuwaal, M., 2001, Requirements for sediment plumes caused by dredging: Final thesis report, Delft University of Technology, Sydney

NPWS, 1997, Aboriginal Cultural Heritage Standards and Guidelines Kit, National Parks and Wildlife Service, Sydney South

NPWS, 1999, Litoria aurea Threatened Species Information, National Parks and Wildlife Service, Hurstville, NSW

NPWS, 2001, Hygiene Protocol for the Control of Disease in Frogs, Hurstville, NSW

NPWS, 2003, Little Tern (Sterna albifrons) Recovery Plan, Hurstville, NSW

NSW Government, 2003, Ports Growth Plan, NSW Maritime, Sydney

NSW Government, 2006, NSW State Plan : A New Direction for NSW, Sydney

Patterson, Britton & Partners, 2005, "MPB3 and EB4 Dredging and Disposal of Material to the Outer Harbour",

North Sydney

Patterson Britton, 2005b. Port Kembla Outer Harbour Reclamation Area Sediment Sampling and Testing, North Sydney

Pogonski, J., 2000, Threatened Fish Profile - Black Cod (Epinephelus daemelii). Threatened fish profile. Aust Soc, Fish Biology Newsletter 30 (2), accessed August 2009, http://www.asfb.org.au/research/tsp/tfp_brockcod.htm

Pollard D.A. and Pethebridge E.L., 2002, Report on Port Kembla Introduced Marine Pest Species Survey, NSW Fisheries Final Report Series No. 41

Port Kembla Copper Pty Ltd, 2009, Port Kembla Copper Site Demolition Project: Preparation for Future Use Environmental Assessment.

Port Kembla Port Corporation, 2005, Natural Resources Reduction Plan 2005-10, Port Kembla

Port Kembla Port Corporation, 2006, PKPC Environmental Policy Statement, Port Kembla

Port Kembla Port Corporation, 2007, 'National Economics (NIEIR)' in PKPC Sustainability, accessed 26 August, 2009, http://www.portkembla.com.au/index.pl?page=23

Port Kembla Port Corporation, 2009, personal communication

Property Council of Australia, 2009, Australia on the Move, Sydney

Pyke, G.H. and A.W. White, 2001, 'A review of the Biology of the Green and Golden Bell Frog, *Litorea aurea'*, *Australian Zoology*, Vol. 31 (4): 563-598

RTA, 2002, Guide to Traffic Generating Developments, NSW

SKM, 2004, Cargo Handling Facility in the Inner Harbour. Environmental Assessment prepared under Part 3A of the Environmental Planning and Assessment Act 1979, Sydney

SKM, 2007, Port Kembla Land Use Strategy, Sinclair Knight Mertz, Sydney

Simpson, S., Batley, G., Chariton, A., Stauber, J., King, C., Chapman, J., Hyne, R., Gale, S., Roach, A. and Maher, W., 2000, *Handbook for Sediment Quality Assessment*, CSIRO, Canberra (referenced in text as CSIRO, 2005)

SPC 2007. Section 96(1A) Modification – Application to Modify Conditions B2.9 and B2.22. Application to Department of Planning and Natural Resources

Stewart, J, 2000, Flood study & preliminary culvert design, Salty Creek, Old Port Road, Port Kembla, Forbes

Rigby Pty Ltd for Port Kembla Port Corporation, Sydney

United Nations (UN), 1992, Report of the World Commission on Environment and Development: Our Common Future, Document A/42/427, Chapter 2; Sustainable Development, p. 1, accessed 29 January, 2009, http://www.un-documents.net/wced-ocf.htm

UNSW, 2009, Description of Marine Flora and Fauna in Port Kembla Outer Harbour, Sydney

URS Australia Pty Ltd, 2003, Port Botany Expansion Environmental Impact Statement, Sydney

URS Australia Pty Ltd, 2004, Phase II Environmental Site Assessment, Port Kembla Port Corporation, Inner and Outer Harbour Soil and Groundwater Assessment, Port Kembla NSW

US FWS, 2006, Draft Guidelines for the Protection of Marine Animals During the Use of Explosives In the Waters of the State of Florida, US Fisheries and Wildlife Service Draft, Washington, D.C.

Wilson, G.D.F., 1998, 'A post-impact monitoring study of benthic fauna in areas dredged for the third runway in Botany Bay: A report to the Federal Airports Corporation', Sydney

Wollongong 1: 50 000 Geological Sheet, 1974, Geological Survey of NSW, Department of Mines Sydney.

Wollongong City Council, 2008, Community Profile, accessed January 29, 2010, http://profile.id.com.au/Default.aspx?id=302

Wright D.G and Hopky, G.E., 1998, *Guidelines for the Use of Explosives In or Near Canadian Fisheries Waters*, Canadian Technical Report of Fisheries and Aquatic Sciences 2107

Pyke, G.H. and A.W. White, 2001, 'A review of the Biology of the Green and Golden Bell Frog, *Litorea aurea'*, *Australian Zoology*, Vol. 31 (4): 563-598

ANZECC, 1990, *Technical Basis for Guidelines to Minimise Annoyance due to Blasting Overpressure and Ground Vibration*, Australian and New Zealand Environment and Conservation Council